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研究課題名（和文）Creating a Corpus-informed Online University Medical English Course

研究課題名（英文）Creating a Corpus-informed Online University Medical English Course

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研究成果の概要（和文）：本研究の主な目的はオンライン医学英語教材を作成することにある。オンライン教材は学習の効率化を図る反転学習講座を構築することを目的としており、対面授業に係る時間を大幅に削減することで授業での成果を最大化することを最終目的とする。そのためのオンライン医学英語教材開発を進め、人体システムに係る医学分野の統合的且つコーパスに基づく医学英語のカリキュラムを構築するに至る。これまでのところ、解剖学的肢位、整形外科、神経科、循環器科を含む10ユニットを作成しており、現在婦人科、眼科、耳鼻咽喉科の作成に取り組んでいる。有用性の高い医学用語を特定し、最重要医学用語集を作成し、用語は全て学習教材に盛り込んでいる。

研究成果の学術的意義や社会的意義
We have built a highly efficient flipped learning course, informed by a truly interdisciplinary approach involving the input of medical specialists. Importantly, we have succeeded in creating a glossary of medical terms which bridges the divide between stand-alone word lists and pedagogic materials.

研究成果の概要（英文）：The primary aim of this research has been to develop a set of online materials for learners of medical English at the early stages of their studies. These materials have been used to build a highly efficient flipped learning course which integrates classroom learning and e-learning. The flexibility of a flipped learning approach has enabled us to significantly reduce teaching time and maximize the efficacy of face-to-face lessons, leading to the creation of a fully-integrated, corpus-informed medical English curriculum based on medical fields connected to different body systems. We have created units covering anatomical position, orthopedics, neurology, cardiology, endocrinology, pulmonology, immunology, dermatology, gastroenterology, hepatology, and nephrology. Work is being completed on gynecology, ophthalmology, and ENT units. Key medical terms have been identified, and a 2,000-word glossary has been compiled which forms a core medical word list embedded in the pedagogic materials.

研究分野：Applied linguistics

キーワード：Medical English　Materials development　Online learning　Flipped classroom　Corpus analysis　Word list　Glossary

様式 C-19，F-19-1，Z-19，CK-19（共通）

1．研究開始当初の背景

The background to this research lies in our previous central-government funded project has been to produce corpora, word lists, and pedagogic materials for students and researchers in a university medical faculty.

An Integrated Approach to Materials Design

Several researchers (e.g., Cowan, 1974; Salager 1983; Baker, 1988; Chung & Nation 2003) have investigated the lexis of medical texts, and more recently, Fraser (2009), Wang, Liang and Ge (2008), Hsu (2013), and Lei & Liu (2016) have worked in constructing corpora and word lists in medicine and related fields. However, it is difficult to know how to utilize such lists in the classroom. Also, although corpus analysis in English for Specific Purposes (ESP) has previously been applied to syllabus and materials design (Flowerdew, 1993, for example, created a corpus from transcriptions of biology lectures), it is more usual for these studies to take place independently of course creation.

In our previous project, the development of an intensive medical English course for third-year students, we attempted to address this shortcoming. The methodology we employed involved an ongoing interaction between corpus analysis, word lists, and materials development (see Fraser, Davies & Tatsukawa, 2015, for an overview). In the initial phase of the course development, commercially produced materials were used, a small pedagogic corpus was built, and a list of terms was compiled. The next stage involved conducting interviews with senior medical professors (Davies, Fraser, & Tatsukawa, 2014). In these discussions, anatomy, physiology, and common diseases and symptoms were highlighted, with anatomy and physiology singled out as being especially important.

An anatomy corpus was constructed (Fraser, Davies, & Tatsukawa, 2014), based on *Gray's Anatomy for* Students. Basic anatomy materials were produced and trialled before being added to the existing course materials. A new set of materials was designed, linking anatomy and physiology to medical conditions, and informed by a subsequent corpus analysis of *Harrison's Principles of Internal Medicine* (Fraser, Davies, & Tatsukawa, 2016). A revised word list was drawn from these materials which focuses on anatomy, common diseases, and symptoms. Such a corpus-based approach enriched the course by improving the materials themselves and creating specialized word lists, helping students with their learning of the most salient medical terms. Close contact with the medical faculty ensured that we were able to provide students with English in situations and contexts with which they were already familiar from their own medical studies, and feedback from students regarding the materials, and word lists in particular, was very positive (Fraser, Davies, & Tatsukawa., 2015).

From interviews with the medical faculty, ten broad medical areas have been identified that should comprise the discipline overall: cardiovascular medicine, digestive medicine, respiratory medicine, neuromusculoskeletal medicine, infectious diseases and immunology, oncology, developmental medicine, nephrology and endocrinology, critical care and anesthesiology, and sensory organology. Awareness of these categories has helped us to organize integrated sets of materials, and the categories are also enabling us to construct a corpus of medical research articles with a view to helping students with their reading and writing of such articles.

Using Online Instruction to Expand Learning Opportunities

The application of information communication technology (ICT) is becoming increasingly common in educational institutions around the world. ICT involves the use of electronic media for educational purposes; such media include Moodle and other similar learning management systems (LMS), computers, smartphones, and cloud sharing. Nowadays, many departments of higher education institutions, including the Institute for Foreign Language Research and Education at Hiroshima University, are using LMS for the administration of online courses, with the aim of providing greater flexibility in addressing students' needs. Online digital media are often combined with traditional classroom methods, a methodology known as "Blended" learning. "Flipped" or "Inverted" learning (Bergman & Sams, 2012) is a form of blended learning that delivers instructional content online, allowing learners to use classroom time to work through problems, collaborate with their peers, and gain a deeper understanding.

In the field of medical English education, researchers are beginning to realize the potential of ICT, and blended learning particularly, to enrich the learning environment. One example of this is a recent study investigating the effects of increasing ICT use in a medical English oral communication course, (Jego, Udagawa, Taniguchi, & Nemoto, 2016), in which the positive effects of ICT in improving speaking skills are clearly demonstrated. However, the experience was not a positive one for all students, particularly for reasons of access and technical support, and the authors stress the need for careful consideration of the way in which e-learning is implemented.

2．研究の目的

Building upon our previous studies, the primary aims of this project have been to:

(1) Create, using a corpus-informed approach, a comprehensive online medical English course, including a pedagogic word list, which integrates both traditional classroom and e-learning components;
(2) utilize existing medical corpora based on *Harrison's Principle of Internal Medicine* and *Gray's Anatomy for* Students to inform the development of the course and materials by identifying, contextualizing, and categorizing the most important lexis and linguistic/discourse patterns in the discipline overall and in important sub-fields;
(3) construct a medical English glossary containing the key terms embedded in the pedagogic materials.

3．研究の方法

In the first year of the project, our methodology involved an interplay between materials development, corpus analysis, and input from medical specialists. Our focus was on how the use of information technology at our university could be exploited to create e-learning opportunities for students of medicine as well as other medically-related fields, and we began planning the construction of a set of online medical English materials. Aided by interview data and feedback from medical professors, this initial planning stage involved determining

the content, the type of tasks to be used, and the selection of a suitable web-based platform to deliver the materials.

It was initially decided that an online course for second-year medical students would be built, one which parallels their medical studies in Japanese and dovetails with existing materials for third-year students, and based on anatomy/physiology; meetings with senior members of the medical faculty had led to an agreement that, for second-year students, anatomy should be given the highest priority. However, after several months of experimentation it became clear that it would be impossible to create a syllabus of materials based on discrete areas of anatomy. We decided to switch to a flipped learning approach, involving both online and classroom components, and which integrated anatomy with medical problems and treatments.

The second year of the research involved the development of a flipped learning course for third-year medical students. Content relating to receptive skills was created, and, using the university's management system, placed online. Comparisons with the *Harrison's* and *Gray's Anatomy* corpora using the AntConc suite of corpus analysis tools helped us to ensure that the language of the materials was as natural and authentic as possible, and that important terms had not been excluded. The efficacy of the course was determined through feedback from both teachers and students, and the results of an end-of course vocabulary test. Feedback was obtained from students by means of an online questionnaire. With a view to expanding and improving our materials-based pedagogic word list, research into high-value items for the neurosurgery component of the list was conducted through documentary analysis and interviews with a neurosurgeon.

In the third year of the project, our focus was on further materials development and the piloting of a second-year term-based course. Also, work began on producing a medical English glossary. Corpus analytic techniques, consultation with subject experts, and morphological analysis were used to identify key terms and word components embedded in the materials.

4．研究成果

Year 1: Initial Planning of the Project

Selecting an Appropriate Web-based Platform for Delivering Online Materials

It was important to choose a web-based platform that would be accessible and easy to use for both learners and instructors. After comparing the relative advantages and disadvantages of several systems, we concluded that Bb9 would be the most suitable for our project. In addition to covering all the functions necessary for our planned activities, this LMS, being an in-house service provided by Hiroshima University's Information Media Center, was expected to alleviate the technical hurdles that would be encountered by students, instructors, and course designers. Using this platform, we could focus on developing the content of the materials.

Planning a Flipped Learning Course for Third-year Students

Our initial plan was to target second-year students, but it became apparent that flipped learning could work with the third-year intensive course as a means of reducing costs and improving efficiency. The four-day intensive course required four instructors to teach 12 classes over four days, with a vocabulary test and evaluated writing task included in this time. With a flipped learning approach, involving pre-course study on the university's learning management system (LMS), content relating to receptive skills could be placed online. This e-learning content includes essays and audio, along with a variety of pedagogic matching and multiple choice tasks. By integrating e-learning into the course, it was possible to reduce the classroom-based component to two days, allowing room for further content to be added and taught in a traditional, non-flipped way. An additional day was allocated for end-of-course testing.

Year 2: Developing the Flipped Learning Course

Converting and Extending Existing Course Materials

We had 14 planned units of material, of which seven were selected for conversion to an online format (Table 1). Four of the units were designed to build speaking skills in the form of doctor-patient role plays, and two of the units were oriented towards the development of writing skills in the form of summary writing. The online materials were selected with the aim of providing learners with the specialized language relating to medical problems and the underlying anatomical terminology.

Table 1: Units of teaching material for conversion

Units of Pedagogic Material
Anatomy planes, terms of location, and views
The Brain (speaking skills)
The Heart (speaking skills)
The Pulmonary System (writing skills)
The Endocrine System (writing skills)
The Digestive System (speaking skills)
The Skeletal System (speaking skills)

The course materials have been designed to alternate between input and output activities, and the online materials are oriented towards the technical medical English used by doctors rather than the more colloquial English of doctor-patient interactions. On the university's LMS, a course file, Third-year Medical, was created. The speaking skills units could be divided into seven sections, as illustrated in the screenshot of Unit 11 (The Skeletal System) in Figure 1 below. They were built around two essays (Reading 1 and Reading 2).

The online materials were extended by adding audio files for listening and pronunciation activities and exercises. High-quality audio recordings of the essays and of the key words for the vocabulary exercises were made, using primarily American pronunciations. Audacity software was used to splice and edit the recordings. The resulting audio files were then integrated into the online materials. Video clips were created by adding images to the audio files. These were then uploaded to YouTube with transcript files, so that the YouTube audio could be followed with the caption option.

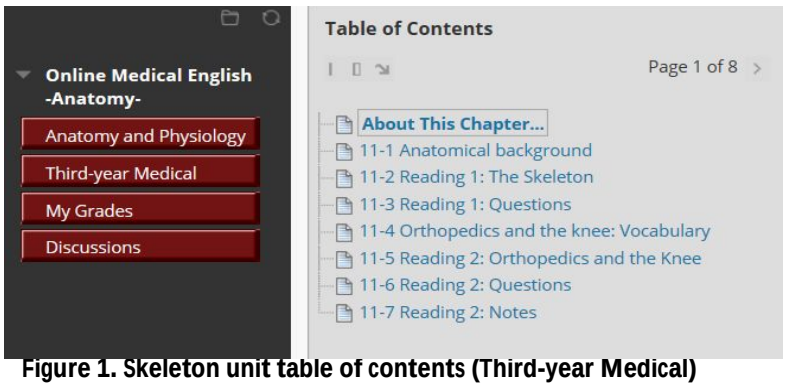

Figure 1. Skeleton unit table of contents (Third-year Medical)

Anatomical terms were introduced through matching activities (Figure 2). Pictures were purchased from the Shutterstock website, which contains extensive materials on anatomy. These pictures were then edited to create vocabulary-diagram matching activities.

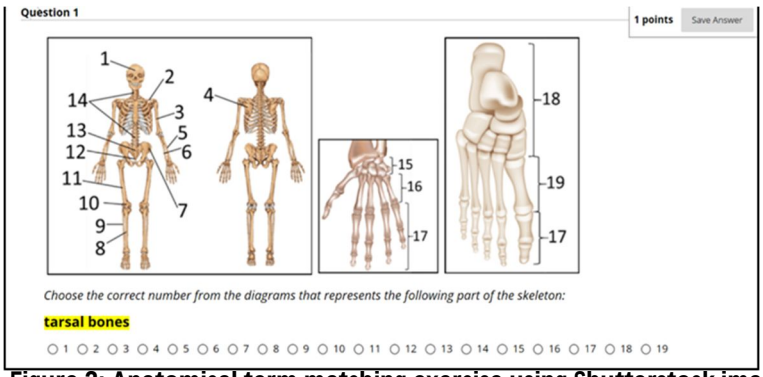

Figure 2: Anatomical term matching exercise using Shutterstock images

A second word exercise, related to Reading 2 in the medical problem section, involved matching medical terms to their definitions in English (Figure 3).

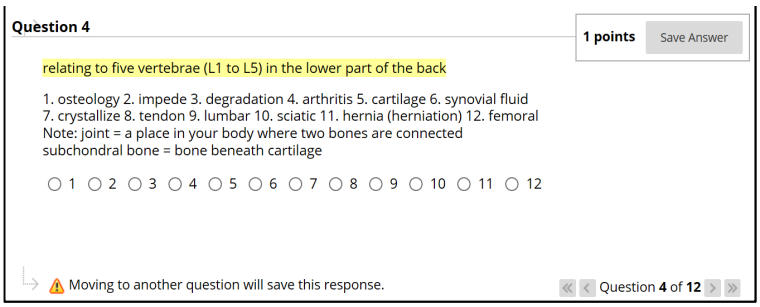

Figure 3. Matching exercise using definitions

Implementing the Course

The self-study component of the course took place in August 2017, with a deadline for completion set the week before the commencement of the taught component in September. The taught component involved all third-year medical students, 121 in total, who were divided into four groups of about 30. The self-study component made it possible to substantially reduce the number of classroom contact hours from 18 hours in 2016 to 11.5 hours in 2017, although the same amount of material was covered. The same team of four instructors taught on both the 2016 and 2017 courses.

In the previous year's course, instructors had taught three 90-minute sections per day over four days to groups of around 30 students. Each instructor taught the same content four times, and student groups rotated around the instructors. In the 2017 course, each instructor was required to teach four classes of 70 minutes each day for two days, with student groups again rotating around instructors.

Feedback on the Course

Of the 121 students who took the course, 98 (81%) completed a feedback questionnaire. The results showed that almost all the students found the course useful and had high levels of motivation. The results of a vocabulary test, administered at the end of the course, showed no significant difference from those of the previous year, indicating that, for a variety of tasks, it was just as effective for students to study online as in class. The results of an evaluated task on summary writing showed that students produced better summaries than in previous years. This was probably because the flipped learning course created more out-of-class time to prepare for the task and more time to write the summaries. Teacher perceptions indicated several key points: While the flipped learning course was more complex regarding planning, very strong support from medical faculty senior staff and administrators made it possible; overall, flipped learning lightened the load of teaching contact hours, although the taught component was much more intense; the complete separation of evaluation tasks from teaching was

beneficial; students benefited from the opportunity to work at their own pace; and the use of the LMS made it easier to monitor students and obtain feedback from them.

Word List Development

During this year, work was taking place on expanding the existing medical English word list, beginning with the neurosurgery component. This involved preliminary documentary analysis, leading to the development of a more comprehensive list through interviews with an experienced neurosurgeon concerning the items on the initial list. The results of the interviews enabled us to create four general categories within the neurosurgery component (and which can also be applied to other medical areas): Gross Anatomy/Histology/Physiology (GAHP), Medical Problems and Symptoms, Tests, and Treatments. Regarding individual items for the list, we found that the issues of word form, degree of 'technicalness', and the ways in which words combine to form terms have implications for the organization of words within the four categories of the list.

Year 3: Expanding and Refining the Materials

In the final year of the project, we continued to work on further developing the materials and pedagogic word list, aided by input from our corpus data and the expert knowledge of medical doctors in a variety of fields. Units of material were extended to include self-study sections on treatment. To date, we have body-systems based units covering anatomical position, orthopedics, neurology, pulmonology, Cardiology, endocrinology, gastroenterology, hepatology, dermatology, immunology, and nephrology/urology.

Trialling a Second-year Term-based Course

An experimental flipped learning course for second-year students was planned and successfully taught, indicating that students can cope with the material at an earlier stage of their studies than the third year. It was experimental primarily because the course materials were originally designed for third-year students. An additional aspect of the experiment was to teach the classroom component over a seven-week period in contrast to the intensive three-day way it was taught to third-year students. The success of the course was evaluated using test results and student feedback in the form of both qualitative and quantitative data gathered from a questionnaire survey.

Almost a third (35) of the second-year students completed the course, which took place in October and November 2018. Of the 35 students, 31 passed the final-day tests first time. A major part of the tests comprised a 50-item multiple choice vocabulary test, and the average student score was 75.8% (S.D.=16.1). The same test was given to third-year students in their September 2018 intensive course; here, the average score was 80.1% (S.D.= 14.7). An unpaired two-sample t-test using R showed no significant difference between the two data sets ($t(53)=1.399$ $p>.05$), indicating that second-year students could cope just as well as third-year students regarding the study of medical terminology.

Data from the quantitative feedback show that student motivation was very high, the students considered the course to be useful, and the instruction and materials were clear. The qualitative data indicated that a small number of students considered the course to be too difficult. There were also some minor weaknesses relating to teaching materials.

Creating a Glossary of Medical Terms

An important goal of our research has been to create a glossary of key medical terms for undergraduate medical students. The glossary, which is still under development, will be an extension of the word list emerging from the interplay of materials design and corpus analysis, and contain approximately 2,000 items. We have paid particular attention to the morphology of words and the ways in which word parts and affixes combine to form complex medical terms. For ease of use, the glossary is divided into three parts: Part 1 lists key terms, appearing by unit, alongside other members of the same word family (e.g., abnormal, abnormality) and semantically linked word parts (e.g., tumor, -oma, onco-); Part 2 lists the entire list of key words alphabetically; Part 3 lists combining forms and affixes (e.g., -oma), with examples drawn from Part 1 (e.g., adenoma, angioma, astrocytoma, glioblastoma, glioma).

Future Directions

We are currently working on completing the glossary, which, when finished, will form a core medical word list embedded in the materials, so bridging the divide between stand-alone word lists and pedagogic materials. The gynecology/urology, ophthalmology, and ear, nose, and throat units are being finalized. In the near future, we hope to be able to publish the materials in the form of a textbook for undergraduate students.

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6． 研究組織

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