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

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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

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

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

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, …)

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)

Stage 1: Building a (demo) corpus
Random Sampling

Stage 1: Building a (demo) corpus
Stratified Sampling

Stage 1: Building a (demo) corpus
Whole Population
Stage 2: Obtaining a Corpus Tool

Tool used to analyze corpora

- AntConc
- Longman Mini-concordancer
- Monocconc Pro
- Oxford Concordancing Program
- Sarah (with BNC)
- Sketch Engine
- WMatrix
- WordSmith Thick
- Xaira (with BNC XML or your own corpus data)
- Other

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

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 4: Teaching the class

Example: Materials/Methods writing

Overcharge reaction of lithium-ion batteries
- Takahisa Ohsaki*, Takashi Kishi, Takashi Kuboki, Norio Takami, Nao Shimura, Yuichi Sato, Masahiro Sekino, Asako Satoh

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Journal of Power Sources 146 (2005) 97–100
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**
  - "The length varies from 500 nm to 1 μm."

<table>
<thead>
<tr>
<th>Common Verbs used in present, active</th>
<th>Consists</th>
<th>Includes</th>
<th>Means</th>
<th>Occurs</th>
<th>Provides</th>
<th>Reaches</th>
<th>Shows</th>
<th>Suggests</th>
<th>Summarizes</th>
<th>Supports</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>gives</td>
<td>decreases</td>
<td>falls</td>
<td>gives</td>
<td>includes</td>
<td>makes</td>
<td>means</td>
<td>occurs</td>
<td>provides</td>
<td>reaches</td>
<td>shows</td>
<td>suggests</td>
</tr>
</tbody>
</table>

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 (O), the first word to the right (R1), and the second word to the right (R2).

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

- **Style - Past, passive verbs**
  - "The length varies from 500 nm to 1 μm."
- **Style - Present, active verbs**
  - "A lithium-ion cell with a nominal capacity of 650 mAh was assembled."

<table>
<thead>
<tr>
<th>Common Verbs used in past, passive</th>
<th>Falls</th>
<th>Was added</th>
<th>Was calculated</th>
<th>Was determined</th>
<th>Was employed</th>
<th>Was fixed</th>
<th>Was heat</th>
<th>Was made</th>
<th>Was measured</th>
<th>Was obtained</th>
<th>Was performed</th>
<th>Was placed</th>
<th>Was prepared</th>
<th>Was set</th>
<th>Was tested</th>
<th>Was supplied</th>
<th>Was coated</th>
<th>Was collected</th>
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<td>summarizes</td>
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<td>uses</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

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|are" compared with "was|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.
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 “blu-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.

- 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-determination 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°.

Before: Class usage of passive verbs (Methods section)

<table>
<thead>
<tr>
<th>achieved</th>
<th>considered</th>
<th>investigated</th>
</tr>
</thead>
<tbody>
<tr>
<td>analyzed</td>
<td>consulted</td>
<td>measured</td>
</tr>
<tr>
<td>applied</td>
<td>discussed</td>
<td>obtained</td>
</tr>
<tr>
<td>carried</td>
<td>divided</td>
<td>performed</td>
</tr>
<tr>
<td>collected</td>
<td>established</td>
<td>prepared</td>
</tr>
<tr>
<td>compared</td>
<td>examined</td>
<td>proposed</td>
</tr>
<tr>
<td>conducted</td>
<td>included</td>
<td>read</td>
</tr>
<tr>
<td>connected</td>
<td>introduced</td>
<td>substituted</td>
</tr>
</tbody>
</table>

Question (Scale 1 to 5)

<table>
<thead>
<tr>
<th>Question</th>
<th>Class One (Fri. 3)</th>
<th>Class Two (Fri. 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The class was easy to understand.</td>
<td>4.9</td>
<td>4.8</td>
</tr>
<tr>
<td>The class increased my motivation.</td>
<td>4.9</td>
<td>4.6</td>
</tr>
<tr>
<td>The class improved my writing</td>
<td>4.4</td>
<td>4.6</td>
</tr>
<tr>
<td>The class was important to me.</td>
<td>4.6</td>
<td>4.7</td>
</tr>
<tr>
<td>It was a good class (overall).</td>
<td>5.0</td>
<td>4.8</td>
</tr>
</tbody>
</table>

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."
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