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LEARNING SCIENCE ENGLISH AFTER PRIOR EXPOSURE: FEEDBACK FROM YEAR-1 PHARMACY STUDENTS LEARNING PHARMACEUTICAL SCIENCE ENGLISH AT THE TERTIARY LEVEL

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ANNOUNCEMENT

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Full Paper

Learning Science English after Prior Exposure: Feedback from Year-1 Pharmacy Students Learning Pharmaceutical Science English at the Tertiary Level

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Abstract

In a first-semester (S1) study, although students had acquired certain level of pharmaceutical science English (PSE) ability, the lack of ability/confidence in public speaking remained. In this second-semester (S2) study, we enrolled two classes of first-year (Yr-1) students –different from those in the prior S1 study – who had studied PSE in S1, and investigated if the degree of self-confidence in public speaking shown in S1 students was improved in the S2 students after studying PSE on a weekly basis over a 4-month period. The S2 students participated in the study without prior knowledge. After completing 12 lectures, each student was given a questionnaire in which to rate a series of items. Based on the results, the highest-rated item was item 1 with an average rank score of >3.5 (ca. 90%), followed by items (in descending order) 6, 12, 5, 7, 8, 2, 4, and 9 with scores of 3.0-3.5, and items 13, 3 and 10 with scores of 2.5-3.0, while scores on item 11 was the lowest (2.0-2.5). The perceptive outcome reflected a similar perceptive tendency of listed items by both S1 and S2 students. Furthermore, S2 students – similar to S1 students - were lack of confidence in speaking using PSE, despite having prior (S1) PSE experience. Therefore, the results indicate that the S2 students required more time and experience with PSE before their ability/confidence in public speaking would improve; however, interest in learning PSE persisted in the S2 students after prior exposure to PSE in S1.

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1. Introduction

English-as-a-second-language (ESL) learners spontaneously improve their English skills over time with various non-classroom methods such as watching linguistics videos, etc.¹ Those who are intensely interested and

have a good understanding of basics can usually proceed with more enthusiasm and greater ability to apply the PSE they have learned, and therefore develop higher confidence in public speaking as well.

Students learning a foreign language improve with time: a study of elementary school children over a period extending several months has shown that the students who have studied French the longest perform the best.² Additionally, learning a foreign language depends on the native language of the learners.³ All in all, language learning improves over time,² and is further accelerated with useful teaching and relevant materials.^{4,5}

In the case of Japanese ESL learners, it has been recognized that there is an enormous gap in science English (SE) and pharmaceutical SE (PSE) ability of tertiary level first-year (Yr-1) students (the result of a lack of SE-learning programs in Japanese secondary educational system), and therefore the authors thought that a special system had to be established for ESL learners to learn SE,^{6,7,8,9} and PSE.¹⁰ Since we launched the stepwise-stepup tertiary science English educational (SSTSEE) system¹⁰ in 2012, we have learned that Yr-1 pharmaceutical science students at University A harbor affirmative attitude toward learning PSE in the first semester (S1)¹¹ using the SSTSEE system. However, students experienced a lack of ability and confidence in speaking PSE publicly or before their peers (Table 1: Items 11, 12).¹² In the present study, we enrolled two classes of Yr-1 students (different from those in the previously studied S1 classes) who had undergone one semester of PSE (S1), and investigated if the aforementioned shortcomings (items 11, 12) improved after learning PSE on a weekly basis over a 4-month period over the second semester (S2).

2. Methods and Subjects

2.1 Subjects and teaching materials

Students (n=57) of both genders (age range: 18-19 years; female: 33, male: 24) from Classes C and D (vs Classes I and J in S1) in S2 (vs n=56 in S1; female: 35, male: 21) were enrolled 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). Students used a textbook¹³ with an attached MP3 disk consisting of sample pronunciations and readings in basic PSE, which included units on: grammar with technical terms,^{14,15} scientific English vs everyday English;¹⁶ neurons and diseases of the brain; bacteria and viruses: shapes & dimension; practicums in laboratory apparatus and equipment; describing/expressing chemical equations; position, action, movement and direction; as well as properties, qualities and features of materials.

2.2 Methods

After completing the 12-session lectures (another 2 lectures for tests), each student was given a questionnaire (similar to that used in S1; Table 1 with 13 items). Students were then told how the data would be used in the study, and instructed to omit their names and other individual particulars. Students then proceeded to voluntarily fill out the questionnaire. Anyone who objected to the how the data were to be used was asked 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 were analyzed accordingly.

2.3 Data analysis

The questionnaire consisted of a list of 13 items, and students were asked to rank scores on a scale of 1-4, where 1 represented a rating of “poor/incomplete”, and 2, 3, and 4 for rankings of “fair/okay,” “good/nearly complete,” and “excellent/complete,” respectively. The 13 items were 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 the students in the respective items were summed up, and averaged. The average total ranking scores (ordinate) plotted (as column graphs) against the respective items (abscissa) of S2 students in present study were plotted along side those of the S1 students in the previous study to provide a more comprehensive visual assessment and comparison (Fig. 1).

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

Apart from scoring the 13 items, students were also requested to voluntarily write comments in separate columns (under Table 1) concerning the following areas: 1) usefulness/benefit of subject/lectures; 2) improvements needed in subject/lectures; and 3) miscellaneous.

3. Results

3.1 Differences between particulars and ability of subjects

As students were in classes from the same academic year (Yr-1) with no significant difference in age-range and gender, these 2 factors were therefore considered irrelevant in the present study. Students were randomized according to the alphabetic order of their last name without reference to their performance ability, they were distributed in an unbiased fashion in terms of performance and ability on a group-vs-group comparison.

3.2 Ranking scores vs items

The response rate for the questionnaire was 100%. None of the answer sheets contained missing values (including ambiguous or indecipherable markings), yielding an effective response of 100%. Based on the results, the highest-ranking item was item 1 with ranking scores of more than 3.5 (ca. 90%), followed by items (in descending order) 6, 12, 5, 8, 2, 4, and 9 with scores of 3.0-3.5, and items 13, 3 and 10 with scores of 2.5 – 3.0, while the scores on item 11 was lowest, 2.0-2.5 (Fig. 1).

3.3 Statistical analysis

With regard to statistical difference, score differences in the ranking were all not significant when verified with the Student t-test. The trend and pattern of the items scores were rather similar over the semesters, even though the students were from different classes.

3.4 Comments

The 57 students who provided positive comments cited the following (in descending order): improved pronunciation after correction (23/57; 40%), greater knowledge of medical/pharmaceutical facts and technical terms (17/57; 30%), writing out chemical compounds and reactions (13/57; 23%), in PSE (15/57; 26%), usefulness of CD (2/57; 4%), benefits from report-writing in English (5/57; 9%), and enjoying lectures that included lecturer's personal experiences (5/57; 9%). As for areas where there was room for improvement, i.e. negative comments, students requested: more exercise work/practice on writing (4/57; 7%), more emphasis on items other than pronunciation (1/57; 2%), more time on listening and speaking (4/57; 7%), and revision of typographic errata in textbook (5/57; 9%).

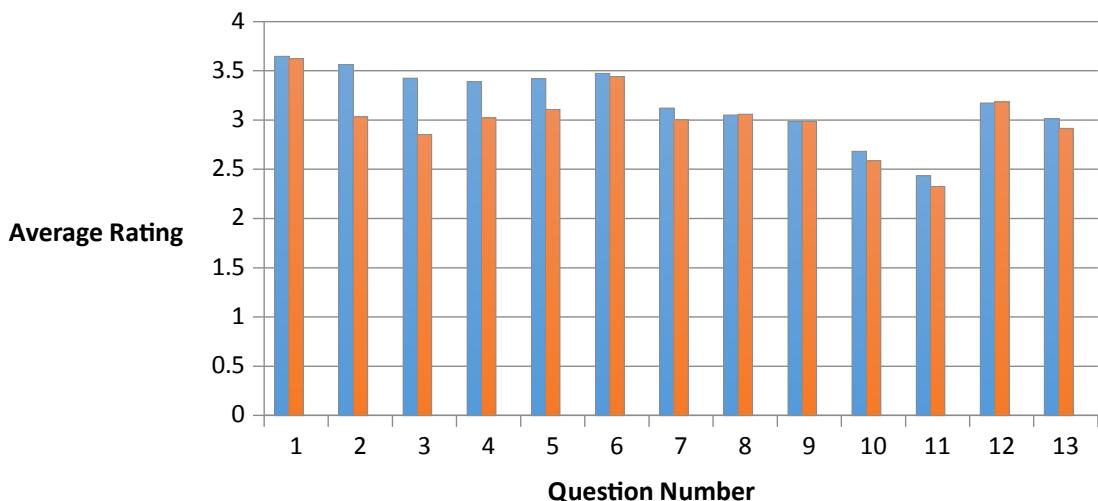


Fig 1: Ranking scores (ordinate: 1-4) of S2 students (orange) and the respective items (abscissa) of S1 students (blue) were plotted alongside each other to provide for easy comprehension and visual assessment. Note that S1 and S2 represent first and second semesters, respectively.

Concerning the quality of the S2 PSE teaching, ca. 90% of students found the subject matter and lectures useful (item 1); a finding similarly provided by S1 students.^{1,2} They also found the subject contents (item 2; scores 3), textbook contents/materials (item 4; scores >3) and teaching (item 3; 2.5-3.0) useful, and they seemed to have learned more technical terms/words (item 6; score >3) and PSE (items 12; scores >3). In the comments, although students appreciated the teaching approach and methods, the scores were not analogously reflected in the data.

4. Discussion

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, while others are using materials from popular science and not pure science.^{1,2} Regarding PSE teaching at University A, both the S1⁸ and S2 studies demonstrated that students found the subject content/lectures useful (items 1 and 2) and teaching/textbook of subject contents/materials were beneficial (items 2, 4, 5) as most felt (items 6, 13) that they had learned more about PSE (item 12). They also perceived that they could read, think, and write (items 7-9) in PSE (vs S1). The most difficult items reported in both the S1 and S2 students persisted: lack of confidence and ability in public speaking or speaking using PSE before their peers.

The SSTSEE system¹⁰ provides a gradual way of learning PSE, where students in S1 learn the basics of: i) the numerical system with decimals, powers, and units;¹¹ ii) shape, size and with dimensions;^{17,18} iii) expressions involving fractions, mathematical equations;¹⁹ and formulae for chemical elements/compounds²⁰ in S1. Having learned these basics in S1,²¹ S2 students then proceed to learn: iv) basic knowledge in pharmaceutical/medical sciences (anatomy, microbiology, diseases); v) apparatus and equipment in the laboratory; vi) expressions of chemical reactions in words and via chemical equations (involving organic and inorganic agents);²¹ vii) description of position, action, movement and direction of objects in pharmaceutical sciences; viii) the five senses (sight or ophthalmception), hearing or audioception), taste or gustaception), smell or olfactoception/olfacception), and touch or tactioception) required to describe the properties, qualities and features of objects and chemical agents; and ix) vocabulary based on Greek and Latin²² as well as grammar related to pharmaceutical/medical sciences.¹³ The SSTSEE system, in fact, prepares students with all the above basics in Yr-1 and approximates to an abbreviated and condensed version of the advanced level in British secondary science education or high-school science education in the States.^{11,13} Details of Yr-1 lecture contents in S1¹¹ and S2¹³ are printed in the textbooks, while progression of the lectures (i.e. syllabi for S1 and S2) are described in the university prospectus. The results of a review of the SSTSEE system in S1¹¹ are encouraging: students find PSE useful (40%), significantly meaningful (36%), and that it can provide special characteristic linguistic features. In addition, students report that the PSE topics are well-taught (38%), excellent (31%), and interesting/stimulating (28%).¹¹ In this study, a positive approach was also noted in their acquisition of listening, reading, writing, thinking, and understanding abilities (analogous to previous findings in 2014,¹⁰ and 2015¹²), even after their first PSE

exposure previously, suggesting that students were keen to learn more of PSE and were not deterred or turned off by the subject. This may be probably attributed to their understanding of PSE needs for future professional development as well as academic and research endeavors.

In this study, we followed up probing the perceptions of students on learning of PSE- after having been previously exposed to certain aspects¹¹ of PSE in S1. Although the main objectives in PSE-learning include improving several important abilities such as listening, writing, reading, speaking, and thinking in PSE, the syllabi and contents of Yr1 were aimed more at developing the foundation of handling PSE. Therefore, Yr-1 of the SETSEE system places less emphasis on speaking than on the other abilities mentioned above.

Having had limited exposure to SE and PSE in their secondary education, students in University A were keen to pursue PSE-leaning in S1.¹² Although they have acquired a certain level of ability in PSE,¹¹ the more advanced topics covered in S2¹³ required a solid foundation of the topics covered in S1. The pattern of rating in S2 resembled that portrayed in S1 (Fig. 1). Items 2-4 in S2 indicated slight decreases without statistical significance compared with S1, albeit attention must be focused to address the trend. The slight decreases might have been due to: a) difficulty in the content/textbook; b) differences in the strictness of the lecturer; and/or c) higher demands on students in S2 to spend more time and effort on study and review. S2 students continued to display a level of interest in learning PSE; a level similar to that of S1 students, and students were aware cited the usefulness of PSE (item 1); and they converged on other items (6-13) reported in S1 findings (from the other 2 different classes) as well. Similarly, although differences between the S1 and S2 scores were not significant, the lower average score ranking on items 10 and 11 indicate more attention should be paid to these items.

Those items that were perceived positively were probably perceived so because of certain factors related to the teaching methods. For example, the use of microphones by both the lecturer and students, which has been found useful,²³ again proved to lead to greater interaction as all lectures were conducted with bilateral microphone-use by students and the lecturer. Furthermore, this method contributed to the positive comments and ratings by students: viz., improved pronunciation after correction was specifically rated highest (23/57; 40%), followed by the gain in medical/pharmaceutical knowledge and technical terms (17/57; 30%), PSE improvement (15/57; 26%), and writing out chemical compounds and reactions (13/57; 23%) in the S1 study. The present S2 perceptive outcomes resemble those reported in the previous (S1) study,¹² and we concluded that the teaching methods were adequate and perceived as useful, after all the lecturers have taken efforts to improve whatever inadequacies revealed in the previous study.¹²

The perception pattern of ratings was similar in both S1 and S2 studies involving different groups of students (Fig. 1), suggesting that students required more time and exposure/experience to actually register improvement in items 11 and 12 (i.e. confidence in public speaking using PSE). This is to be expected of Japanese university students as they are not well prepared for learning PSE by the Japanese secondary educational system, where curricula include almost exclusively literary English (without either SE or PSE), and where training in public speaking using English (not to mention SE or PSE) is not provided. With the deficiencies of this secondary education system in mind, the SSTSEE system was specifically designed to provide a teaching-and-learning program that can train students to communicate in SE or PSE, and expressly build their confidence in doing oral presentations in front of their peers in their subsequently higher levels (Yr-2 and above) of PSE learning in the SSTSEE system.

As is shown by the voluntarily written comments and perceptions, Japanese students appreciated having mispronunciation corrected (40%), and gained knowledge in medical/pharmaceutical fields and PSE technical terms (30%). Almost 1 in 4 students (23%) were glad that they could now write and express/describe basic chemical compounds and chemical reactions involving organic and inorganic compounds. We further probed into issues where students were asking for improvements in the curriculum, specifically: I) more exercise/time on writing (4/57; 7%); II) more exercise/time on listening and speaking (4/57; 7%); and III) more emphasis placed on items other than pronunciation (1/57; 2%). With regard to I), it should be noted that writing practice, using concepts presented in the grammar section, was incorporated into some of the exercises; and if students had ventured to do the exercises by themselves, they would have enough writing practice. Our observation is that: for some reasons some students may not have been fully aware or availed themselves of these exercises, and thus denied enough writing practice

to establish the level of skill necessary to begin learning PSE. Due to time limitations, excessive teaching content to be covered, and the large-class size, writing was not the main focus of lectures, and the writing exercises were intended to be more of self-assigned and self-motivated learning initiatives taken on by the students per se. Some students, however, did not realize the lecturers had designed certain aspects of the course to rely on personal initiative, and thus ended up feeling the lecturer should spend more time on writing and speaking. As for II), listening was available all the time if the student had the textbook (an MP3 disk is attached to the book), and students could use the disk whenever and wherever needed; this again was more a matter of self-motivation and personal initiative. The lack of self-motivation in Japanese students could be due to the consequence of routine 'spoon-feeding' and habitual provision of lecture material to passively receptive students by most lecturers in Japanese private institutions/universities. As for speaking, although students were asked to read and answer questions during lecture, speaking PSE is limited in the Yr-1 curriculum, as it could be counterproductive to have students speak when they do not have the basic vocabulary and tools to communicate far and wide. Realizing that speaking is one of the SSTSEE system objectives, the syllabi have been designed such that students start to 'speak' PSE at higher levels via question-and answer sessions during oral and poster presentations. With reference to III), at some point it became apparent that the lecturers needed to introduce supplementary remedial efforts and material to bring pronunciation levels up to par (as this is closely related to confidence in public speaking); despite this necessary increase in attention to pronunciation, it was made sure that the textbook material was not neglected, but presented alongside these efforts. Therefore, lectures consisted of considerably more than teaching pronunciation alone. As previous S1 students had been taught by different lecturers (who it appears might not have placed due emphasis on pronunciation, or who were too busy to teach other items), the S2 students were given additional assistance in performing proper pronunciation in our lectures, although this may have appeared striking in contrast to their previous experience. Because under these circumstances, authors saw it as their duty (i.e. in the best interest of the students) to not leave pronunciation errors uncorrected, these were addressed promptly when and where the need arose. This was felt especially appropriate given that proper pronunciation supports the critical goal of establishing confidence in public speaking.

In the present study , the reported perceptions of students from two S2 classes was compared with that of two different classes of S1 students¹² from our previous study. This difference in scores could be due to prior exposure of students to different lecturers. In other words, the results would have been different if the same students from the previous study¹² had been enrolled in the present study. The findings nonetheless showed that both groups of students gave similar ratings to the listed items. Furthermore, the aforementioned lack of ability/confidence in public speaking using PSE that has been previously reported,¹² was again found to be reflected in this second group of students, despite previous exposure to PSE. Further studies using the same students for S1 and S2 are warranted to determine if perceptive outcome on the listed items would have differed from those the present study.

5. Conclusion

The present study investigated feedback received from Yr-1 Japanese students learning PSE in the second semester (S2) after a prior exposure (S1) of learning PSE at the tertiary level. Based on the results, students were affirmative and positive about learning PSE: a finding analogous to that reported in a previous study of S1 students. Although students from the two classes in S1 were different from those in S2, they demonstrated a similar pattern of perceptions and ratings for the listed items. One specific result was identical in both studies: both the S1 and S2 students had one issue in common: lacking of ability and/or confidence in speaking before their peers or in public using PSE.

Endnotes:

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