Learning analytics with EventFlow and CoCo:
Exploring course enrollment pathways to inform curriculum planning

Leah P. Macfadyen, leah.macfadyen@ubc.ca, Faculty of Arts, UBC, Canada

The Society for Learning Analytics Research (SoLAR, http://www.solaresearch.org) defines Learning Analytics as

the measurement, collection, analysis and reporting of data about learners and their contexts for purposes of understanding and optimizing learning and the environments in which learning occurs.

The emerging interdisciplinary field of learning analytics, however, has thus far given little attention to analytic exploration of 'the environments in which learning occurs', or their influences on learning outcomes or student success. I consider curriculum design and course offerings to be critical elements of the *learning environment*, a position supported by Ochoa and colleagues [1], who also argue that LA techniques can offer educators greater insight into the nature of their course and curricular environments.

In this study, I seek to complement Ochoa's statistical approach by using EventFlow and CoCo to explore student course enrollment patterns and pathways in degree program areas of interest, and discover how these may influence student choices and performance (specializations (e.g. Majors), future enrollments, degree completion pathways, and measures of achievement (time to graduation, GPA)). This approach offers two important advantages. First, use of visual analytics tools is strategically important because visual representations of data are most compelling for my Faculty of Arts audience. Second, while VA tools such as Tableau or Gephi allow valuable visualization of enrollment data or 'course relatedness', they have no capacity to analyze or visualize temporal sequence data such as enrollment patterns.

Fig 1. Example pairwise representation of iSchool student enrollments, aligned by first Professional course (purple). In this example, roughly equal numbers of students complete *Library Services for Adults* (yellow) courses before and after a first *Professional* course.

I will present, discuss (and seek input on) three case study applications of EventFlow/CoCo to enrollment pathway problems, including discussion of the challenges of the data, and the "sharpening strategies" [2] that are assisting the analysis. Each case study makes use of ten years of course enrollment data in the program area under study, and seeks to address pressing curricular questions from departments in our Faculty:

1. Anthropology: Do early course enrollment patterns predict subsequent Majors choices?
2. iSchool: Does completion of a 'Professional' co-op term or internship shift student career pathways (as demonstrated by later course enrollment choices)?
3. Asian Studies: Can we identify Asian language course enrollment patterns that correlate more commonly with progression or dropout?

Fig. 2. Most differentiating subsequences between male and female iSchool students. Yellow = *Library Services for Children*; Beige = *IT & Systems*; Pink = *LIBR core*.

[1] Méndez et al. (2014). Curricular Design Analysis: A Data-Driven Perspective. *Journal of Learning Analytics*, *1*(3), 84–119. http://epress.lib.uts.edu.au/journals/index.php/JLA/article/view/4079/4420

[2] Du et al. (2015). Coping with Volume and Variety in Temporal Event Sequences: Strategies for Sharpening Analytic Focus. HCIL-2014-27. http://www.cs.umd.edu/localphp/hcil/tech-reports-search.php?number=2014-27