Daisy Map: A Visualization Tool For Student Assessments Data

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From Theory to Practice: Design, Vision and Visualization Workshop

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Motivation

- Computers are ubiquitous in schools today.
- Education data is gathered covering a wide range of information on:
  - student assessments
  - student enrolment
  - financial aspects
- Amount of data collected is overwhelming to educators, administrators, policy-makers.
- Our work explores the use of intelligent data analysis and visualization techniques to help make sense of education data.
Academic Assessments Case Study

- We worked with Children's Progress Inc.(*) to develop visualization and analysis tools on their student assessment application named CPAA.
- The CPAA covers **core concepts** that are essential to early childhood development, grouped into **language arts** and **mathematics** categories (listening, pre-reading, alphabet knowledge, phonemic awareness, reading, writing mechanics, numbers and quantities, numeracy, operations, measurement and patterns).

* http://www.childrensprogress.com
CPAA Overview

• The **core concepts** are divided into **prime questions** which address specific concept components.
• For example; phonemic awareness is comprised of prime questions related to: **rhyming, initial sound, blending, and syllable counting**.
• The concepts were chosen to reflect US national and state academic standards for language arts and mathematics for ages 4-8.
The prime questions are organized within the assessment in an **adaptive** manner.

If a child answers a particular prime question correctly, then she will receive a more difficult prime question; if not, she will receive a **hint**.

A hint is the same question again, presented in a **different format**.

Each incorrect response choice has a particular outcome that provides a **different kind of hint** to guide the child to the correct answer.
Assessment Map

Writing Assessment Map
Scoring

- Each assessment covers multiple concepts (Reading (re), Writing (wr), Measurement (me), Operations (op), Pattern Forming (pf) and so on).
- Children receive one of the four scores from each concept:
  - 1 Below expectation
  - 2 Approaching expectation
  - 3 At expectation
  - 4 Above expectation
- These scores are State standard.
- Assessments are repeated from time to time within a year (fall, winter, spring) and across different grades (from pre-k to 3rd grade).
Data Cube of Assessment Scores

“Who?”

“When?”

“What?”
Task: Design a Visualization Tool

- We want a high-level visualization tool to help us monitor how a group of students performed on assessments over a period of time.
- We want to see the scores on each concept within an assessment.
- We want to see the changes in scores across different assessments.
- This is like displaying the data cube (3D) on the screen (2D).
From Data Cube to Daisy Map
Color Coding of Scores

• Each petal represents the score received for one concept.
• Color of the petal depends on the score.
• More suitable for humans to examine visually than a bunch of numbers since humans are great *pattern recognizers*.
Visualization Application

• We built a visualization tool based on our Daisy Map design.
• Each student assignment is represented by a daisy.
• Goal 1: Each row represents one student's performance across time.
• Goal 2: Each column shows the performance of all students on one assessment.
Visualization Goal 1

- **One student's** performance across time
Visualization Goal 2

- Performance of all students on one assessment
• Daisy Map design worked well for our task.
• In general, Daisy Map works well in representing a small number of categorical data items.
• Color coding the scores as petals of the daisies is more effective than putting the numbers on the screen.
• Daisy Map helped us visualize the 3D data cube of student assessments on the 2D screen.
• We were able to simultaneously visualize one student's performance across time (horizontally) as well as a group of students' performance on the same assessment (vertically).
Thank you!

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