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Difficulty of Japanese Students in Pronouncing Certain Words and Numerals in Scientific English: Problems Arising from the Speaker's Native Tongue and Prior Exposure (Part 1)

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JAS4QoL

Full Paper

Difficulty of Japanese Students in Pronouncing Certain Words and Numerals in Scientific English: Problems Arising from the Speaker's Native Tongue and Prior Exposure (Part 1)

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Abstract

The English language has slowly and surely evolved to be an important language in communication in many non-English speaking countries. Whether in trade, legal matters, science or other fields, it is important to use the proper words, correct technical terms, accurate numerals, clear and logical reasoning supported by evidence, and proper grammar for mutual understanding to communicate effectively. Pronunciations of a total 695 undergraduate students (years 2-4; age range: 19 – 21 yr) of either gender during oral presentations in lecture hours were collected and analyzed. It is noted that common mispronunciations of English words is due to the limited number of sounds in Japanese relative to English. The Japanese language (JL) is limited in the number of phonemes, and each follows the next with a standard pronunciation without mixing or absorbing/combining the other syllables. Corrected and Revised versions of commonly mispronounced words and syllables are presented to promote self-awareness and develop correct pronunciation. British/European versions of pronunciations are occasionally given to allow readers to grasp a wider perspective of regional differences of the English language. The proper approach to learning pronunciation is to first focus upon one regional English and master it before moving to other regional languages. Mispronunciations of words/terms and numerals are attributable to speakers' native tongues and prior exposure.

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1. Introduction

The English language first came to Japan in 1848 prior to the arrival of Perry's "black ships" in 1853.[1] A Scottish-American Indian (Ranald MacDonald) from Oregon left a whaling ship on his own accord to land and explore Hokkaido in 1848, and he was taken captive and was transferred to Nagasaki to be placed under house arrest for illegal entry.[2] During this time, two diplomatic interpreters, MORIYAMA Takichiro (who later played an important role in negotiations with Commodore Perry when he forcefully ended the isolation of Japan in 1853) and UEMURA Sakushichiro, learned English from MacDonald: [2,3] He was, in fact, the first English teacher in Japan. Then, FUKUZAWA Yukichi – whose portrait is on the Japanese 10,000-yen note – was indeed the person who most influenced English-learning in Japan. On a trip to Yokohama in 1859 he realized that he could not read signs and notices written in English.[4] He was disappointed but knew the stakes were high for future development of Japan, as he understood that English played a very important role as the medium of instruction/communication in education, business, industry, and politics in the then industrialized English-speaking countries such as the United Kingdom and The United States of America. He could 'see' the 'stones and pillars' of building a modern society required Japanese people to learn English so they would be able to learn from the more developed western countries. He eventually established the Keio-Gijuku School, which later produced many distinguished and successful graduates in business, industry, and politics in Japan. He also published many 'must-read' English books for emerging modern schools, which eventually developed into the many modern universities at that time that espoused English as a medium of instruction in Japan. Since then and till the modern Japan of today, not only in the economic and political fields, but also in scientific communication English has always occupied an important position in Japanese education, industry, politics, and development.

Although English is learned intensively and extensively in Japan, the author observes Japanese English-as-a-second-language (ESL) learners are plagued with multifaceted issues in learning it: viz., grammar, vocabulary, expression, listening, and speaking. Throughout the author's experiences in teaching science English (SE) with Japanese students/scientists at the tertiary and graduate levels, pronunciation has been one issue that almost all ESL learners and lecturers face. Thus, in this study, the pronunciation of especially SE is focused upon. The following is a list of common mispronunciations among Japanese scientists in verbal communication at conferences and collaborative study discussions. Emphasis on the pronunciations of single words is an easy foundation from which ESL learners can have their pronunciation corrected; however, they may need extra effort when these 'difficult-to-pronounce' words/terms and numerals arise in a sentence, or in actual conversation. Additionally, the study of pronunciation may help students not only learn to enunciate those 'difficult' words/terms and numerals, but also to understand the use of those words/terms in a sentence or conversation. The sentences analyzed in this study are constructed from errors in pronunciation committed by tertiary-level Japanese ESL learners.

2. Methods and subjects

2.1 Subjects

Pronunciations used in scientific presentations given by a total of 695 undergraduate students (first with second semesters combined; age range: 18-22 yr) from Yr-2 (n=366), Yr-3 (168), and Yr-4 (n=159) enrolled in this pharmaceutical science study at University A were collected and analyzed. Yr-1 students were excluded because they were still experiencing their first exposure to learning SE, and have not had enough experience giving verbal communication interactively via presentations using SE.

2.2 Methods

Students from different levels gave scientific presentations during their regular lectures. Certain usual/proper and mispronounced words were collected and analyzed. The pronunciations were transcribed into syllables so as to indicate and contrast the correct from inappropriately pronounced versions. Not all students mispronounced those words/numerals exemplified herein. Therefore, only certain words that needed attention or correction were analyzed in this study. It is easy to verbally correct the pronunciation of a single word; however, much more effort is required when those words arise within full sentences as part of spoken or written language. Therefore, sentences were given as examples as to how certain words are used in the context, with certain usual/common mispronunciations (**UMP**s) of

words/terms and numerals given to students to raise their awareness of and then learn the proper pronunciation. In addition, '***More examples***' were given as guide pronunciations of words with relevant pronounced syllables (based on American English) not given in the examples but may be encountered in literature and communication.

2.3 ***Usual/Common Mispronunciations (UMP)*:**

Below are examples of sentences that use words/numerals that certain Japanese students find difficulties to pronounce and enunciate, especially when those terms are used in a sentence. The "usual/common **mispronunciations**" (**UMP**s) or mispronounced syllables are colored in red (as spoken by some - not all - Japanese speakers) and the "revised versions" (**Rev**) of the mispronunciations are given below **UMP**. Standard IPA (International Phonetic Alphabet) pronunciation symbols for the pronunciation are provided in order to allow students to improve their self-awareness and learn to improve their pronunciations. The common pronunciations used here are based on American English (**Rev**); however, occasionally, British/European [**Rev(BE)**] versions are also added to make students aware of and understand regional differences/perspectives in pronunciation. Certain additional common SE words with tricky pronunciations are occasionally added at the end of relevant sections.

3. Results

3a) Japanese ESL learners should note the difference between 'a' (ə / éɪ / ət) vs 'ae' (e[ə]), 'an' (ən) vs 'un' (ˈʌŋˈ); 'the' (ðə / ði) and 'ther' (θér) as well as differentiating 'a' (ə / éɪ) vs 'e' (ə):

i) ***Un***cle George believes that ***ae***robic exercise is ***an exa***mple of exercise ***ther***apy for diabetes.

UMP: 1) ***Un***cle (ˈʌŋˈkuːlrú), 2 ***ae***robic (ətróʊbɪk), 3 ***an*** (`ʌn), 4 ***exa***mple (ɪgsəmpúːrˈʊ), 5 ***the***rapy (zírəpi)

Rev: 1 (ˈʌŋkl), 2 (e[ə]róʊbɪk), 3 (ən), 4 (ɪgzˈæmpl), 5 (θérəpi)

Rev(BE):2 (e[ə]rˈəʊbɪk), 4 (ɪgˈzɑːmpəl), 5 (ˈθɛ.ɹə.pi)

ii) **The ali**mentary t**ra**ct is not a simple **ele**mentary route.

UMP: 1) ***The*** (záə˞), 2) ***a***limentary (álimént'æli), 3) **tra**ct (tr'ʌkút'ɔ), 4) ***e***lementary (èləméntəli)

Rev: 1 (ði - Note: *before vowels*), 2) (`ælәménṭəri), 3) (trˈækt), 4) (èləménṭəri)

iii) '***Bac***teria' is the plural for '***bac***terium'; and ***bam***boo is not for ***mam***bo.

UMP: 1) ***bac***teria (bˈʌktí(ə)riə), 2) ***bac***terium (bˈʌktɪɹiəm), 3) ***bam***boo (bˈʌmbú:), 4) ***mam***bo (mˈʌmboʊ)

Rev: 1 (bæktí(ə)riə), 2 (bækˈtɪɹiəm), 3 (b`æmbú:), 4 (má:mboʊ)

Rev(BE): 4 (mˈæmbəʊ)

iv) Treatment of ***a***cinar cell ***a***denoma is usually done by surgical excision without follow-up ***ra***diotherapy.

UMP: 1) ***a***cinar (ásìnɑr), 2) ***a***denoma (ətdéɪnóʊmə), 3) ***ra***diotherapy (lá˞dʒú:tˈərəpi)

Rev: 1 (ˈæsìnɑr), 2 (`ædɪˈnóʊmə), 3 (réɪdioʊθérəpi)

v) When unit cells are ***a***ligned in ***a*** linear ***fa***shion to produce ***e***lectric currents, it is then called a ***bat***tery.

UMP: 1) ***a***ligned (ətláɪnd), 2) ***a*** (ɑ̀ɚ), 3) ***fa***shion (fɑ́ɚʃən), 4 electric (əlέktrɪk), 5 ***bat***tery (bət;ṭəri_)

Rev: 1 (əláɪnd), 2 (ə / éɪ), 3 (fˈæʃən), 5 (bˈæṭəri)

vi) Deoxyribonucleic ***a***cid (DNA) consists of 2 ***stran***ds of nucleotides ***a***rranged in ***a*** double-helix configu***ra***tion.

UMP: 1) ***a***cid (ə;sɪd), 2) ***stran***d (strənd), 3) ***a***rranged (ə;réɪnd), 4) configu***ra***tion (kənfìgəlɑ́ɚʃɔn)

Rev: 1 (ˈæsɪd), 2 (strˈænd), 3 (ɚ́ɪndʒd), 4 (kənfìgjʊréɪʃən)

vii) The ***ad***verse drug ***e***ffects ***a***ffected the postural ***ba***lance of the ***pa***tient.

UMP: 1 ***ad***verse (ədˈɔbɬ́s / ədˈɔbˈʌs), 2 ***e***ffects (éfèktsú), 3 ***a***ffected (éɪfέkt_),

4 ***ba***lance (bɑ́lˈʌnz), 5 pa***tient*** (pádiən)

Rev: 1 (ædvˈɚːs), 2 (ɪfékts), 3 (əfέktəd), 4 (bˈæləns), 5 (péɪʃənt)

Rev(BE): 1 (ˈædvəːs), 4 (ˈbaləns)

More examples with correct American English pronunciations indicated below **(typical terms/words that Japanese students find difficulties in pronouncing):**

‘æ’ pronunciation: b***a***mboo, b***a***sket, c***a***lcium, ***a***llergy, m***a***cromolecule, m***a***ngo, str***a***nd, f***a***t, p***a***ncreas, ***a***tom, ***a***ction, tr***a***ct, tob***a***cco, f***a***ctor, b***a***ck, pr***a***ctice, b***a***rrier, b***a***nk, b***a***rren

‘ɑɚ’: b***a***rbarians, b***a***rbiturate

‘ɑ́ɚ’: b***a***r, b***a***rber, b***a***rbital, b***a***rk

‘ə’: b***a***rium, b***a***rometer, m***a***terial, m***a***trix

‘éɪ’: b***a***se, b***a***sal, m***a***jor, membr***a***ne, r***a***dius

3b) Differences between ‘arter’ (ɑɚtì[ə]r) vs ‘ather’ (æ̀θɚʊ), ‘anti’ (ˈæn̩ṭi) vs ‘anchi’ (non-existent in English enunciation):

i) ***Ather***oscleorosis is a form of ***arter***ioscleorosis, and both can induce stroke and heart failure.

UMP: 1) atherosclerosis (ə;térɚsklə́ˈroʊsəs), 2) arteriosclerosis (ɑ́ɚṭṭérɚsklə́ˈroʊsəs)

Rev: 1 (æ̀θɚoʊsklɚ́ʊsɪs), 2 (ɑɚtì(ə)rioʊsklə́ˈroʊsəs)

Rev(BE): 2 (ɑːtìəriəʊoʊsklə́ˈroʊsəs)

ii) ***Anti***gen-***anti***body interaction is a specific chemical interaction between ***anti***bodies produced by B cells of the white blood cells and ***anti***gens (e.g. pathogens, chemical toxins) during immunoreaction.

UMP: 1 ***anti***gen (`ʌntʃíːgˈæn), 2 ***anti***body (`ʌntʃíːbɑ̀di), 3 ***anti***bodies (`ʌntʃíːbɑ̀disuː)

Rev: 1 (ˈæn̩ṭɪdʒən), 2 (ˈæn̩ṭɪbɑ̀di), 3 (ǽntɪbɑ̀diz)

Note: No SE words begin with ‘anchi-’

3c) Prefixes ‘bi’ (bí) vs ‘vi’ (vái); ‘ca’ (ká) vs ‘’car’ (kɑ́ɚ) and ‘cap’ (kˈæp) vs ‘cup’ (kˈʌp) vs ‘cop’

(kάp) in enunciating scientific terms

i) ***Bi***llions of ***vi***ruses and ***vi***rus particles, or ***vi***rions, are found on any ***bi***tumen road and in nature.

UMP: 1 ***bi***llions (bílíɑnsuː), 2 ***vi***ruses (wílrəsz), 3 ***vi***rus (wílrəs), 4 ***vi***rions (wílíɑnz), 5 ***bi***tumen (bítʃɚmən)

Rev: 1 (bíljənz), 2 (váɪrəsəz), 3 (vάɪ(ə)rəs), 4 (vάɪ(ə) ráɪənz), 5 (bɪt(j)úːmɪn)

Rev(BE): 2 (ˈvaɪrəsəz), 3 (ˈvaɪɹəs), 4 (ˈvaɪráɪənz), 5 (bítʃʊ)úːmɪn)

ii) Osteoporosis-related ***ca***vities in bones are not found in the ***car***tilage of healthy bones.

UMP: 1 ***ca***vities (kάːbɪtiz), 2 ***car***tilage (kάrútʃílɪdʒ)

Rev: 1 (kǽvɪtiz), 2 (kάɚṭəlɪdʒ)

Rev(BE): 2 (kάːṭəlɪdʒ)

iii) ***Vi***tamins enhance the immunodefense system, and can therefore be used to protect against ***vi***ral infections of the living system.

UMP: 1 ***vi***tamins (bítəmíntsuː), 2 ***vi***ral (wílrərú)

Rev: 1 (váɪtəmənz), 2 (vάɪ(ə)rəl)

iv) Bitter herbal extracts are usually en***cap***sulated by a ***cap***sule for oral intake, which is facilitated using a ***cup*** of drinking water, and not by wearing a ***cap***.

UMP: 1) en***cap***sulated (ɛnkˈʌpsəlèɪtɪd), 2) ***cap***sule (kˈʌpsl), 3) ***cup*** (kˈʌppú), 4) ***cap*** (kˈæpú)

Rev: 1 (ɛnkǽpsəlèɪtɪd), 2 (kˈæpsl), 3 (kˈʌp), 4 (kˈæp)

v) Drinking a ***cup*** of tea is more enjoyable than chewing on ***cup***rous or ***cup***ric oxide. ***Cu***pric oxide is also known as ***co***pper (II) oxide.

UMP: 1 ***cup*** (kˈʌppú), 2 ***cup***rous (kˈɔpúrəs), 3 ***cup***ric (kˈʌpúrɪk), 4) ***cop***per (kˈʌppɚ)

Rev: 1 (kˈʌp), 2 (kjúːprəs), 3 (kjúːprɪk), 4 (kάpɚ)

Rev(BE): 3 (kjúːúːprɪk), 4 (kˈɔpə)

More examples with correct American English pronunciations indicated below **(typical terms/words that Japanese students find difficulties in pronouncing):**

'kˈæp': ***cap***acity, ***cap***illary, ***cap***itation, ***cap***sid

'kˈʌ': ***co***polymer, ***co***worker, ***co***llaborate, ***co***operate, ***co***pe

'kά': ***cop***rophile, ***cop***rostasis, ***cop***ulation

'k(j)ú': ***cu***premia, ***cu***rare, ***cu***rette

'kjˈʊ': ***cu***re, ***cu***rative, ***cu***rie

'kˈʌp': ***cup***ped, ***cup***ping,

3d) Pronouncing the words and elements in a proper manner with prefixes/suffixes 'ca(l)' (k

ˈæ[l]) **vs 'ka(l)'** (ká[l]) **and 'chi'** (ˈtʃiː / káɪ) **vs 'tid'** (tiːd) **and 'tide'** (táɪd) **vs 'side'** (sáɪd) **vs 'ride'** (raɪd)**:**

i) ***Ka***posi sarcoma is ***ca***tegorized as a type of cancer.

UMP: 1) ***Ka***posi (kəpósi), 2) ***ca***tegorize (káɚtégərὰɪz), 3) ***ca***ncer (káːnsɚ)

Rev: 1 (kəpóʊsi), 2 (kˈætɪgərὰɪz), 3 (kˈænsɚ)

Rev(BE): 3 (ˈkæːnsə)

ii) ***Cal***cium is the English name while ***Kal***ium is the German name for the element with atomic number 20. Both elements combine with chlo***ride*** ions to form their chlorides.

UMP: 1 ***Cal***cium (kˈɚrúsiəm), 2 ***Kal***ium (kάrɪəm), 3 chlo***ride*** (kúrˈɔːraɪdˈɔ)

Rev: 1 (kˈælsiəm), 2 (kάlɪəm), 3 (klˈɔːraɪd)

iii) The phosphate ester of the nucleo***side***, which is the basic unit of the DNA or RNA, is called a nucleo***tide.*** A chromosome consists of two chroma***tids***.

UMP: 1 nucleo***side*** (n(j)úːkliəsítdá), 2 nucleo***tide*** (n(j)úːkliətʃíːdá), 3 chroma***tids*** (kúrˈəʊmʌtʃíːdάzú)

Rev: 1 (n(j)úːkliəˌsάɪd), 2 (n(j)úːkliəˌtάɪd), 3 (krˈəʊmˈʌtiːdz)

iv) 'Tai***chi***' is a form of ***Chi***nese marshal art**.**

UMP: 1 tai***chi*** (taɪˈkíː), 2 ***Chi***nese (tʃíníːz)

Rev: 1 (ˌtaɪˈtʃiː), 2 (tʃὰɪníːz)

v) ***Chi***tosan is a chemically processed form of ***chi***tin; it is a polysaccharide and not a polypep***tide***, and is used as a source of dietary fiber.

UMP: 1 ***chi***tosan (tʃíːtọʊsˈʌn), 2 ***chi***tin (tʃíːtʃín), 3 polypep***tide*** (pάlitʃíːdά)

Rev: 1 (kάɪtọʊsˈʌn), 2 (kάɪtn), 3 (pάlipéptὰɪd)

Rev(BE): 2 (kάtɪn)

3e) Differences of prefixes 'di-' (dei) **vs 'di-'** (di) **vs 'de-' and suffixes '-dium'** (dɪəm) **vs '-tium'** (ʃ(i)əm)**:**

i) ***Di***viding the ***di***ameter by 2 yields the ra***di***us.

UMP: 1 ***Di***viding (dάɪwíldíŋ), 2 ***di***ameter (dɪətmətὰː), 3 ra***di***us (rˈædʒiəz)

Rev: 1 (drvάɪdɪŋ), 2 (dɑɪˈæməṭɚ), 3 (réɪdiəs)

ii) The human duo***de***num is 25- to ***38***-cm long, and it connects the stomach to the jejunum.

UMP: 1 duo***de***num (díṭoʊódéɪnˈʌm) 2 ***thirty-eight*** or ***38*** (sὰɚṭi-eɪtú)

Rev: 1 (d(j)ùːədíːnəm) 2 (θˈɚːṭi-eɪt)

Rev(BE): 1 (djùːùːədíːnəm) 2 (θˈɚːṭi-éɪt)

iii) Masticated food from the buccal cavity of the film ***di***rector is transported ***di***rectly to his stomach for ***di***gestion via peristalsis of the esophagus.

UMP: 1 ***di***rector (dɪrékuːtɑ́), 2 ***di***rectly (dɪrékuːli) 3 ***di***gestion (dɪdʒéstʃɔn)

Rev: 1 (dəréktɚ), 2 (dɑɪéktli), 3 (dɑɪdʒéstʃən)

Rev(BE): 1 (dɑɪéktɚ)

iv) So***dium***, lith***ium***, and lute***tium*** are elements found in the periodical table. Interestingly, zinc and chromium, also found in the periodic table, are useful for ***dia***betes.

UMP: 1 so***dium*** (ˈsəʊdʒím), 2 li***thium*** (lídʒím), 3 lute***tium*** (luːtíːtʃíːəm), 4 (dɪɑ́ɚbétiːz)

Rev: 1 (ˈsəʊdɪəm), 2 (líθiəm), 3 (luːtíːʃ(i)əm), 4 (dɑ̀ɪəbíːtiːz)

More examples with correct American English pronunciations indicated below **(typical terms/words that Japanese students find difficulties in pronouncing):**

'dɪ': ***di***ffuse, ***di***vide, ***di***vine, ***di***vide, ***di***versify

'də': ***de***rail, ***de***cide, ***de***cision, ***de***tect, ***de***rive, ***de***cide, ***de***lay, ***de***lete

'dɑ́ɪ': ***di***late, ***di***methyl, ***di***chlorodiphenyltrichloroethane, ***di***vert, ***di***oxide, ***di***rection, ***di***aphragm

3f) No difference in pronouncing 'f' and 'ph':

i) Although different in spelling, sulphuric acid in British/European English is pronounced the same as sulfuric acid in American English: i.e. H_2SO_4.

UMP: 1 sulphuric (θrufjˈʊ(ə)rɪkuː), 2 sulfuric (θrufjˈʊ(ə)rɪ kuː)

Rev: 1. (sʌlfjˈʊ(ə)rɪk), 2 (sʌlfjˈʊ(ə)rɪk)

ii) ***Pha***ntom pain is intractable and can be ***fa***thomless.

UMP: 1 ***pha***ntom (fʌnṭəm), 2 ***fa***thomless (fʌṭəmləz)

Rev: 1 (fˈæntəm), 2 (fˈæðəmləs)

3g) Differentiating prefixes 'gi' (zai) vs 'gi' (gi) and be careful about the pronunciation of suffix '-gue' (gjuː / g / gi):

i) Modern chips can easily store memories of ***gi***gabit orders; ***gi***bbons may have memories of lesser orders.

UMP: 1 ***gi***gabit (dʒígəbít), 2 ***gi***bbons (gíbɑ́n)

Rev: 1 (ˈgɪgəbít), 2 (gíb(ə)nz)

ii) ***Gi***ngiva, the gum of the mouth, holds our teeth in place; and ***gi***ngivalgia or pain due to ***gi***ngivitis (inflammation due to gum infection), is not easy even for ***gi***ants to bear.

UMP: 1 ***Gi***ngiva (gíndʒíːbɑ́ː), 2 ***gi***ngivalgia (gíndʒíːbɑ́rúːgíə), 3 ***gi***ngivitis (gíndʒíːbítíːz), 4 ***gi***ants (dʒɑ́ɪənz)

Rev: 1 (dʒíndʒáɪvìéɪ), 2 (dʒíndʒáɪvǽldʒíːéɪ), 3 (dʒíndʒáɪváɪtíz), 4 (dʒáɪənts)

iii) Many ar***gue*** about the va***gue*** signs/symptoms between influenza and common cold; however, immediate development of fati***gue*** is an obvious sign of the former.

UMP: 1 ar***gue*** (rúːgjuː), 2 va***gue*** (wágjuː), 3 fati***gue*** (fáːtígjuː)

Rev: 1 (ɚgjuː), 2 (véɪg), 3 (fətíːg)

Rev(BE): 3 (fəˈtiːg)

iv) Den***gue*** fever is different from yellow fever.

UMP: 1 Den***gue*** (déŋgjù)

Rev: 1 (déŋgi)

Rev(BE): 1 (ˈdɛŋgeɪ)

More examples with correct American English pronunciations indicated below **(terms/words that Japanese students find difficulties in pronouncing):**

'dʒɑɪ': ***gi***gantic, ***gi***antism, ***gi***gantism

'dʒάɪ': ***gy***rate, ***gy***rectomy, ***gy***rencephalic, ***gy***rospasm

'gàɪ': ***gy***necology, ***gy***nephobia, ***gy***nopathy

ˈdʒí': ***gi***nger, ***gi***raffe, ***gi***nseng

'gí': ***gi***bbon, ***Gi***bson, ***gi***ft

3h)Differentiating prefixes and suffixes of 'i' (aɪ) vs 'i' (ì) and take care of '-kane' (kèɪn) vs '-kene' (kìn) vs '-kyne' (káɪn):

i) Occasional ***i***diopathic problems have been ***i***dentified to be the results of ***i***atrogenic outcome from ***i***buprofen overdose.

UMP: 1 ***i***diopathic (άɪdioʊpáːtʃík), 2 ***i***dentified (ìdéntəfàɪd), 3 ***i***atrogenic (ìætroʊdʒénɪk), 4 ***i***buprofen (ìbjuplˈʊfən)

Rev: 1 (ìdiəpˈæθɪk), 2 (aɪdéntəfàɪd), 3 (aɪˋætroʊdʒénɪk), 4 (àɪbjuprόʊfən)

Rev(BE): 4 (ìbjuprόʊfən)

More examples with correct American English pronunciations indicated below **(typical terms/words that Japanese students find difficulties in pronouncing):**

'aɪ': ***i***dol, ***i***con, ***i***dentity, ***i***dea, ***i***deology, ***i***odine

'ì': ***i***diocy, ***i***diot, ***i***diolysin

ii) Al***kan***es are saturated ali***pha***tic hydrocarbons. Al***ken***es, also known as olefins, are unsaturated aliphatic hydrocarbons; while al***kyn***es are unsaturated aliphatic hydrocarbons consist of chains of carbon atoms containing triple bonds.

UMP: 1 Al***kan***es (ətrˈʊkáːn), 2 ali***pha***tic (ælɪˈfάtʃík), 3 Al***ken***es (ətrˈʊgén), 4 al***kyn***es (ətrˈʊkɪn)

Rev: 1 (ælkèɪnz), 2 (ælɪˈfætɪk), 3 (ælkìnz), 4 (ælkáɪnz)

3i) Differentiating prefixes 'la' (lˈæ), 'li' (lí), 'lu' (lˈʊ), 'le' (lé), and 'lo' (lá) vs 'ra' (rˈæ), 'ri' (rí), 'ru' (rú:), 're' (rɪ), and 'ro' (rˈəʊ):

i) ***Rou***tine ***La***tin ***le***arning helps ***Li***ly to understand medical terms better.

UMP: 1 ***Rou***tine (rù:tʃín), 2 ***La***tin (rátʃín), 3 ***le***arning (rátnɪŋ), 4 ***Li***ly (rili)

Rev: 1 (rù:tí:n), 2 (lˈætn), 3 (lˈɚ:nɪŋ), 4 (líli)

Rev(BE): 2 (ˈlæt.ɪn) 3 (lˈə:nɪŋ)

ii) ***Ra***ther than ***ri***tual practice and ***ru***mor-mongering by ***lo***bbying and ***lu***ring friends, the ***ro***ad to success in life depends on ***le***ssons ***le***arned, wisdom ***re***ceived, self-***re***flections, and not ***lu***ck alone.

UMP: 1 ***Ra***ther (rázá:), 2 ***ri***tual (rítʃɚ), 3 ***ru***mor (rú:mɚrù), 4 ***lo***bbying (rˈəʊbiɪŋgu:), 5 ***lu***ring (rú:rɪŋgu:), 6 ***ro***ad (rˈəʊdáʊ), 7 ***le***sson (lésún), 8 ***le***arned (lˈʌndá), 9 ***re***ceived (ɹɪˈsi:budá), 10 ***re***flection (rɪflékùʃˈɔn), 11 ***lu***ck (lˈʌkʊ)

Rev: 1 (rˈæðɚ / rá:ðɚ), 2 (rítʃuəl), 3 (rú:mɚ), 4 (lábiɪŋ), 5 (lúrɪŋ), 6 (rˈəʊd), 7 (lésn), 8 (lˈɚ:nd / lˈɚ:nt), 9 (ɹɪˈsi:vd), 10 (rɪflékʃən), 11 (lˈʌk)

Rev(BE): 1 (rá:ðə), 3 (rú:mə), 4 (lˈɔbiɪŋ), 6 (ɹəʊd), 8 (lˈə:nɪd)

3j) Differentiating terms using 'ma' (méɪ / mˈæ) vs 'me' (mé / méɪ) and 'mi' (mí / mɑɪ) vs 'my':

i) Th e ***maj***or index for ***mo***nitoring blood pressure is ***meas***urement of the systolic over diastolic blood pressures.

UMP: 1 ***maj***or (méɪdʒá:), 2 ***mo***nitoring (mánətáɚɪŋ), 3 ***meas***ure (méɪdʒáɚ)

Rev: 1 (méɪdʒɚ), 2 (mánətɚɪŋ), 3 (méʒɚ / méɪʒɚ)

Rev (BE): 1 (méɪdʒə), 3 (méʒə)

ii) To***ma***toes facilitate sleep; and ***mu***sic attenuates stress.

UMP: 1 To***ma***to (təmˈʌ ṭoʊ), 2 ***mu***sic (mjú:síkù)

Rev: 1 (təméɪṭoʊ), 2 (mjú:zɪk)

Rev(BE): 1 (təmá:təʊ)

iii) A ***mi***nute amount of snake venom may produce a ***my***riad of unwanted reactions within ***mi***nutes, and time is a ***ma***ster of none.

UMP: 1 ***mi***nute (mínətá), 2 ***my***riad (mɑɪriədá), 3 ***mi***nutes (mínətˈɔ: *with reference to time*), 4 ***ma***ster (mˈʌstá:)

Rev: 1 (mɑɪnjú:t: *with reference to quantity*), 2 (míriəd), 3 (mínəts), 4 (mˈæstɚ)

RevBE): 4 (mά:stə)

4. Discussion

Mutual understanding in spoken conversation - be it in the scientific community or the business world - depends on interactive communication. The use of correct words and technical terms, accurate numerals and quantities, and logical explanations accompanied by supporting evidence, as well as proper grammar are essential for mutual understanding. Therefore, the words/terms and numerals in a sentence have to be voiced and enunciated accordingly for comprehensive and effective input of the listening party to understand what is being spoken in order for him/her to analyze and respond thereof; and in so doing proper pronunciation and enunciation consequently allow both parties to carry out interactive communication. Although pronunciation and enunciation are not the only elements necessary for effective communication, proper pronunciation and enunciation do play a highly important role in communication.

The science-related UMPs typical of Japanese scientists from alphabets 'a' to 'n' – such as [ə;] or [éɪ] vs [ət]; [bæk] vs [bˈʌk]; [ˈæ] vs [ə;]; [b`æm] vs [bˈʌm]; [vˈɚːs] vs [bˈʌs]; [ˈæntɪ] vs [`ʌntʃíː], etc. (vide supra) – are very much rooted in the native language of speakers: i.e. the Japanese language (JL) in this case. Because Japan has a long history of isolation, interaction with languages foreign to or outside Japan was probably very limited to the priorities and edicts of the ruling and administrative classes. Given the cultural history of the Japanese people, Japanese people learning a foreign language might have be branded as 'non-patriotic or suspicious characters' by the over-zealous few during the isolation or 'Sakoku' (literally: closed country) period from 1633–1853 when Japan's isolation policy was in effect, and by which leaders attempted to 'close' to or isolate Japan from outside (other than Chinese and Dutch) influence.[5] No wonder learning the practice of medicine and other sciences in Japan was very much rooted in Dutch[6] and Chinese teachings during the Sakoku period, and is still influenced by the Dutch-based scientific terms used and pronounced by Japanese scientists before the onslaught from the English language and culture that began with the arrival of the Americans in July of 1853,[1] and the 'awakening' of FUKUZAWA Yukichi in the Yokohama incident in 1859.[4] As such, Japanese - for a long time - knew little or did not dare to venture out to learn English until the arrival of the Perry's black ship in 1853 or thereafter when the pursuit of knowledge and scientific progress demanded knowledge of foreign languages, especially English.

JL has only one pronunciation for each phonetic symbol (kana),[7] while Chinese has 4 (tones), and English varies according to the adjoining and surrounding letters. Therefore, it takes much effort and practice for Japanese scientists to correctly pronounce English words in scientific communication even in this modern age. The above UMPs reflect the single-pronunciation-per-kana nature of JL, as the same UMP is noted in different words having the same alphabetical components. Additionally, tertiary-level students, who have been taught in secondary schools by their teachers (who were taught by their former teachers) with improper pronunciation, continue to pronounce words incorrectly when they enter university. Therefore, if Japanese students can make an effort to be aware of the restriction in their phonology, and consequent UMPs, then they can quickly comprehend the differences in pronunciation between English and Japanese and improve their pronunciation (and enunciation as well). A further complication of learning English pronunciation is the regional differences between American, British/European, and Australian versions. The first step for Japanese ESL learners is to master basic correct pronunciation of a regional version (it is the American English in the case of Japan) before proceeding to become acquainted and familiarized with regional differences of the English language in the international community. It is no wonder that American English-orientated students and Japanese find American English-based TOEFL (Test of English as a foreign language) much easier to challenge than the British/European English-based IELTS (International English Language Test System).

In this study, the UMPs of students from Yr-2 to Yr-4 in University A enrolled in pharmaceutical science courses were analyzed; however, these collected samples may be different from those of students pursing linguistics or other courses of study elsewhere in Japan. In any case, the aforesaid UMPs are exemplary of Japanese ESL learners as a whole. It is indeed an urgent matter for Japanese scientists to make efforts to improve their pronunciation in conference presentations and communication in order to constructively deliver their intended message and findings. Having an intense interest in SE-learning[7] and with a pool of accumulated knowledge as a result of hard work and intense reading and research are learning-affirmative; however, being unable to deliver the message you want others to share and appre-

ciate in a proper manner is frustrating indeed. Speech is of course an importantly interactive means of sharing and contributing to mutual and multilateral understanding; and if the sentences are semantically and grammatically correct, then pronunciation can become a determining factor in making the communication productive. Further UMPs and difficult-to-say words for Japanese ESL learns will be added in subsequent papers. Meanwhile, we present the following 'tongue-twisters' involving 'æ', 'dɪ', 'dάɪ' and other sounds for practice and for improving eloquence:

1) There is a blue bug in my black bag at the back of my brilliant red car.

2) If dichlorodiphenyltrichloroethane, or DDT, is diluted three hundred thirty-three fold, it is still effective and stable. Make sure it is diverted and disposed of in a proper manner before it diffuses to cause environmental damage.

3) Geishas in Ginza clad in kimono exhibit healthy gingiva and blackened teeth without fear, fright or flight, while George in Ghana wears shirts with buttons, torn jeans, and shredded pants with belts and buckles without bother, title, or care.

4) Idiopathic pain appears idiotic to the physician, but is excruciating suffering to the patent.

5) Viruses may not become virulent, and the living system may be protected from viral infection from virions if vitamins are taken regularly to boast the vital immunodefense system of the living body.

Endnotes:

1 Article Review. (1953). *Perry Ceremony Today; Japanese and U. S. Officials to Mark 100th Anniversary"* New York Times (July 8)

2 *Ronald MacDonald and the Opening of Japan.* www.jai2.com/RM.htm

3 *Tsuyakudachi No Bayumatsuishinn.* (2012). By KIMURA Naoki, p66-67. Yoshikawa Kobunkan Publisher. (in Japanese)

4 UNESCO. (1993). *Prospects: the quarterly review of comparative education (International Bureau of Education)*, Vol. XXIII (3/4):493-506; 1993.

5 https://en.wikipedia.org/wiki/Sakoku

6 *Dutch-Japanese Relation* http://japan.nlembassy.org/you-and-netherlands/dutch-japanese-relations.html

7 FUJIWARA Yumi. (2016). *Towards Practical English teaching and learning in Japan: use of English for Special Purposes.* Wisdom (Philosophical) Note: J Acad Soc for QoL Vol 2(1) (the present issue)