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## **Goals**

This visualization will support teachers who are in the process of aligning their existing resources (or new resources they have discovered) with the Common Core State Standards. To effectively support the tasks associated with this process, the visualization aims to familiarize teachers with both the structure and content of the Standards.

## **Related Work**

This project is meant to be complementary to our masters final project, in which we are creating a tool to help teachers find and share resources that are aligned to the recently implemented Common Core State Standards.

We have conducted extensive user testing since fall 2013. The project began with a series exploratory user interviews, in which we spoke with four educators about their experience with technology and adopting the Common Core State Standards. We also interviewed administrators from across the country (California, New Mexico, Wisconsin, New York) to ask them about their experiences with these new standards.

Once we built prototypes of our tool, we conducted usability tests with teachers to understand how they navigated the main tasks of uploading, finding, and saving resources, and most importantly, tagging these resources with the appropriate Common Core State Standards. Part of this testing was prompting teachers to explain when they needed additional help, and what kind of a “help tool” they would expect to see. Having observed a need for teachers to see the Standards, we decided to create a visualization that would allow them to meet this need.

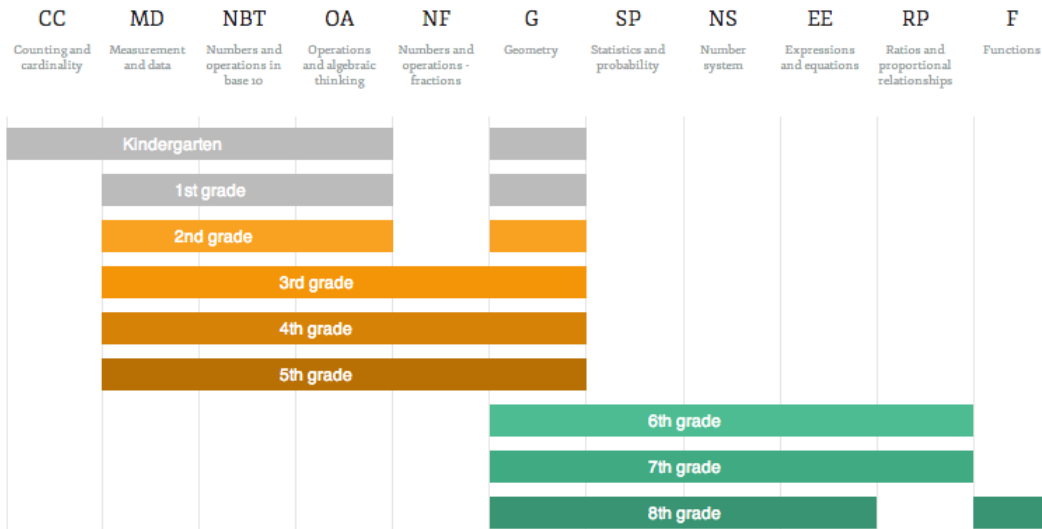
## **User Testing Results**

We conducted usability tests with three teachers before implementation of our visualization. We showed them three existing visualizations: one was a visualization of Common Core Standards, and the other two were visualizations we planned to draw inspiration from. All three are pictured on the following pages.

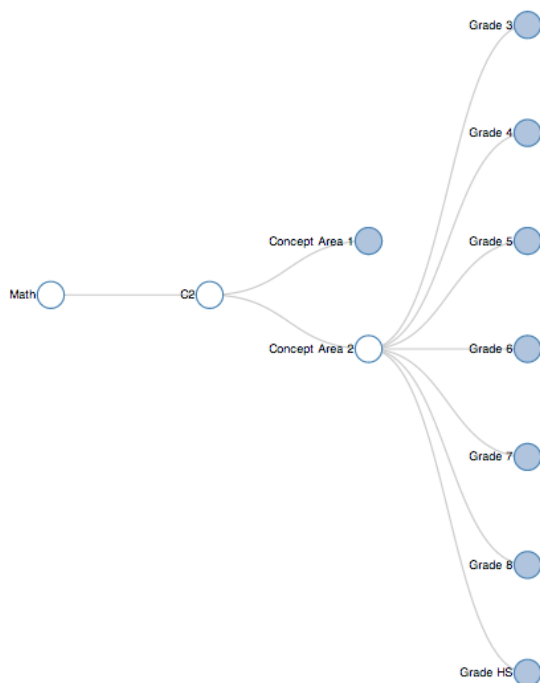
#1: Learnzillion Common Core Navigator  
 found at [http://learnzillion.com/common\\_core/math/k-8](http://learnzillion.com/common_core/math/k-8)

## Common Core navigator

Math: Grades K-8    Math: High school    English language arts

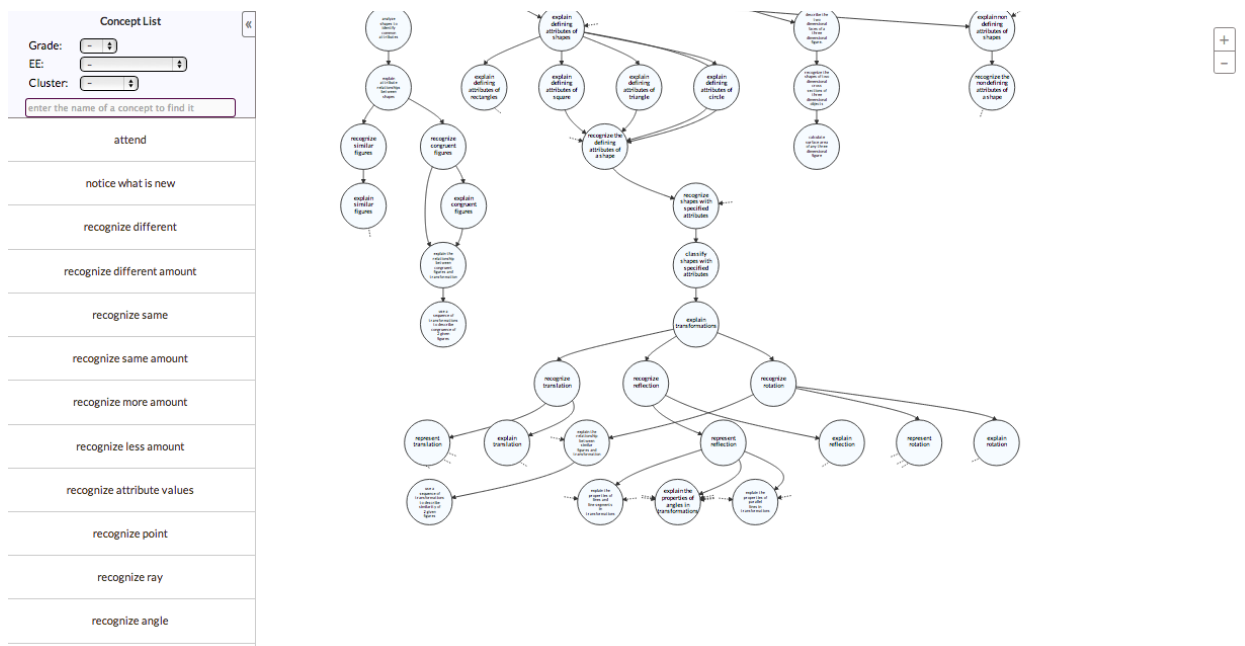


#2: DLM Collapsible Tree Layout  
 found at <http://people.csail.mit.edu/zp/DLM-viz/viz4.1.html>



### #3 Flowchart with Dropdown Filter

found at <http://people.csail.mit.edu/zp/DLM-viz/kmap/dev.html>



We asked each user to click through the three visualizations (in the same order), and follow a thinkaloud process to share their reactions. The main findings from these tests were:

- Users liked the color coding in the first visualization. It helped them follow which standards were applicable to their grade.
- Users wanted to see context. As they clicked through a hierarchy, they didn't want to lose track of where they had come from.
- Users wanted a big picture view while also accessing the details of the standard.
- Users didn't want to see everything at once; it overwhelmed them.
- Users had different ways of interacting with standards based on which subject they were focusing on.
- Users wanted to compare standards from one grade to the next.

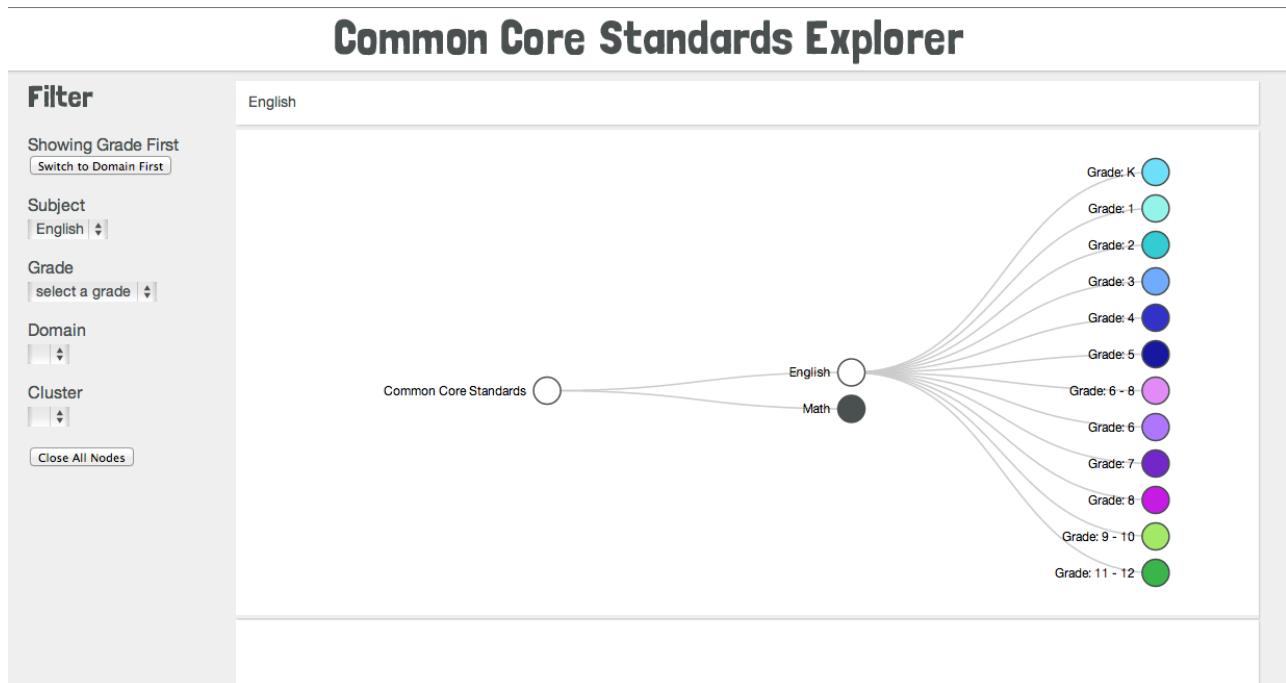
This feedback helped us to make several important decisions in the design of our visualization.

### The Visualization

The visualization is a progressive disclosure tree map, which enables teachers to select their grade, and then traverse the hierarchy of the standards in order to see those that are relevant to them. Ideally, a user who comes to this page from our final project site will see a visualization that is initialized to their settings (our site knows which grade and subject a teacher is interested in). Since that connection has not yet been set up, the user can either

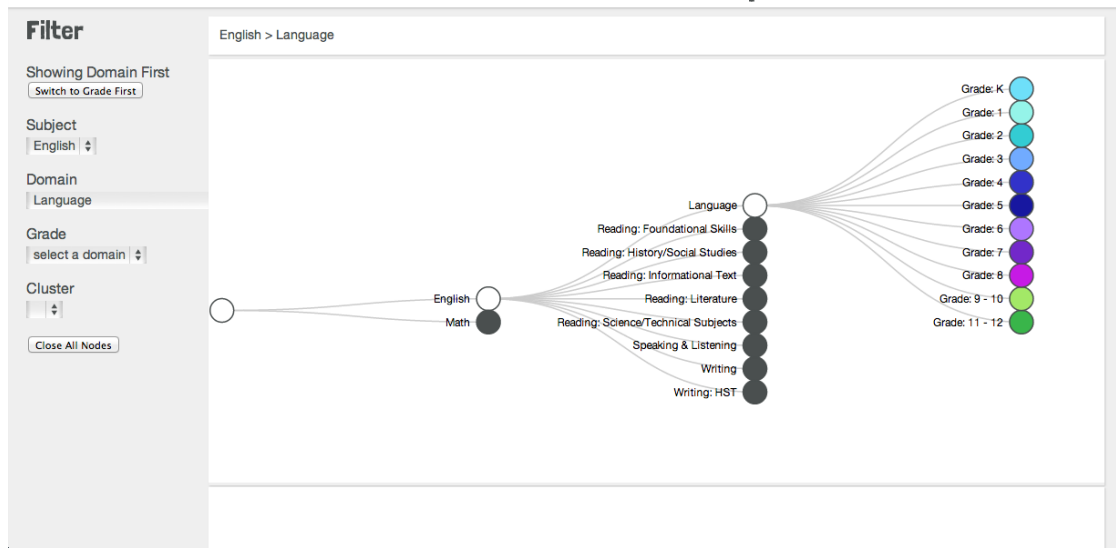
click through the graph, or adjust the drop-down filter to the left to uncover the parts of the tree relevant to them.

The standards are also color-coded by grade, so once a user enters the series of nodes following a particular grade, the color will remain consistent. This allows for easy comparisons across grades. Also, the standards are typically grouped by K through five, six through eight, and nine through 12. So, the color families in these ranges are similar. We have blues for grades K through 5, purples for grades six through eight, and greens for grades nine through 12. This creates easy visual grouping and doesn't overwhelm the eyes with too many different colors. This allow grades to be distinguishable from one another, but still supports grades far apart from one another to pop out. The initial view is shown below.



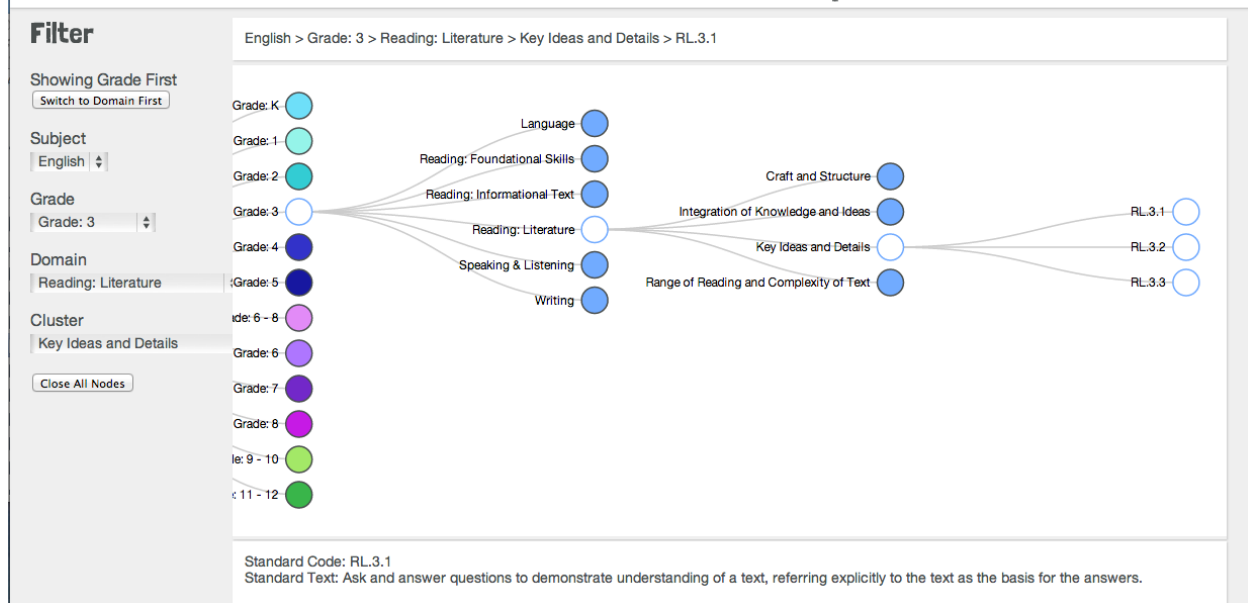
If a user toggles to “Domain first” view instead, their first choice will be which domain they wish to view (shown on the following page). In this case, the color coding doesn't appear until the grade level.

# Common Core Standards Explorer



Once a user starts clicking through nodes, a breadcrumb path is revealed above the visualization so that a user can keep track of the context of their view. When the user reaches the leaf nodes (the most granular standards), he or she can hover over them and the standard text populates the box below the visualization. This helps teachers to become familiar with both the names of the standards and their content. The breadcrumbs and hover text are shown below.

# Common Core Standards Explorer



## Data

There is no official data set of the Common Core State Standards, but we found a spreadsheet online of someone's attempt to scrape the Common Core website of the standards text. Our final project team worked together to look through about 1500 rows, and clean up the data. We converted this to a csv document, and then with our javascript file, converted that to JSON. The flat JSON data, however, needed to be converted to a hierarchical JSON format so that it could then be placed into a tree visualization. Drawing from several examples on StackOverflow.com, we were able to get a recursive algorithm to convert our data into a nested form that d3 could parse.

## Tools

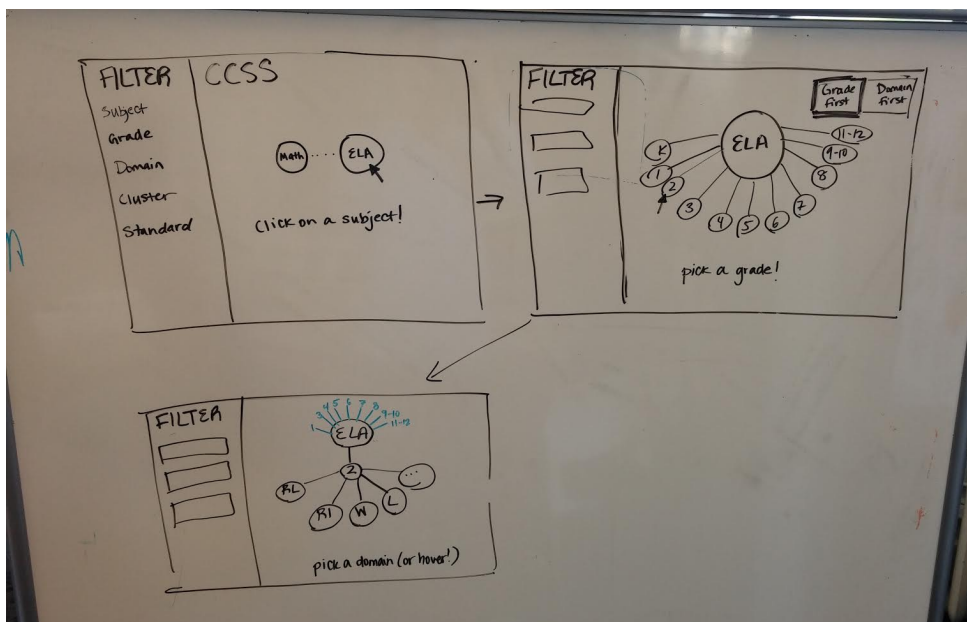
jQuery, CSS, HTML

D3.js

GitHub

## Process

- Exploratory Research to identify the need space: Due to the connection of our visualization with our final project, we actually conducted exploratory research to determine the needs of our teachers last semester. This helped us to define the problem space more clearly, and understand the specific gaps in teachers' knowledge regarding the Common Core State Standards.
- Research of Existing Visualizations: We searched for existing Common Core Standards visualizations, and upon finding only one, we searched through D3 example visualizations to seek inspiration.
- Prototyping of our system: Selecting features from a few existing visualizations, we drew basic charts to illustrate how teachers might interact with our visualization.



- Usability Testing of the system
  - We conducted usability tests with three teachers of three existing visualizations to understand whether our approach would 1) visualize the standards appropriately and 2) serve the need that we are trying to meet.
  - After initial implementation, we showed the visualization to two ISchool students who are former teachers, to get more feedback on the structure.
- Building the visualization
  - Using the tree layout code from mbostock's d3 repository, we found that the default interactions and layout of the tree layout code was not suitable for the massive amount of data that we wanted to visualize. As a result, we had to modify the existing code and create new functions that would allow us make the visualization easier to interact with. For example, by default, the tree would sort the data alphabetically. But for the Grades data, we needed 'Grade K' to be before 'Grade 1'. So we had to create an array that contained the grades in the order we wanted, and then sort the data that got printed to the screen by the indices of the first array.
  - Two of the most challenging features we implemented were the filter and the ability to toggle between 'Grade First' and 'Domain First'.
    - For the filter, the most difficult part was figuring out the logic in updating the visualization and the other filter dropdowns based on what selection was chosen.
    - For the Grade First/Domain First switching, the difficulty was that d3 doesn't easily allow you to load two sources of data in its 'd3.csv' function. Our workaround for that was to create two nested JSON objects, one that had domain at a lower depth than grade, and vice versa. Then, we created separate functions that each contained its own 'd3.csv' calls. On first load, the visualization would load the 'grade first' JSON file, and then would listen for the button click that would call the other d3.csv function, which then loaded the 'domain first' JSON file. Although we were relieved that the functionality worked, we didn't like the fact that we now had to maintain two separate javascript functions as we added more functionality. If we were to continue developing this visualization, we would try to continue looking for more efficient solutions for changing between 'grade first' and 'domain first'

## Links

The visualization is available at the following link:

<http://jentonlee.com/infoVizFinal/>

## Future Plans

We would like to make this visualization available to teachers online. However, after showing the implemented visualization to students and a couple former teachers, there are a few things we would like to change. These changes are listed below:

- Some of the data needs to be tweaked (a few of the longer standards texts had unrecognized characters that we didn't notice until the end)
- The breadcrumbs should be links, so teachers can navigate to any part of the path easily.
- The hover text must be made more visible.
- The earlier nodes of a path could be shrunken so as to fit on the screen without being obtrusive.
- The hover text from a standard will, in the future, link to resources that are relevant to that standard on our website.
- It might be interesting to add numbers to the nodes to indicate how many child nodes follow (to give teachers an idea of how many standards are nested).
- A teacher's profile from our website will initialize the visualization to be immediately relevant to the teacher.

## Breakdown of Work

	Isha	Jenton
Searching for Existing Visualizations	50%	50%
User test design and implementation	100%	
Cleaning up data	50%	50%
Converting data	50%	50%
Initial set up of tree code		100%
Modifying tree code	50%	50%
Design	50%	50%