Journal of Academic Society for Quality of Life
Vol. 1(4): 40-46, 2015
Available online at http://as4qol.org/?p=1232

Learning Science English for the First Time: Feedback from Year-1 Pharmacy Students Learning Pharmaceutical Science English at the Tertiary Level

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Received: December 1, 2015 Accepted: December 24, 2015

Abstract

Results from a previous study of the Stepwise-stepup Tertiary Science English Educational (SSTSEE) system have been encouraging: students find pharmaceutical science (PS) English (PSE) useful. In this study, we probed further into students' perception of PSE lectures. First-year students (n=56) of both genders participated in the study at University A. Students followed the PSE lectures using a standard textbook containing learning materials for PSE basics (e.g. numerals, grammar, mathematical equations, chemical elements/compounds, Latin and Greek, etc.) for the first-semester study. After completing 12 lectures, students were given a questionnaire to rank their perceptions on a scale of 1-4 (containing 13 items). The effective response rate was 100%. The two highest ranked items were items 1 and 2 with scores of >3.5 (ca. 90%), followed by other items (in descending order of rank) items 6, 3, 4, 5, 12, 13, 7, and 8 (scores: 3.0-3.5), and the lowest ranked items (in descending order) were items 9, 10 and 11 (scores: 2.0-3.0). In their first exposure to PSE, students (ca. 90%) found the subject/lectures and contents (items 1, 2) and textbook contents/materials (item 4) useful as some felt they had gained some knowledge via PSE learning (item 12) and improved their own pronunciation. This study indicated that the interactive approach resulted in their ability to listen, read, write, think, understand and reproduce PSE basics. Based on the results, students were affirmative about learning PSE using the SSTSEE system as they recognized the usefulness and applicability of PSE in their study and future careers as research personnel and pharmacists.

Keywords: educational system, pharmacy students, pharmaceutical English, science English

Introduction

Although literary English is taught systematically in many Japanese secondary schools, science English (SE), or, for the purposes of this study, pharmaceutical science English (PSE), is not taught systematically at the tertiary level at Japanese universities.[1] Often SE is taught in a randomized and non-systematic fashion in different faculties at the university level: lecturers tend to conduct their lectures using textbooks and teaching materials without a basic and systematic approach, since the lecturers assume students have already acquired the basics.[1,2]

It is not wrong to assume students have acquired basic grammar and have attained a certain vocabulary level in literary English after spending 6 years studying grammar, novels, and other literary works at the secondary level. The grammar is similar; however, certain expressions and grammatical usages may be different from

those in secondary-level practice.[3,4,5] Therefore, when it comes to PSE, many are unprepared, and they definitely need a review of the basics of SE and develop certain basic learning tools[6] before venturing into the fields of pure and applied science. Wherever and whenever their students come across expressions that they do not know, lecturers teaching PSE in many universities in the current fashion explain the unknown word, an expression, or element as they arise. Likewise, for mathematical expression/equations, chemical compounds and reactions, the explanation would be for that certain expression, compound or reaction per se. In other words, students would only learn - at random - the explanation or meaning of a particular word, element, compound, reaction, or mathematical expression without knowing or understanding the basic approach involved. Therefore, students tend to be at a loss when encountering new expressions, compounds, and the like, because they have learned in a randomized fashion: i.e. knowing a certain aspect (e.g. a term, expression, element, compound, reaction, etc.) and not knowing expanded versions derived from the basics. If this is going to be the educational approach, Japanese university students of pharmaceutical science discipline will never learn to handle PSE or SE in a systematical fashion; they will be able to handle only certain limited expressions that they have learned at random without further expansion/development. The approach is therefore randomized and nonsystematic, and a more systematic learning approach is therefore urgently needed to improve the presently helpless situation.

In 2012, a stepwise-stepup tertiary science English educational (SSTSEE) system[1] was introduced in University A, and the present study investigated how the students felt about and fared in the SSTSEE system of PSE teaching at the university. The SSTSSE system provides a gradual way of learning SE and PSE, where students first learn the basics of the numerical system with decimals, powers, and units followed by shape, size and with dimensions.[7,8] Students then learn how to express fractions, mathematical equations,[9,] formulae of chemical elements/compounds, and reaction equations.[10,11] Additionally, they also learn how to express position, direction, quality, and quantity of equipment and apparatus in the laboratory, etc. The use of Latin terms in describing experiments, the coining of words derived from Greek and Latin word sources,[12] and the description qualities and quantities using the five senses are the groundwork students have to master before they can apply these basics at higher academic levels. The SSTSEE system, in fact, prepares students with all the above basics.[1] Details of the syllabi are published in standard PSE textbooks for first-year (Yr-1) university students.[3,13] The results of the SSTSEE system are encouraging: students find PSE or SE useful (40%), significantly meaningful (36%), and provides special characteristic linguistic features.[1] Furthermore, students find the PSE content well-taught (38%), excellent (31%), and interesting and stimulating (28%). In this study, we probed further into students' perceptions, and gathered that they did not fare well in certain aspects of PSE learning.

Methods

Based on the SSTSSE system, a total of 56 students of both genders (age range: 18-19 years) participated in the study without prior knowledge. Students followed the PSE lecture once a week for 12 weeks, for a total of 14 lectures (2 lectures were used for midterm and final tests). A standard textbook[3] with an attached compact disk (CD)[6] consisting of pronunciations and readings of basic PSE including grammar with technical terms,[4,5] numerals, decimals, time, shapes and dimensions,[7,8] mathematical expressions,[9,10] chemical elements/compounds, Greek and Latin basic terms (and the coining of technical terms), and technical terms used in pharmaceutical sciences were used for the first-semester study. After completing the 12-session lectures (another 2 lectures for tests), each student was given a questionnaire (containing 13 items) to answer (Table 1). Students were then told how the data would be used in the study, before being asked to fill in the questionnaire and instructed to omit their names and other individual particulars. Anyone who objected to the manner of use of data was allowed to show his/her hand, and identify his/her completed questionnaire for omission from the study. As no one objected, all the students were

considered to have given consent, and all the data was analyzed accordingly.

The questionnaire was ranked on a scale of 1-4, where scores of 1 for poor/incomplete, 2 for fair/okay; 3 for good/nearly complete; and 4 for excellent/complete for the 13 items as follows: 1) usefulness of the subject/lectures; 2) subject contents; 3) teaching methods/approach; 4) teaching textbook/materials; 5) contents of textbook/materials; 6) acquisition of technical terms; 7) ability to think in PSE; 8) ability to write PSE; 9) ability to read/understand PSE; 10) ability to speak PSE; 11) confidence in public speaking using PSE; 12) PSE acquisition; 13) feeling of achievement (Table 1). The total scores of students for the respective items were summed up, and averaged. The average scores (ordinate) were then plotted as column graphs against the respective items (abscissa) (Fig. 1).

Apart from scoring the 13 items, they were asked to write comments in separate columns concerning the following areas (voluntary written request): 1) usefulness/benefit of subject/lectures; 2) improvements needed in subject/lectures; and 3) miscellaneous.

Results

The response rate of the questionnaire was 100%. Marking of the respective items was 100% effective without error, yielding an effective response rate of 100%. The two highest ranking items were items 1 and 2 with scores of more than 3.5 (ca. 90%), followed by items (in descending order) 6, 3, 4, 5, 12, 13, 7, and 8 with scores of 3.0-3.5, and the lowest items in descending order were 9, 10 and 11 with scores of 2.0-3.0 (Fig. 1).

In PSE teaching at University A in the present study, ca. 90% of students found the subject/lectures and contents useful (items 1 and 2). They also found the textbook contents/materials useful (item 4) as some felt they had gained some knowledge via PSE learning (item 12).

The number of students responded to the voluntary written request were expressed as a ratio of the total number in the study. For Comment 1: acquisition of knowledge and technical terms/expressions (30/56; 53.6%) were established, lectures were interactive (use of microphone for answering questions and pronunciation correction: 33/56; 58.9%), and teaching text/CD (5/56; 8.9%) were useful (comments in Comment 3 analogous to Comment 1 were included in Comment 1); while for Comment 2, attention to write more legibly on the black board (3/56; 5.4%), and improvement of recorded listening questions for tests (9/56; 16.1%) were required of the lecturer (miscellaneous comments were negligible in counts, and therefore omitted for discussion). As is shown by the written perception results, Japanese students appreciated having mispronounced words/terms, mathematical equations, or chemical expressions corrected: they found this teaching method/approach useful as their pronunciation was corrected whenever they mispronounced words or expressions when asked to read or speak out loud. They were found to have improved their pronunciations in the series of interactive lectures over time.

Table 1: Questionnaire containing 13 items with scores of 1-4 for marking by students.

Item	Description	*Ranking* *Poor*			*Excellent*
1	Usefulness of subject/lectures	1	2	3	4
2	Subject contents	1	2	3	4
3	Teaching methods/approach	1	2	3	4
4	Teaching textbook/materials	1	2	3	4
5	Contents of textbook/materials	1	2	3	4
6	Technical terms acquirement	1	2	3	4
7	Ability to think in English	1	2	3	4
8	Ability to write in English	1	2	3	4
9	Ability to read/understand in PSE	1	2	3	4
10	Ability to speak in PSE	1	2	3	4
11	Confidence in public speaking	1	2	3	4
12	PSE acquirement	1	2	3	4
13	Feeling of achievement	1	2	3	4

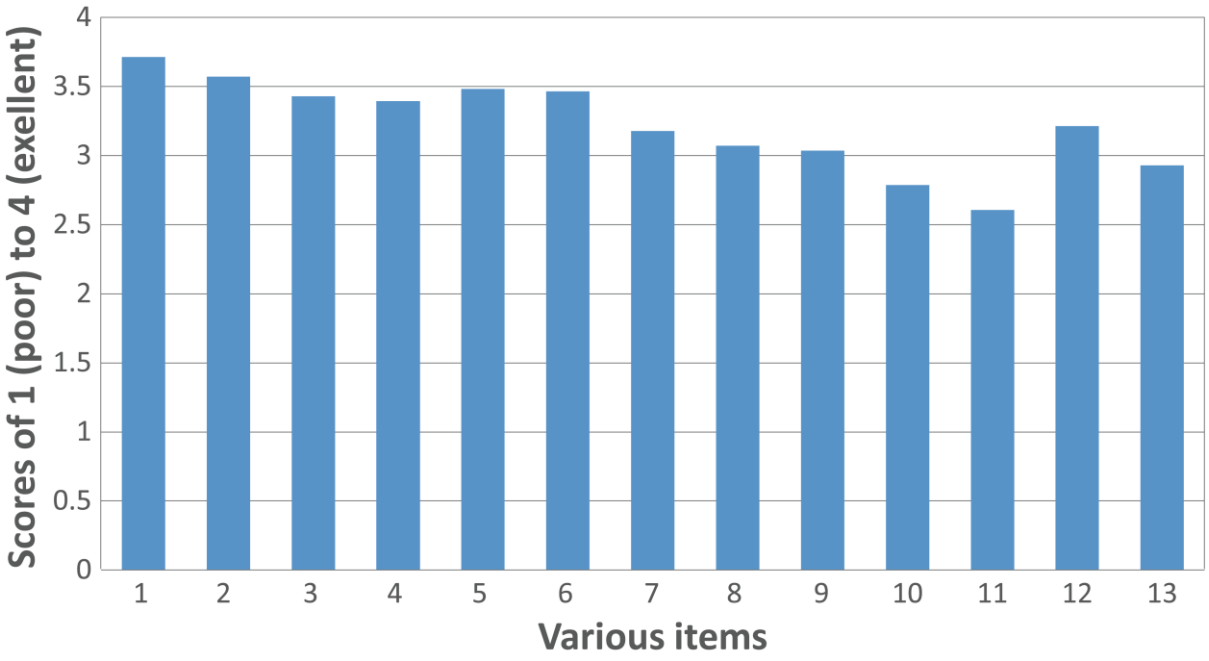

Fig. 1: The average scores (ordinate) against the respective items (abscissa) listed in Table 1.

Discussion

In English-speaking countries, students are exposed to English at all levels, beginning from primary schools. In a manner similar to SE-learning, native English speakers learn about the use of numerals, technical terms and relevant aspects through a stepwise system. However, in the case of Japanese ESL (English as a second language)

learners, there is a huge vacuum in SE-learning (from secondary school systems), and therefore a special system has to be established for ESL learners to learn SE.[14-17] The main objectives in PSE-learning include improving the following abilities: a) listening; b) writing; c) reading, d) speaking; e) thinking, and reproducing PSE basics. Lecturers (from art stream at universities) teaching SE or PSE often misconceive that literary English is somewhat similar to SE.[15-17] In fact, many English lecturers teaching SE or PSE to science and pharmacy students in Japan do not have a science background. Therefore, the so-called SE or PSE taught in pharmacy schools is more of popular science. The major differences between SE or PSE and literary English are that the former is: 1) qualitative, 2) quantitative, 3) specific, and 4) objective. In other words, SE or PSE is written with descriptions of appearance (qualitative), mass and dimensional (quantitative) aspects in a non-subjective (objective) fashion with specific details (specificity) included for the object in question.[3,13]

PSE teaching is new in faculties of pharmaceutical science in Japanese universities. To date, less than a handful of universities have been conducting lectures of PSE content, while others are using materials from popular science and not pure science. Texts that use popular science contain short passages of scientific content with superficial notes and introductory knowledge for general readers without dwelling on the details of scientific knowledge. For example, a chapter on influenza may define symptoms of influenza, and the relevant virus with reference to public hygiene and wearing masks as preventive measures; viz., contents typical of those found on the internet for the general public. PSE, however, deals more specifically with the field-related knowledge comprising the following details in addition to what is written in popular science: the different types of influenza viruses; the meaning of the enzyme neuraminidase (N) and the protein hemagglutinin (H) that define virus type (e.g. N1H5, etc.); characteristics of the disease; symptoms related to body temperature, etc.; route of infection and means of cellular destruction and its consequences; causes of mortality; differences in various strains as well as antiviral drugs and their effects; mechanisms of action; development of drug resistance and adverse drug reactions (i.e. specifics and knowledge required by medical professionals and pharmacists).

In PSE teaching at University A in the present study, students found the subject/lectures useful (items 1 and 2) and the textbook contents/materials beneficial (item 4)[3] as most felt they had learned more about PSE (item 12). As PSE involves a spectrum of SE-related technical terms, some found the subject/lecture refreshing (53.6%; see comment 1). Based on their comments, they also found that correcting their mispronunciation of technical terms was useful in the interactive lectures using the microphone (Comment 1: 58.9%), a finding consistent with better understanding of lectures described in a previous investigation.[18] As Japanese students tend to pronounce words poorly in English (and other foreign languages), they found that the teaching method/approach correcting their mispronunciations was basic and useful as they then speak out with more confidence once they had learned the proper pronunciation. The refreshing perception of the subject was attributable to contents more relevant to their field of discipline/specialty (and away from what they were taught in secondary school), and which they know that they would need in their future practice and research work. These results support the outcome of a previous study with students at the same level.[1]

As for items that needed improvement, the lecturer was required to improve the handwriting and recording of facts for listening tests. As the lecturer wrote in cursive script, and the students did not learn italic or cursive writing in their secondary schooling, this resulted in their inability to read the writing. Therefore, it was not the legibility of writing per se; rather the students were just unable to read cursive writing. Recordings for the listening tests were made with a simple recording device (with slight noise interference), and therefore students disapproved of the quality; however, this could be an occasion, albeit to only a limited extent, for students to adapt to oral pronunciation in a natural environment where noises are present. As a matter of fact, students would be well prepared for the real world if they were trained to be

able to listen to conversation under spontaneous conditions including a certain amount of natural noise.

The affirmative approach was also noted in their ability to listen, read, write, think, and understand PSE in this study (analogous to a previous finding in 2014[1]), albeit this is the first time that they were exposed to the various aspects of PSE. This is most likely due to the 'freshness' of the subject and challenge they felt studying PSE. Students, most of whom have only taken courses in literary English, during their 6 years of secondary school, find that PSE poses a new challenge, offering new perspectives and with relevant applications of their choice of study (i.e. pharmaceutical science in this case).

However, students felt a lack of ability and confidence in speaking PSE (Fig. 1) before their peers in class and in general. This is naturally to be expected as Japanese secondary schools and the Japanese educational system provide only (limited) instruction in literary English conversation, least of all in speaking in PSE, and does not provide training in public-speaking. Students usually have to go for private lessons or attend commercial language schools to develop and improve their speaking ability. With the deficiency of these conditions in mind, the SSTSEE system has purposely been designed to provide a teaching-and-learning program for training students to speak PSE and to build up their confidence by doing oral presentations in front of their peers in their subsequently higher levels (Yr-2 and above) of PSE learning. Perceptions of Yr-2 study are currently under study, and will be published after analysis of the data on completion of the present study.

Conclusion

The present study investigated the feedback from Yr-1 Japanese students learning PSE for the first time at the tertiary level. Based on the results, students were affirmative and positive about learning PSE as they sensed the usefulness and relevant application of using PSE in their study and future career as research personnel and pharmacists, confirming previously published findings. They also found PSE to be 'fresh' and challenging, and the SSTSEE system appeared to be useful for the students in PSE acquisition. The present study noted that many affirmative feedbacks, and we will have to dwell with whatever that had been sensed deficient (lack of confidence in speaking English in front of others; and lack of confidence in public speaking) and needed by the students in their subsequent years at university and in society.

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