A Practical Guide to Teaching ESP Using Data-Driven Learning (DDL) Tools and Techniques

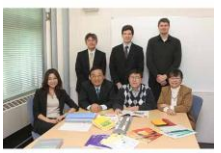
Laurence Anthony
Center for English Language Education in Science and Engineering (CELESE),
Waseda University (早稲田大学), Japan
anthony@waseda.jp
http://www.antlab.sci.waseda.ac.jp

Outline

- Waseda University CELESE ESP Program
  - background, needs, and program design
- Introducing Data-Driven Learning (DDL) into the ESP Classroom
  - challenges in teaching technical writing
  - reasons for introducing DDL
- Four stages to a DDL approach
  - corpus creation, tools selection, materials design, teaching
  - case study: teaching materials/methods writing

Waseda University, CELESE English Program for Scientists and Engineers

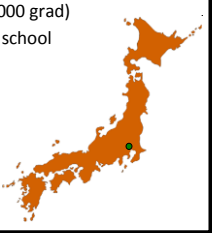
早稲田大学 理工学術院 英語教育センター
Waseda University Faculty of Science and Engineering
Center for English Language Education (CELESE)



Center for English Language Education in Science and Engineering (CELESE)

Waseda University, CELESE English Program for Scientists and Engineers

- Institution:
  - Faculty of Science & Engineering
- Schools/Departments:
  - 3 schools; 17 departments
  - ≈10,000 students (6,000 undergrad; 4000 grad)
  - ≈75% of students proceed to graduate school
- English Faculty:
  - 9 full-time faculty, 55 part-time faculty
- English Courses:
  - Seventeen courses: 500 sections

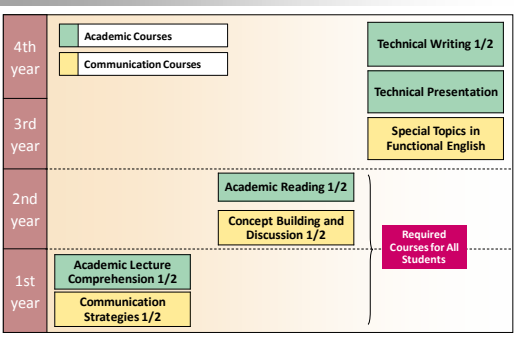


Needs analysis at CELESE

- Student Needs
  - English to study, research, discuss, and present content of special area of study
  - English to discuss and resolve global issues as citizens of Japan as well as of the world
  - English for the workplace

(Ministry of Education Advisor, 2009)

An Example ESP Program: The CELESE Program

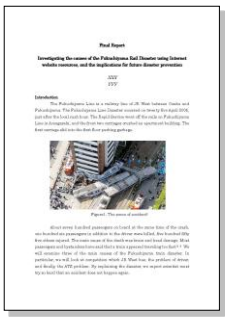


CELESE Undergraduate Program (B.Sc.)

1st Year Courses:
Academic Lecture Comprehension 1/2・Communication Strategies 1/2

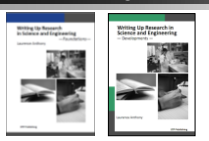
- Course goals
  - lecture understanding
  - note-taking
  - summary writing
  - discussion
  - debate

2nd Year Courses:
Academic Reading 1/2・Concept Building and Discussion 1/2



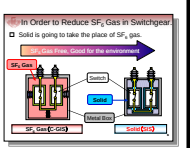
- Course goals
  - Reading & Writing
  - Group & Individual projects
    - processes/chart explanations
    - avoiding plagiarism
    - Internet searching
    - discussion
  - Presentation
    - PowerPoint slide design
    - presentation basics

3rd & 4th Year Courses:
Technical Writing 1/2・Technical Presentation



- Course goals
  - Research paper English
    - organization
    - flow & style
    - specialist vocabulary
  - Presentation English
    - understanding the audience
    - effective delivery methods
    - useful expressions
    - ...

3rd & 4th Year Courses:
Technical Writing 1/2・Technical Presentation



- Course goals
  - Research paper English
    - organization
    - flow & style
    - specialist vocabulary
  - Presentation English
    - understanding the audience
    - effective delivery methods
    - useful expressions
    - ...

Overview of Technical Writing

- Course objectives
  - moving from explicit to implicit learning
  - moving from templates to original writing
  - moving from generic to specialized research papers
- Final Goal
  - a 4-5 page research paper written at the level of a national conference proceedings

Curriculum/Syllabus Design Questions

- How do we teach the characteristic patterns of research paper writing in 17 different specialist fields?
- How do we train (non-specialist) teachers to instruct students in the classroom?
- How do we empower students to be able to identify the characteristic patterns of language use in other text types after graduation?
  - e.g. email writing, memos, technical reports, proposals, ...

  ⇨ **Introduce Data-Driven Learning (DDL) into the technical writing classroom**

DDL in the ESP Classroom

- Characteristics of Data Driven Learning (DDL):
  - A focus on the exploitation of authentic materials
  - A focus on real, exploratory tasks and activities
  - A focus on learner-centered activities
  - A focus on the use and exploitation of tools

(Bernd Rüschoff, 2010)

13

DDL in the ESP Classroom

- Advantages with using a data-driven approach (see Boulton, 2009)
  - Teachers do not need to be experts in 17 specialized fields
    ⇨ Teachers need only teach the DDL approach to students
  - Students can learn unique features of writing in their specialized field
    ⇨ Most textbooks only cover general writing principles
  - Students learn life-long skills
    ⇨ Students learn how to create and analyze corpora of any text type (e.g. research papers, emails, …)

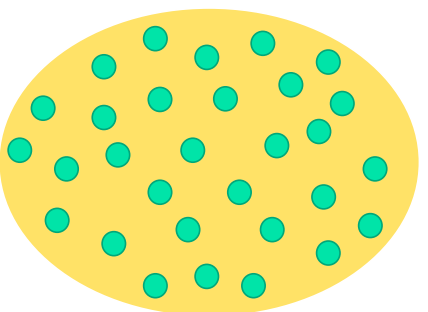
14

Stage 1: Building a (demo) corpus

- Step 1: Decide the target area
  - Identify a core set of high impact journals representing faculty disciplines
    - *Pattern Analysis and Machine Intelligence, Journal of American Chemical Society, Physical Review (B), CELL, Annals of Mathematics, Non-Linear Analysis*
- Step 2: Decide collection/sampling procedure
  - random sampling, stratified sampling, whole-population
- Step 3: Collect the texts
  - download/scan⇨convert to text⇨split into sections⇨save
- (Step 4: Annotate the corpus)
  - e.g. add Part-Of-Speech (POS) tags
  - e.g. add gender, age, country information (meta data)

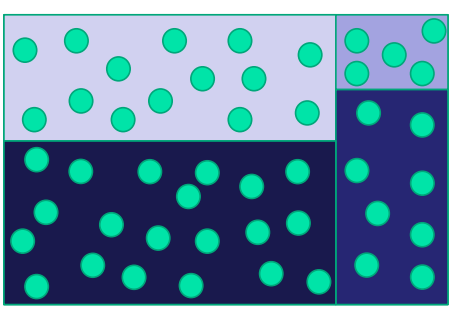
15

Stage 1: Building a (demo) corpus Random Sampling



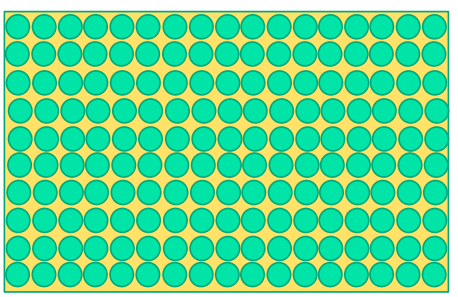
16

Stage 1: Building a (demo) corpus Stratified Sampling



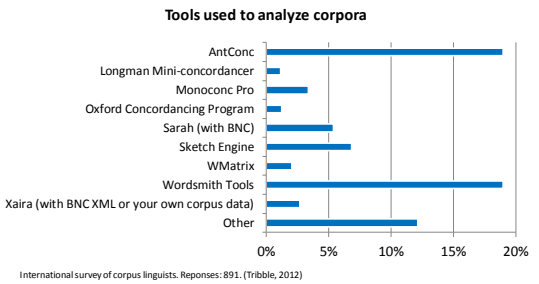
17

Stage 1: Building a (demo) corpus Whole Population



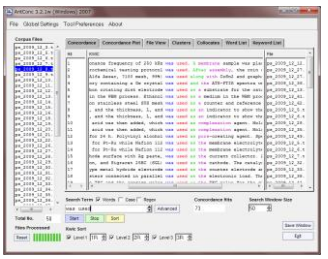
18

Stage 2: Obtaining a Corpus Tool



International survey of corpus linguists. Reponses: 891. (Tribble, 2012)

Stage 2: Obtaining a Corpus Tool



AntConc (ver.3.3.x)

Gotagger (ver. 0.7)

Stage 2: Obtaining a Corpus Tool
AntConc (Anthony, 2012)

- Freeware
- Multiplatform
  - Win 95/98/NT/XP/7
  - Linux
  - OS X
- Single-file portable app
- Unicode compliant
- HTML/XML tag handing
- Search Features
  - Wildcard/Regex
- Tools
  - KWIC Concordancer
  - Distribution Plot
  - File View
  - Clusters/N-grams
  - Collocates
  - Word Frequency
  - Keyword Frequency

Stage 3: Designing materials
Textbook creation

- Section 1: Basic Principles
  - Introduction to science and engineering
  - Writing principles in science. and engineering (APOFSP - Swales, 2004)
  - Introduction to text analysis (corpus linguistics basics)
- Section 2: Applications in Writing
  - Titles
  - Introductions
  - Materials and Methods
  - Results and Discussion
  - Abstracts

Stage 3: Designing materials
Textbook creation

Stage 4: Teaching the class
Example: *Materials/Methods* writing

- **Overcharge reaction of lithium-ion batteries**
- Takahisa Ohsaki[a],*, Takashi Kishi[a], Takashi Kuboki[a], Norio Takami [a], Nao Shimura [b], Yuichi Sato [b], Masahiro Sekino [b], Asako Satoh [b]
- [a] Corporate Research & Development Center, Toshiba Corporation, 3-4-10, Minami-Shinagawa, Shinagawa-ku, Tokyo 140-0004, Japan. [b] Battery & Energy Division, Display Devices & Components Control Center, Toshiba Corporation, 3-4-10, Minami-Shinagawa, Shinagawa-ku, Tokyo 140-0004, Japan
- ***Journal of Power Sources 146 (2005) 97–100***

Stage 4: Teaching the class
Example: *Materials/Methods* writing

- **Prismatic, hermetically sealed 633048-type lithium-ion cells with a nominal capacity of 650 mAh** were assembled.
- **The cells** were 6.3mm in thickness, 30mm in width and 48mm in height, using LiCoO2 cathodes, graphitized mesophase-pitch-based carbon fiber (MCF) anodes and polyethylene separator.
- **The graphitized MCF** was prepared at Petoca Co. Ltd.
- **The electrolyte** was a 1M solution of LiPF6 in a mixture of ethylene carbonate (EC) and ethyl methyl carbonate (EMC).
- **The overcharge test** was carried out at a 1 C rate constant current using a 7.5V power supply.
- **Current limiting or temperature trip safety devices (e.g. PTC)** were not used in the experimental cells.
- **An H-shaped glass cell** was also used to analyze the gas composition evolved at the cathode and anode, respectively.
- **The cathode (40mm × 30 mm) and anode (40mm × 30 mm)** were arranged separately in the glass cell, and then **overcharge** was carried out at 3 mA cm^{-2}.
- **The internal gas** was collected by a micro-syringe, and analyzed by gas chromatography.

25

Stage 4: Teaching the class
Example: *Materials/Methods* writing

- Style - Past, passive verbs
  - "A lithium-ion cell with a nominal capacity of 650 mAh was assembled."
- Style - Present, active verbs
  - "Figure 1 shows a schematic of the apparatus."
  - "The length varies from 500 nm to 1 µm."
- Style - Present, passive verbs
  - "A schematic of the apparatus is shown in Figure 1."

Common Verbs used in past, passive

was added	was determined	was measured	was set
was applied	was employed	was obtained	was tested
was calculated	was fixed	was performed	was supplied
was carried out	was heated	was placed	was coated
was conducted	was made	was prepared	was collected

26

Stage 4: Teaching the class
Example: *Materials/Methods* writing

- Style - Past, passive verbs
  - "A lithium-ion cell with a nominal capacity of 650 mAh was assembled."
- Style - Present, active verbs
  - "Figure 1 shows a schematic of the apparatus."
  - "The length varies from 500 nm to 1 µm."
- Style - Present, passive verbs
  - "A schematic of the apparatus is shown in Figure 1."

Common Verbs used in present, active

consists	gives	means	shows
contains	includes	occurs	suggests
decreases	increases	provides	summarizes
exhibits	indicates	reaches	supports
falls	makes	refers	uses

27

Stage 4: Teaching the class
Example: *Materials/Methods* writing

- **Part 1: Instructions**.
  - Follow the instructions below and investigate voice (active/passive) and tense (past/present) usage in materials and methods sections.
  - You will need your own corpus of materials and methods sections saved as text files.
    - 1. Using the *AntConc* cluster tool, find the most common verbs used in the passive voice. Hint: Search for "was|were" for words clusters of two words. Write down your results.
    - 2. Using the Concordance Plot tool, compare the number of times authors use "is" and "are" compared with "was" and "were." Do authors tend to write in the present or past tense?
    - 3. Some authors choose to write methods mostly in the present tense. Using the Concordance Plot tool, search for "is|are" write down how many authors adopt this strategy.
    - 4. How do the majority of authors use "is" and "are" in the methods section? Write three different reasons for using these verbs.

28

Stage 4: Teaching the class
Example: *Materials/Methods* writing

- **Part 2: Instructions**
  - Follow the instructions below and investigate preposition (*at, by, during, from, in, into, on, through, to, under, via*) usage in materials and methods sections.
    - 1. Using the Concordance tool, search for the following prepositions and write down common expression(s) in which they appear.
      - Hint: search for "at|by|in|on|under" and order by the center word (0), the first word to the right (R1), and the second word to the right (R2).

29

Stage 4: Teaching the class
Example: *Materials/Methods* writing

- **Part 2: Instructions**
  - Follow the instructions below and investigate preposition (*at, by, during, from, in, into, on, through, to, under, via*) usage in materials and methods sections.
    - 2. The preposition "to" is often combined with a verb at the start of sentences.
      - Using the Clusters tool, find the two most common verbs that can appear after "to" in this position.
      - What article typically follows the verb in these cases?
        - Hint: Set the minimum and maximum cluster size to 3, and fix the search term position to "On Left" to ensure that all the clusters start with "To". Also, remember to activate the Case option, so that only "To" is searched for.

30

Stage 4: Teaching the class
Example: *Materials/Methods* writing

- **Student A (Before taking class)**
  - II. MATERIALS AND METHODS
  - To collect the information about blu-ray disc, first the Google search engine (3) was used by retrieving the term "bru-ray disc", with 18,500,000 hits. To narrow these results down to fewer and practical ones, more detailed terms such as "history of blu-ray disc" were used and the result of these searches is organized as table 1. Except for several advertisement websites, most of the materials hit were read. As table 1 showed, the number of the hits is rather small. Predictably, however, some important terms appears frequently in the majority of the materials respectively.

31

Stage 4: Teaching the class
Example: *Materials/Methods* writing

- **Student A (After taking class)**
  - Ⅲ. MATERIALS AND METHODS
  - Silicon was chosen as the sample substance. Ten g smashed Sin powder was put into a metal cell. The cell was set in the X-ray diffractometer produced by Nipponbunnkou. Figure.1 shows the cross section of the X-ray diffractometer device. The 2θ-θdetermination was adopted to measure the strength of diffraction. The voltage and current of X-ray lamp were set at 40kV and 30mV respectively. Copper or iron was chosen as the target for the X-ray lamp. The range of the angle was between 20 and 140 degree. The speed of the measurement was 4° /min (2θ). Slit size was fixed in DS-1° ,SS-1° and RS-1° .

32

Stage 4: Teaching the class
Example: *Materials/Methods* writing

- **Before**: Class usage of passive verbs (Methods section)

achieved	considered	investigated
analyzed	consulted	measured
applied	discussed	obtained
carried	divided	performed
collected	established	prepared
compared	examined	proposed
conducted	included	read
connected	introduced	substituted

33

Stage 4: Teaching the class
Example: *Materials/Methods* writing

- **After**: Class usage of passive verbs (Methods section)

added	defined	followed	obtained	set
amplified	described	generated	outputted	shown
analyzed	designed	immersed	passed	sonicated
based	determined	increased	performed	stocked
collected	diluted	incubated	prepared	stopped
compared	divided	initiated	published	substituted
conducted	dried	inserted	purified	transformed
connected	eluted	introduced	put	used
considered	employed	lysed	read	visualized
consisted	expanded	measured	regarded	washed
converted	expressed	mediated	removed	
decreased	factorized	multiplied	separated	

34

Student feedback on using DDL
(based on formal survey responses)

Question (Scale 1 to 5)	Class One (Fri. 3) (mean of 8 students)	Class Two (Fri. 4) (mean of 12 students)
The class was easy to understand.	4.9	4.8
The class increased my motivation.	4.9	4.6
The class improved my writing	4.4	4.6
The class was important to me.	4.6	4.7
It was a good class (overall).	5.0	4.8

35

Student feedback on using DDL
(based on formal survey responses)

- Positive
  - "It was really useful. I think I will use it from now."
  - "The explanation was good. I will use it everyday."
  - "I think it is really great."
  - "It was good."
- Negative
  - "It would be good to have a user manual."
  - "I want to know more about how to use AntConc."
  - "I want to know more about good search terms."
  - "I wanted a more detailed explanation of the tool."
  - "Making the corpus was annoying."

36

Conclusions

- DDL can be very effective in the ESP classroom
  - It provides teachers and students with ways to analyze language empirically (scientifically)
  - It empowers teachers and students to discover features of writing in their own and other specialized fields
  - It results in noticeable gains in student language production
- DDL cannot be introduced into the classroom in an ad-hoc fashion
  - Technical issues (software/hardware) need to be addressed
  - Carefully designed student materials are needed
  - Teaching training is essential

37