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CALL Design: Principles and Practice  
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## Investigating an open methodology for designing domain-specific language collections

Alannah Fitzgerald<sup>1</sup>, Shaoqun Wu<sup>2</sup>, and Martin Barge<sup>3</sup>

**Abstract.** With this research and design paper, we are proposing that Open Educational Resources (OERs) and Open Access (OA) publications give increasing access to high quality online educational and research content for the development of powerful domain-specific language collections that can be further enhanced linguistically with the Flexible Language Acquisition System (FLAX, <http://flax.nzdl.org>). FLAX uses the Greenstone digital library system, which is a widely used open-source software that enables end users to build collections of documents and metadata directly onto the Web (Witten, Bainbridge, & Nichols, 2010). FLAX offers a powerful suite of interactive text-mining tools, using Natural Language Processing and Artificial Intelligence designs, to enable novice collections builders to link selected language content to large pre-processed linguistic databases. An open methodology trialed at Queen Mary University of London in collaboration with the OER Research Hub at the UK Open University demonstrates how applying open corpus-based designs and technologies can enhance open educational practices among language teachers and subject academics for the preparation and delivery of courses in English for Specific Academic Purposes (ESAP).

**Keywords:** corpus-based language learning, ESAP, OER, open access, user interface design, teacher education, British law reports corpus, MOOC.

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## 1. Introduction

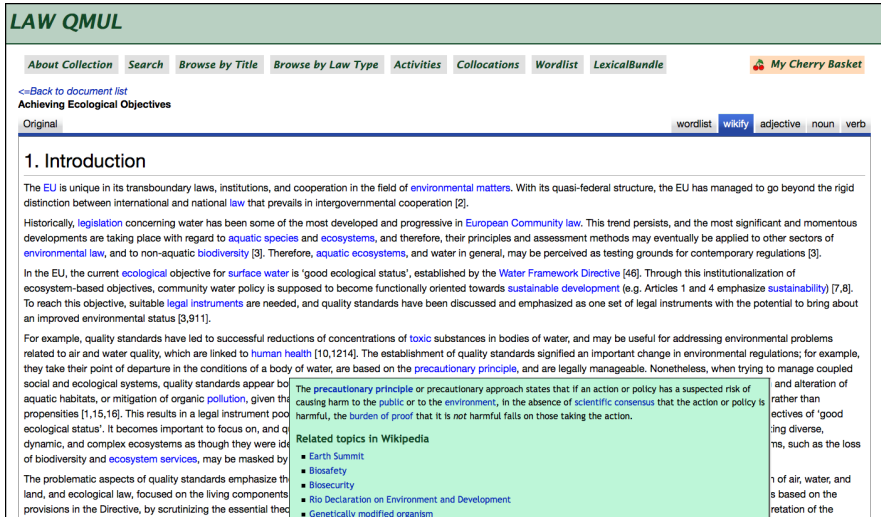
More so than ever, we have increasing access to a range of authentic open content online, such as lectures and podcasts, e-books/textbooks, research publications, blogs, wikis, as well as free and open online tools for their linguistic analyses. Designing easy-to-use interfaces for the use of these linguistic tools is a key requirement for their uptake by non-expert users, namely learners, teachers, subject academics, instructional designers and language resource developers. The Open Educational Resources and Open Access movements within higher education provide a compelling opportunity for the development of derivative domain-specific language learning resources. The field of Computer Assisted Language Learning (CALL) is now presented with a large supply of interesting linguistic material relevant to specific subject areas, including text, supplementary images (slides), audio and video. Such material can be automatically analysed, enriched, and transformed into corpus-based resources that learners can browse and query in order to extend their ability to understand the language used, and help them to express themselves more fluently and eloquently in target subject domains.

Uses for domain-specific corpora in language learning and teaching are increasing in popularity (Gabrielatos, 2005; Stubbs & Barth, 2003). Salient lexico-grammatical patterns are easily identified and retrieved by corpus tools when corpora are derived from genres and certain types of document that predominate in domain-specific areas.

Many studies have been conducted into the perceived usefulness of corpora and concordancers for the search, analysis, retrieval and transfer of language items in language learning. Usability studies on the design and presentation of linguistic data by concordancers and corpus-based systems for uptake by language learners have not yet featured prominently in the research literature into CALL, however.

Collections in FLAX use an automated scheme that extracts recurrent grammatical patterns and phrases from text and presents them in an augmented text interface, designed for the non-expert corpus user (Wu & Witten, *Forthcoming*). Rather than relying on complex search commands to query corpora within involved concordancer interfaces (which have been designed by and for the corpus linguist), FLAX links relevant tools and resources into streamlined online interfaces for the language learner. For example, in the ESAP collections, FLAX connects to the open-source Wikipedia Miner toolkit to extract key concepts and their definitions from Wikipedia articles (Milne & Witten, 2013) to assist with reading and vocabulary as can be seen in [Figure 1](#).

Figure 1. FLAX augmented text interface with wikify function in Law Collections



## 2. Method

### 2.1. Open domain-specific collections building in FLAX

“Use of OER leads to critical reflection by educators, with [...] improvement in their practice” (OER Research Hub, n.d., para. 1). This is one of a cluster of research hypotheses currently under investigation at the OER Research Hub for the development of open language corpora in FLAX in collaboration with Queen Mary University of London (QMUL).

Table 1. Type, number and source of items in the FLAX Law Collections

Type of media	Number and source of corpus items
Open Access Law research articles	40 Articles (DOAJ - Directory of OA Journals, with Creative Commons for the development of derivatives)
MOOC lecture transcripts/videos (streamed via YouTube/Vimeo)	4 MOOC Collections: Copyright Law (Harvard/edX), English Common Law (University of London/Coursera), Age of Globalization (Texas at Austin/edX), Environmental Law and Politics (OpenYale)
Podcast audio files/transcripts (OpenSpire)	10-15 Lectures (Oxford Law Faculty and the Centre for Socio-Legal Studies)
PhD Law thesis writing	50-70 EThoS Theses (sections: abstracts, introductions, conclusions) at the British Library (OA but not licensed Creative Commons – permissions granted by HEIs)
British Law Reports Corpus (BLaRC)	8.5 million-word corpus developed by María José Marín Pérez. Derived from free legal sources at the British and Irish Legal Information Institute (BAILII) aggregation website

Domain-specific law collections in FLAX were developed for ESAP students taking the Law Pathway on the summer pre-sessional and the Critical Thinking and Writing in Law In-Sessional programmes at QMUL. The law collections in FLAX are centred on the re-use of OER and OA research publications in the target domain of Law, as can be seen in Table 1. It is anticipated that these collections for legal English will be of use across both formal and informal language learning and translation contexts.

## 2.2. Formatting resources for use in FLAX

Text extracts of longer than 2-3,000 words are likely to halt or crash the FLAX server application, due to the quantity of text parsing that the FLAX server can efficiently process in a given time. Therefore, source texts have to be divided into sections of not more than 2-3,000 words in length.

Source articles are often downloadable in .pdf format, and are often accessible as full web documents. However, text extracts intended for upload to the FLAX website need to be marked up in HTML. Even with knowledge of HTML, the process of marking up each text extract is a time-consuming process. It was therefore decided to develop a web-based formatting tool, implemented using JavaScript, as can be seen in Figure 2 to ease the process of converting sections of text to HTML.

Figure 2. FLAX HTML resource formatting tool

The screenshot shows a web-based formatting tool with the following components:

- Input Fields (Left Panel):**
  - Subject Area (e.g. Law):** Law
  - Subject Category (e.g. Arbitration):** Banking and Financial Regulation Law
  - Title of article:** on Transborder Insolvencies and Bankruptcies: The Case for Judicial Co-Operation
  - Title of section:** 1. Introduction
- Text Editor (Left Panel):** A large text area containing a sample paragraph about globalization and international financial markets. The text is partially highlighted in blue.
- Formatting Tools (Left Panel):** A row of buttons for text formatting: paragraph, blockquote, line break, numbered list, bullet list, list item, italic, bold, SuperScript, Remove breaks and Justify, and Preview Output.
- Source Information (Left Panel):**
  - Source text:** blr.2011.24015 Published Online December 2011 (http://www.SciRP.org/journal/blr)
  - Journal Citation:** BLR is an international refereed journal dedicated to the latest advancement of law.
  - Export file as:** 1. Introduction (with an Export button)
- Preview Output (Right Panel):**
  - Section Header:** 1. Introduction
  - Text:** The preview shows the formatted HTML output of the sample text, including bolded words like "demonstrates" and "instrumental", and italicized words like "emerge".

The user can paste copied text into a main text field, and paste/type the article title and section headings into labelled boxes. HTML tag buttons enable the user to

insert tags at relevant points in the text in order to re-format as required. When the file is exported, using the ‘Export’ button, the tool generates the HTML file, using the text input by the user. The tool is still in early stages of development and can only handle basic text formatting functions. However, further iterations of the tool are planned (e.g. the inclusion of colour-coded tags for enhanced user readability; the ability to insert image links).

### 3. Discussion

#### 3.1. Learning collocations in FLAX

Among other aspects of language, the ESAP for law collections in FLAX provide an excellent context in which to study collocations, a notoriously challenging aspect of English productive use even for quite advanced learners (Bishop, 2004; Nesselhauf, 2003).

Figure 3. Collocations in Law QMUL Collections linked to FLAX Wikipedia collocations database

**153 collocation(s) associated with the word environmental**

Adjective (80) | Noun + of (38) | Verb (35)

- [environmental law](#) (44)
- [environmental quality](#) (37)
- [environmental science](#) (10)
- [environmental impact statement](#) (9)
- [environmental tobacco smoke](#) (8)
- [environmental effects](#) (6)

- Now, I'd like to close by having you think about damages and how we calculate damages. And as you think about every case that we've discussed in this term, when we think about [environmental effects](#), you should be thinking about the magnitude of the effect and you should be thinking about the distribution of the effect. So think about this comparison between nuclear power on the one hand and wind energy on the other.
- And what we'll see today is that knowledge about the [environmental effects](#) of national security are produced predominately by the Defense Department. They control sites, they control the technology in weaponry and weapon delivery systems, making it extremely difficult for the public to understand really what the dangers might be.
- And the Environmental Protection Agency basically shuts down the public from understanding what that is. And it's all about how much of the chemical is produced, what the company knows about where it goes, and also what the health effects or [environmental effects](#) might be. So access to data, intellectual property rights, secrecy and confidentiality, these are all things that we really need to think about very carefully when we structure environmental law.
- So we could get a whole new level of understanding of energy and the environmental health of different products, including issues such as protein content, fat content, type of fat, amount of salt, et cetera. Right now, most of us walk through the marketplace really blind to these issues, blind to the [environmental effects](#) of food production, blind also to the energy consumption.

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**Learning Collocations** My Cherry Basket Act

environmental  In  (contemporary English Wikipedia)

Family words: [environment](#) [environmentalist](#) [environmentalists](#) [environmentally](#) [environments](#) Synonym

**used as an adjective**

Collocation	Count	Collocation	Count
environmental + noun		environmental issues	2088
		environmental concerns	684
		environmental protection	1146
		environmental concerns	684
		environmental impact	882
		environmental concern	88
		environmental factors	830
		major environmental concern	10
		environmental conditions	794
		local environmental concerns	8
		major environmental concerns	4
adjective + environmental		social and environmental	79
		environmental and social	33
		various environmental	31
		local environmental	27
		significant environmental	26

- One of the **major environmental concerns** facing the park is illegal fishing of Chamo.
- The hills are mostly forested, although deforestation and the formation of fire-**major environmental concerns** in Trinidad.
- Though the route was basically set in stone in Connecticut, many issues remain biggest of which were **major environmental concerns** about how the freeway Reservoir, which is the main drinking water supply for Providence.
- In order to bring global concerns to the forefront of public attention, Pyle has w collaborative relationships between **major environmental concerns** such as

Figure 3 shows the result for the word *environmental*, which returns 153 collocations in the OpenYale lectures. Collocations are grouped under tabs that reflect the syntactic roles of the associated word or words: adjective (shown), noun + *of*, verb. The underlined words, *environmental* and *effects*, are hyperlinked to entries for those words in an external collocations database<sup>4</sup> built from a Wikipedia-derived corpus of 200 million articles. For example, clicking on the link for *environmental* generates a further collocations popup that lists *environmental issues*, *environmental protection*, etc., along with their frequency and their context in this much larger corpus.

### 3.2. Lexical bundles, word lists and natural language processing in FLAX

FLAX identifies “lexical bundles” used in the target ESAP law collections, which are multi-word sequences with distinctive syntactic patterns and discourse functions found in academic prose and lectures (Biber & Barbieri, 2007; Biber, Conrad, & Cortes, 2003, 2004). A typical pattern found in spoken corpora is *verb phrase + that (wanted to reemphasise/mention that...)*.

Figure 4. FLAX open natural language processing of verb phrases in Law QMUL Collections

The screenshot displays the FLAX interface for a law lecture transcript. At the top, there are navigation tabs: 'About Collection', 'Search', 'Browse by Title', 'Activities', 'Collocations', 'Wordlist', and 'LexicalBundles'. A 'My Cherry Basket' icon is visible on the right. Below the navigation is a video player showing a man speaking, with a slide titled 'Warning Labels for Ingredients in Human Breast Milk'. The video player has a progress bar and a 'wordlist' button. Below the video player, the text 'Chapter 3. FIFRA Amendments, The Founding of the EPA and Dietary Diversity' is displayed. The text is analyzed, with several words underlined in blue, indicating they are part of a lexical bundle. A navigation bar at the bottom of the text area includes 'wordlist', 'wikify', 'adjective', 'noun', and 'verb'.

User-friendly interfaces have been developed in FLAX to enable learners to analyse collection documents against well-known word lists such as Coxhead’s (2000) Academic Word List and West’s (1953) General Service List. Topic-specific

4. The database is available at <http://flax.nzdl.org/greenstone3/flax?a=fp&sa=collAbout&c=collocations>

words are also extracted from the documents to highlight recurrent vocabulary and a keyword slider tool function has been designed to identify the keyness and frequency of certain lexical items as they occur in specific texts. Keyness refers to the frequency of words as they occur in specific documents as a text feature rather than in relationship to other words as a language feature in the case of collocations, for example. The FLAX system also uses Open Natural Language Processing for the syntactic tagging<sup>5</sup> of texts, as can be seen in Figure 4 with verb phrases from one of the environmental law lectures.

#### 4. Conclusions

Content varies in terms of licensing restrictions, and FLAX has been designed to offer flexible linguistic support options for enhancing such content across both open and closed platforms. While we anticipate that this open methodology for domain-specific collections building in FLAX will be of value to language communities across formal and informal education, usage studies will be conducted at QMUL to suggest further directions for development.

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5. See the OpenNLP system; <http://opennlp.sourceforge.net>



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