Group Project Documentation
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We confirm that the above list of sources is complete AND that I/we have not talked to anyone else about the solution to this problem.

I. Basic Documentation

Project Overview

The purpose of our app was to answer a few given questions using data visualization techniques using given learning assessment data provided by Vanessa Preast. There were three questions we were aiming to help answer, namely: “What is the level of student achievement of the learning outcomes over time?”; “What phases of the assessment process are departments engaged in over time”; “Which learning outcomes are the most prevalent at Grinnell?”.

This visualization is made for the assessment board of Grinnell College and is meant to allow members of the board to visualize more information regarding the visualization data. We did this in a variety of ways. One method was adding a filter for many of our visualizations so that users could filter by things such as department, year and learning outcome.

We used data provided by Vanessa Preast from assessment surveys done in the past, which had been anonymized so that professors and courses were not recognizable. We also generated our own fake data set which went back to 2015 so that we could create visualizations for a wider time range than before. We created our visualizations and combined them into a single Shiny App for use by whoever wished to use our data.

Functionalities

We have 4 functional visualizations in our shiny app which are relatively straightforward. First we have an adjustable, collapsible tree. This tree allows you to collapse and expand different nodes depending on what you want more information about. An additional feature of the app is that you can orient the hierarchical structure of the tree based on the criteria of your choice and a subsequent dendrogram is generated accordingly. For example, you could make it go by department then learning outcome, or learning outcome then course description, or any number of potential other possibilities.

Another standard vertical tree is displayable, that branches out the different learning outcomes to the specific courses that align to the learning outcome. This is non-interactive unlike the collapsible one. If users would prefer to look at a non-changing fixed tree, this visualization would deem more useful than collapsible tree in such case.

The next visualization can adjust the years visible on the graph as well as filter by learning outcome and department. The trendline is currently a line of best fit, although further developments in the future with a polynomial regression would give more useful information.

The last visualization was a word cloud and bar chart with error bars. We generated a list of potential learning outcomes for each class, then used that list to generate a word cloud to analyze which learning outcomes were the most prevalent across Grinnell courses. We also generated a bar chart showing what percentage of the time the learning outcome of a course selected by professors agreed with one of the potential learning outcomes generated by our program.

Questions

1. What is the level of student achievement of the learning outcomes over time?
2. What phases of the assessment process are departments engaged in?
3. Which learning outcomes are the most prevalent in Grinnell?

Insights

Because the provided data did not include a significant span of time, we created dummy data that spanned multiple years for purposes of demonstrating the way the visualization would work with such data. Therefore, although we were unable to pull any real insights, ideally, you would see growth over time.

Although the collapsible tree is intended for users to interactive with themselves to locate specific paths, by interacting with it ourselves, we were also able to find several insights. Firstly, when we the tree hierarchy by "CWLO", "Academic Program", we noticed that Learning Outcome 2 least cited by professors; we thought this was something worth considering in reformatting or improving the learning outcomes for the CLS. In addition, by ordering the tree hierarchy by "Academic Year", "CWLO", "Course Num", we can visualize which CWLOs were most often used by courses over the academic years. Although the given data did not have academic years in variety, if we were to implement more years, this could indicate the trend in CWLO and what departments are most engaged in over time.

In our word cloud we generated a few insights. First was the prevalence of different learning outcomes. According to provided data, learning outcome 2 was by far the least prevalent.

However, when we used our text analysis to generate a list of potential learning outcomes for each course, we found learning outcome 2 to be the most prevalent, followed by learning outcome 6, then 5, then 4, then 1, then 3. It was also very interesting to view which programs had varying amounts of each learning outcome, which can be seen by filtering to view only specific programs.

We also learned a lot in our bar chart with error bars which analyzes whether professor selected learning outcomes and our automatically generated learning outcomes matched up. Specifically, we found we agreed with professors who said their course was learning outcome 3 85% of the time, but it fell of to 60% of the time for learning outcome 1, 50% of the time for learning outcome 2, and under 30% of the time for the remaining learning outcomes. It remains to be seen whether our text analysis fails to properly generate learning outcomes or if professors do not select the correct learning outcome for their course, but manual inspection along with these insights suggests professors could improve their selection of learning outcomes, and we believe this could warrant further investigation in the future.

Improvement

We think the app could benefit from a superior trendline as well as an updated UI. Besides the trendline, I think the app needs some aesthetic improvements. Ultimately, it is a simple app with a simple purpose which is achieved. One improvement may be to make it animated and the best visualizations from the data would be available as presets. We are considering the fact that those with limited Math/CS/Graph experiences will not be able to fully comprehend and make the most out of the visualization; therefore, a more explanatory or simplified version could be another goal in the future.

One of the things we wanted to implement but were unable to was having further options for node coloring. While we were able to incorporate the node color to be based on numeric categorical variables, we wanted to also create the option for coloring based on the hierarchy in the consecutive order). This is something we plan on implementing sometime in the future. In addition, we want to try adding the function of node size change depending on how many nodes within that node are held in the tree. For instance, if there are 30 courses using CWLO 3 vs. only 5 courses using CWLO 1, we want to show that through size of the nodes indicating CWLOs.

One improvement for the word cloud would be the learning outcome text analysis program. Currently it searches for keywords in the description to figure out which learning outcome(s) a course might fall under. There would be numerous other techniques, each with benefits and drawbacks, which could be used to improve this program. One solution could be to try to use AI or machine learning to generate learning outcomes. Another could be to weight each program and class to generate the correct learning outcome more often. Overall, we did feel this program worked well but we also do believe it has a lot of potential for improvement.

References

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Appendix

MEMORANDUM OF UNDERSTANDING

All *italicized* sentences are considered instructions and should be deleted prior to the submission of the final MOU.

This Memorandum of Understanding (MOU) is entered into by and between: *Provide the agency name and a brief description of each agency.*

A. P**urpose.** *State the purpose of the MOU. Include statements that explain how the collaborative relationship enhances or benefits the Applicant's program;*

Create visualizations of assessment data related to the college-wide learning outcomes to help college decision makers understand what the data means so they can take appropriate actions related to teaching and learning.

A. Roles and Responsibilities. *Clearly describe and delineate the agreed upon roles and responsibilities each organization or agency will be providing to ensure project success. The roles and responsibilities should align with project goals, objectives and target outputs. This may be contribution of staff time, in-kind contributions of space or materials, delivery of program services, provision of training or staff expertise, etc.*

The 324 group agrees to:

Responsibility/ActivityResponsibility/Activity	
Weekly updates	Provide weekly updates, email questions as they come up (Prefers email, chat/calls through teams are okay but email is the best way to stay in contact)
Prototypes	Meetings when we develop prototypes, schedule additional meetings as needed

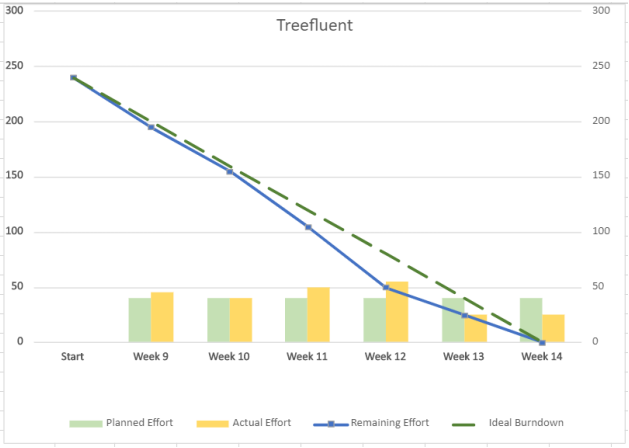
Vanessa Preast agrees to:

Responsibility/ActivityResponsibility/Activity	
Reply to inquiries	Reply in a timely manner to questions about project, prototypes or other questions
Guide project	Offer advice and feedback on prototypes and ideas and help guide journey to final project

Burndown Chart

Feature	Initial Estimate	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Effort Left
Wireframing	40	40	0	0	0	0	0	0
UI	40	0	10	10	20	0	0	0
Visualizations	60	5	15	30	10	0	0	0
Interactivity	60	0	15	10	25	10	0	0
Wrap-up	40	0	0	0	0	15	25	0

Settting	Start	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14
Planned Effort		40	40	40	40	40	40
Actual Effort		45	40	50	55	25	25
Remaining Effort	240	195	155	105	50	25	0
Ideal Burndown	240	200	160	120	80	40	0



II. Stakeholder Map