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Visualizing Student Research though a Multi-Conditional Branching "Choose Your Own Adventure"-Style Tutorial

Introduction

The UBC Faculty of Land and Food Systems (LFS) is in its second year of TLEF funding. They are restructuring their curriculum to support distance learners, increase student engagement, and assess and improve the research skills of their students. I joined the project this summer as an RA, focusing on extracting and assessing data from the Connect-based library research skills tutorial.

The previous year, a lot of work was done in identifying some of the barriers to student success and restructuring the tutorial content to reflect the students' modes of thinking. However, because LFS tutorial content must be hosted in the Connect environment, many of the goals of the project, such as promoting flexible learning styles and designing responsive content, were not possible. Additionally, during the assessment process, the team realized that lack of student confidence was a huge concern and one they would like to focus on. According to the project notes,

> Most of the students apologized at some point for either their research
> process or how they sorted information, and some of them indicated
> that they thought they were doing research 'wrong'. The process seems
> to be intimidating to them, and one that they want to do correctly but
> fear doing poorly.

This summer, Katherine Miller and I designed a "Choose Your Own Adventure"-style module in the existing LFS tutorial. This tutorial allowed students to choose their path through some of the most common research tools (such as Google, Wikipedia, and Summon), positively reinforced student choices even when (rarely) redirecting them toward a more productive path, and reiterated the concepts covered in the previous, more traditional, tutorial content (such as source triangulation and citation searching). We embedded several questions designed to elicit student feedback throughout the tutorial (accessible only to students who select certain target branches) and the survey terminates in a final feedback question available to everyone before students proceed to the next module.

This tutorial content, created with FluidSurvey and embedded in Connect, is currently the best tool the library and the LFS faculty have to see aggregate data across classes. Because Connect is so restrictive, the embedded survey is the first step toward identifying how—and if—students are using the content, how they feel about the tutorial, and what the rate of attrition is within the tutorial. While a single module can't answer this as broadly as we might wish, it has the potential to be an important analysis tool for the library and the LFS faculty.

However the native reports offered by FluidSurvey are not functional for our somewhat non-traditional use of the program. They present each question as a bar chart of response rates, with no visible overview of the structure, no way to view paths through the tutorial, and no logical connection between questions. If the two main user groups are to extract useful information from this module, a different visualization approach is necessary.

Task

Some of the key questions for this visualization are:

1. Are students using the tutorial? How many? In which classes?
   a. Is the information received worth the effort put in?
   b. Should we continue offering individual class surveys or should we combine them into a single survey?
2. Do students like this type of tutorial? Should we invest in additional development, leave it as is, or remove it entirely?
3. Where do students tend to lose interest and drop out? What is the global attrition rate for this module? Are any sections better or worse than the others?
4. Are students reporting differences in research strategies between undergraduate and graduate degrees? If so, are they different enough to require separate instruction?
5. Are students reporting good research habits? Do we need to emphasize certain skills more – or deemphasize ideas they've already mastered? Where are the information gaps for students?
6. Are there choices and paths that are not being used? Where is there potential to streamline the adventure?
7. How can we make the analysis of the results sustainable for the future (is the one click analysis possible)?

Dataset

The survey has 42 questions/nodes, 116 selections/links, and 59 branching rules controlling the visible structure of the tutorial. There are no loops possible, though some questions do allow students to backtrack and see previous sections (in these cases, FluidSurvey will only record the final selections of the user). In this pilot launch, we created identical copies of the survey for each class, but are considering a single instance going forward.

Usage statistics and student feedback are gathered from the survey responses provided. These responses (currently 132) are exported from FluidSurvey as a .csv file. Any data transformation must be done within Tableau to minimize the upkeep required.

Proposed Solution and Implementation Approach

Because the tutorial was created within a survey environment that does not support the desired analysis, finding a sensible way to display an overview of the content has been a primary concern—even for discussing the tutorial within the project team. A tree diagram (a linear node-link network) to convey the global structure of the tutorial has been most of the development work so far. As you can see in Figure 1, the proposed layout uses nodes to represent the questions a student sees and the links represent the possible selections they can make.
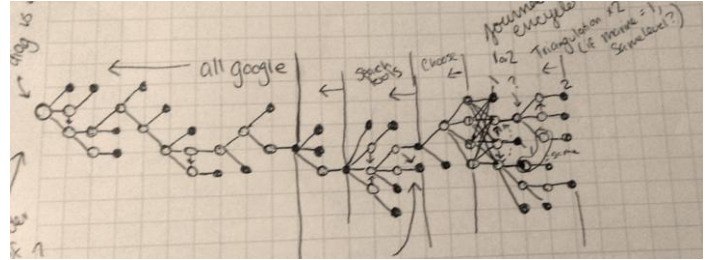

Figure 1. Narrative Overview.

This layout is consistent with most of the work done on Choose Your Own Adventure visualizations—which has not been the subject of academic research, but is a common subject addressed by hobbyists and publishers (Ashwell 2015, Fabulich 2011, Strong-Morse 2010, Swinehart 2009). While some alternative layouts were explored (force-directed graphs and flowcharts, in particular), the node-link tree was the most intuitive and the most sensible to implement.

Although changes are always possible, my initial intention is not to reduce or aggregate any of the tree's structure to make it obvious whether certain branches should be pruned. The usage data will be encoded with line width rather than spatial position to maintain a consistent structure despite changes in student use over time. However, spatial position will be used in an adjacent view to represent the quantity of students who have reached a certain depth in the tutorial (see Figure 2), which will help answer questions about attrition rate throughout the module.
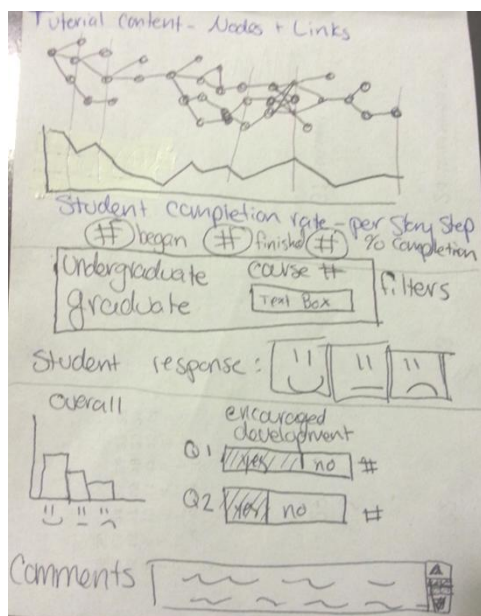

Figure 2. Proposed Dashboard.

Figure 2 shows a mock-up of the proposed dashboard. Key features beyond the visualization above include a graph of student response rates as they move through the tutorial (the increases sketched are possible because of the delayed branching structure and mandatory nodes), interactive filters to narrow the data by student group or student response (positive, negative, or neutral), and detailed breakdown of student sentiments about the tutorial. This duplication of response analysis (between the filters and the detailed breakdown) is necessary to allow users to identify overall sentiment as well as the trends and paths that tend to lead to positive and negative responses.

If time allows, this would only be the "overview" part of "overview first, details on demand." Additional tabs would allow users to narrow in on underused or frequently used branches of the tutorial to look for additional insights, compare the time to complete the tutorial to user response, and allow users to see the response rates over time—such as whether announcements or deadlines affected student use or whether it holds steady throughout the term.

UBC Library has just launched a major Tableau reporting initiative, and my supervisor has explicitly asked for the visualization to be developed in Tableau. Although Tableau is not natively built for network graphs, Figure 3 shows the initial "proof of concept" implementation. The default layout shows the basic structure of the tutorial, with each dead end representing the user's end point in that section. The links to the next question (that section's terminal node) can be toggled on and off for clarity (see Figure 3b) and each node is selectable and shows the text of the question on hover.
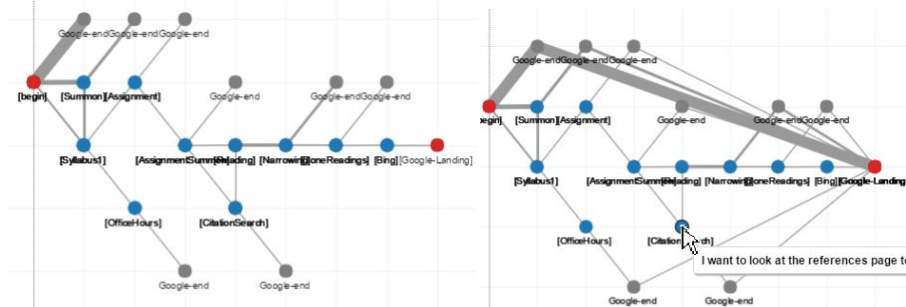

Figure 3. Tableau layout. (a) shows default layout while (b) shows the question text on hover and the optional links to the section's terminal node. https://public.tableau.com/profile/publish/TreeLinks/Sheet2#!/publish-confirm

Scenario of use

Alice is the subject librarian for the Land and Food Systems faculty at UBC. She is passionate about student learning and wants to make sure her students are confident in their research skills, comfortable using the library's resources—and that she is considerate of their time. When the term is over, she has to decide where to spend her effort preparing for next term. She opens this report, uploads the data for the current year, and notices that one branch of the tutorial has only been used once—by a user who didn't even finish the survey. Other branches saw increased use from the previous term, and a lot of those users requested additional development in the embedded feedback points. She makes a note to review that material and see if there are any new tools or research strategies she should mention. She then compares the responses of the students, and is pleased to note that that after cutting a long section on print encyclopedias down to single question, the positive response scores are nearly double the previous years'. However, when she filters to see if this holds true for graduate students and undergraduates alike, she found that the graduate students felt less prepared for the archival research necessary for one of the core courses. Perhaps she should restore that content for the students enrolled in that class. She adds her notes to her summer agenda and gets to work.

Personal experience

I am an MLIS candidate at the UBC iSchool and am very interested in assessment and visualization. As I mentioned, I joined this project over the summer as an RA. Most of my work far has been in the creation and programming of the survey, though I have also been working with Tableau for the UBC Library Assessment Office and Tableau Reporting Team since May. I have created visualizations for the UBC Library Open Data project and am confident in my ability to execute a Tableau dashboard for this project.

Milestones and Schedule

- ✓ 16-Sep - Visualization technique proposed to Katherine Miller (KM)
- ✓ 21-Oct - Tableau Proof of Concept presented to KM
- ✓ 22-Oct - Pitch Presentation to CPSC 547
-    11-Nov - Tree Structure Finalized and Coded
-    15-Nov - Tree and Data linked in Tableau
-    18-Nov - Initial Draft review with KM
-    TBD - Review Meeting with LFS Faculty Will and Fu
-    23-Nov - Status update to Tamara Munzner (TM)
-    4-Dec - Dashboard draft review with KM
-    7-Dec - WILU Session Proposal Due
-    11-Dec - Final dashboard review, initial analysis report with KM
-    15-Dec - Final Presentation to CPSC 547
-    18-Dec - Final Paper due to TM

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