



SLDS Spotlight

Data Visualization for Data Use

Communicating data through charts, graphs, infographics, maps, and other visual displays allows audiences to understand data more easily and can reveal conclusions that are difficult to see with numbers alone. As stakeholders of statewide longitudinal data systems (SLDSs) become more adept at using data in their work and for decisionmaking, SLDS programs in many states are expanding and evaluating their use of data visualization to continue to meet their users' demands for information.

This spotlight examines the data visualization tools and processes used by SLDS programs in Michigan, Maryland, and Hawai'i. It covers how the programs choose data visualization tools, how they help educators and other stakeholders take advantage of visualizations, and how they plan to increase their use of data visualization in the future.

Michigan: Expanding and Redesigning Visualizations for a Broad Audience

Michigan's SLDS is managed by the Center for Educational Performance and Information (CEPI), which is part of the Michigan State Budget Office. CEPI began collecting data from local education agencies in 2003, primarily to fulfill compliance-reporting requirements. Over time, the center expanded its cross-sector data collections with funding from federal SLDS and Race to the Top grants as well as other grant sources.

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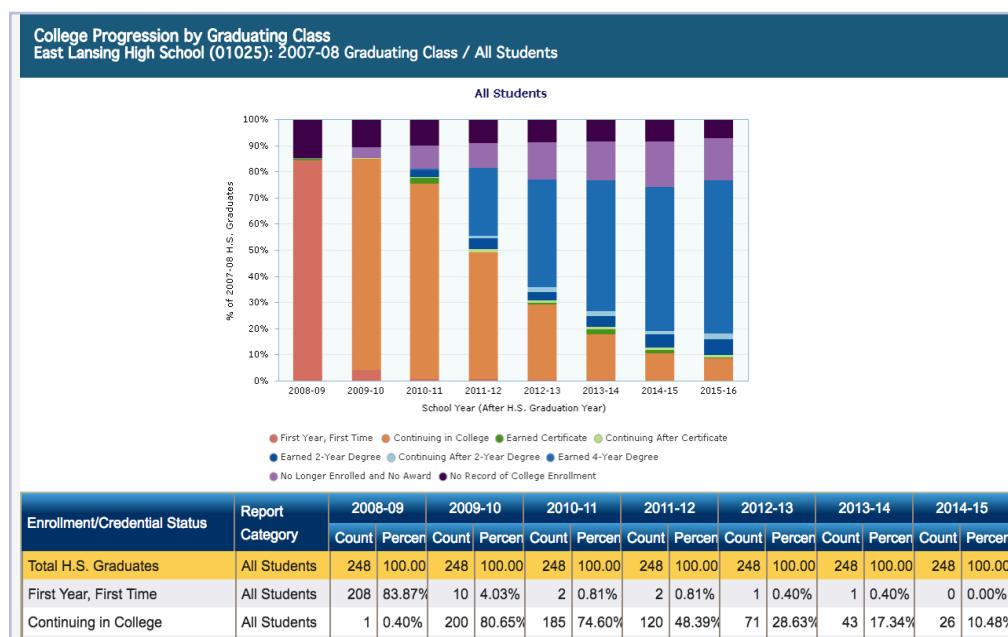
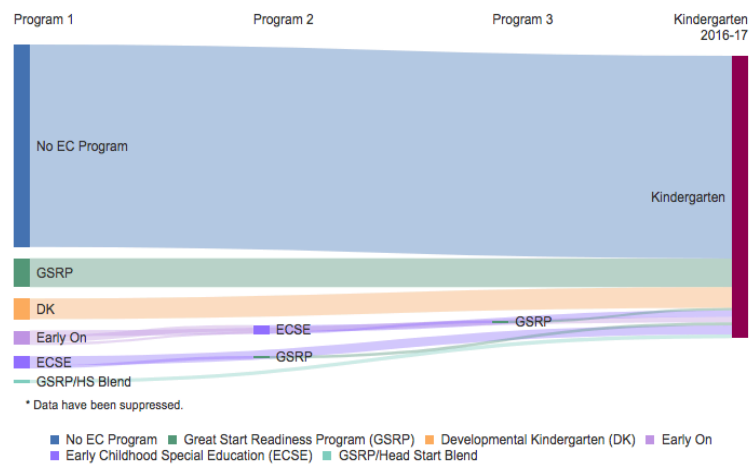


Figure 1. The College Progression by Graduating Class report available on the MI School Data portal shows as many as 8 years of longitudinal data about students' progress through postsecondary education programs. The report uses Telerik controls to display the relevant data.

[About this Graph](#)



Report Category	Program 1	Program 2	Program 3	Program 4	Child Count (Headcount)	Percent of Total
All Students	All Programs	All Programs	All Programs	All Programs	1,313	100.0%
All Students	No Program Reported	N/A	N/A	N/A	909	69.2%
All Students	Great Start Readiness Program (GSRP)	N/A	N/A	N/A	129	9.8%

Figure 2. A Sankey diagram in Michigan's Kindergarten Pathways report shows the number of students enrolled in different types of early childhood programs before entering kindergarten.

A 2009 SLDS grant helped CEPI launch the MI School Data portal (<http://www.mischooldata.org>), a public website offering information about early childhood through postsecondary education and the workforce. The data visualizations available through MI School Data are designed to support school district improvement planning, provide transparency about the state's education and workforce programs, meet reporting requirements, and deliver data of interest to stakeholders.

Data visualization tools

The MI School Data portal offers a variety of data visualizations and dashboards to give families, educators, legislators, and the general public information about Michigan's education programs and the education and career outcomes of its students. Interactive online reports let users filter data by a number of geographic factors and student characteristics. For example, users of the College Progression by Graduating Class report (see figure 1 on page 1) can customize its data tables and charts to show students' progression through higher education by school or district; cohort year; and demographics such as race/ethnicity, gender, and English learner, migrant, or disability status.

MI School Data reports use different visualization types to display data in ways that audiences can easily understand. In addition to column and line charts, some reports use Sankey diagrams to show how students move between different education programs (see figure 2) and maps to help stakeholders focus on specific locations of interest (see figure 3 on page 3).

The interactive reports are created with a number of visualization tools and software:

- A **SQL Server** database stores the data used for visualizations separately from Michigan's SLDS.
- The **.NET** software development framework provides website navigation.
- **Telerik** and **HTML5** support data controls and format the visualizations.
- **SQL Server Reporting Services (SSRS)** creates parameter-driven reports.
- **ArcGIS** displays data in navigable maps.

MI School Data reports and visualizations are created and maintained by CEPI staff members with support from a software development vendor. A team of five CEPI

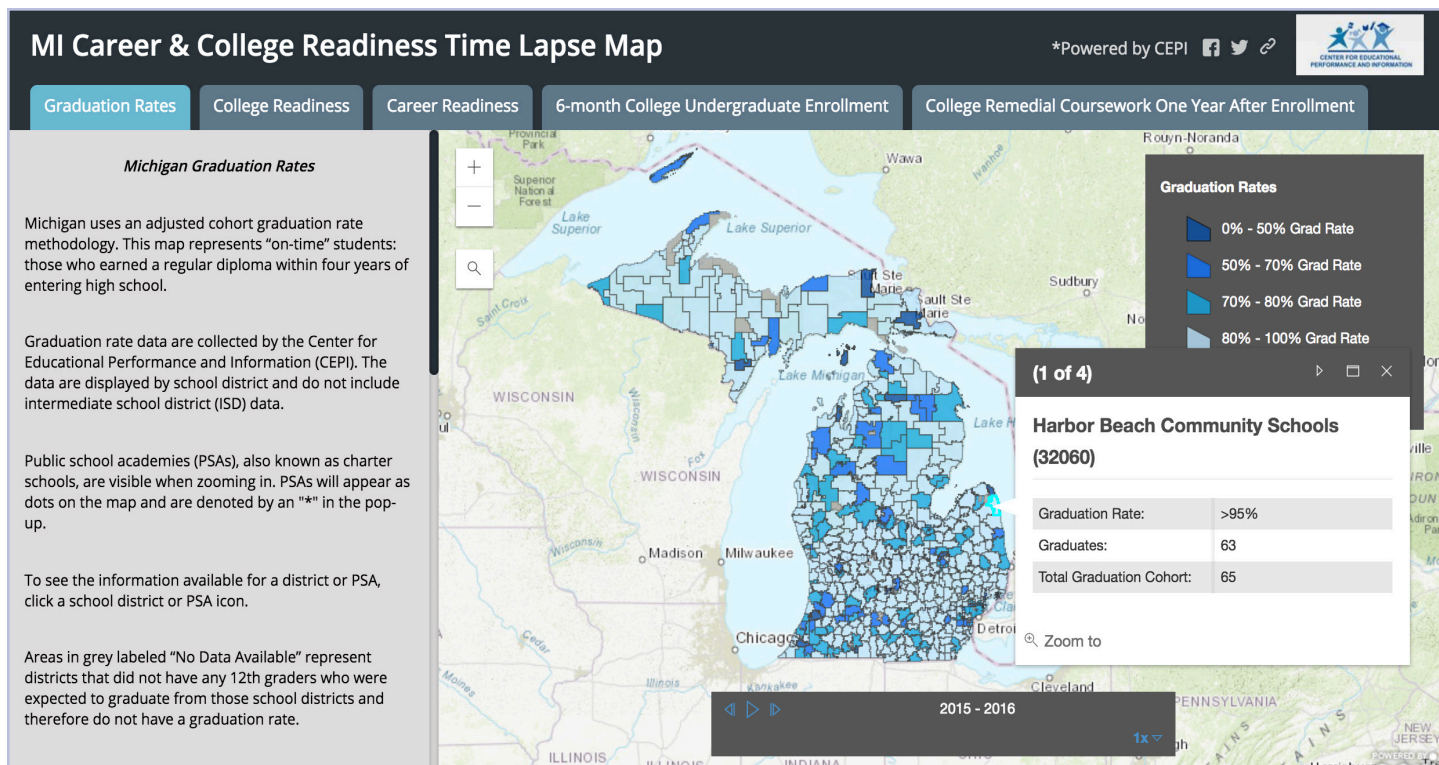


Figure 3. Heat maps created with ArcGIS show the rates of Michigan students graduating from high school, meeting college and career readiness benchmarks, enrolling in college, and completing remedial college coursework by school district. The time-lapse feature lets users watch how those rates change over multiple school years.

analysts works with the vendor and with stakeholders to gather requirements and test the reports. Two database administrators maintain the SQL Server database that feeds the portal's reports. Storing the data for MI School Data reports outside of the SLDS helps the portal's performance while protecting the privacy of sensitive SLDS data.

Enhancements and future plans

Since CEPI's data collections have grown to include early childhood, K12, postsecondary, and workforce data, stakeholders are more interested in seeing and using information from across those sectors. CEPI plans to redesign the MI School Data portal to help keep up with information requests and to provide stakeholders with a more modern, user-friendly experience. The center will evaluate potential new data tools based on the following criteria:

- Ease of publishing new data metrics
- Disclosure avoidance capability, including cell suppression and privacy techniques that adjust based on how the user is interacting with the data
- Role-based data privacy protection
- Direct access to the SLDS or other secure, non-cloud-based data storage
- Ability to apply complex business rules and calculations to data
- Interface with a modern look and feel
- Integration with Michigan's existing single-sign-on security model

In addition to improving the look and functionality of MI School Data, CEPI plans to maintain the redesigned portal with its own staff rather than relying on vendors. Maintaining the website internally will be more cost effective and will make it easier to update the data used in the visualizations.

Maryland: Strategic Planning for Data Visualizations and Data Use

The Maryland State Department of Education (MSDE) uses data visualizations in many of its public reports, including the Maryland Report Card. However, growing interest from stakeholders has led the department to take a closer look at its data visualization capabilities and to plan for expanding its capacity for the future. The department made data visualization an important component of its 2015 SLDS grant goal to build data use capacity. To meet that goal, the MSDE's SLDS team is taking a three-part approach to implementing new data visualization tools and helping its audiences think about and use data differently:

1. Identify and procure a data visualization tool
2. Train users on the tool
3. Build and sustain data visualization capacity

Identifying data visualization tools

When looking at potential data visualization tools, the MSDE considered the information needs of key audiences such as the State Board of Education, the MSDE executives and other internal users, and the public. The department also reached out to local education agencies to learn what data visualization tools were already being used in the state.

Based on its expected needs, the department established the following criteria for evaluating data visualization tools:

- Ability to create interactive visualizations based on best practices and the ability to meet the needs of intended audiences
- Availability of training resources and access to experts, both for initial rollout and ongoing support
- Compatibility with source data systems
- Ease of updating software
- Data analysis capabilities, including the ability to explore data, patterns, and changes over time
- Procurement requirements and cost to ensure a sustainable solution

After reviewing several tools, the MSDE decided to use Tableau data visualization software to fulfill the goal of its 2015 grant.

Training users

The MSDE identified core data users and early supporters of visualization work across all divisions and invited these early adopters to use the selected visualization tool. Involving stakeholders in this way will help build support for the new tool and encourage a statewide culture of data visualization and use. On-site training was made available for core users within the MSDE as well as from other state agencies.

Building and sustaining capacity

The MSDE created a Data Visualization User Group to help its analysts and educators build data visualization expertise and further advance data use statewide. The group will develop standards and branding guidelines for data reports and establish communications strategies to engage and share products with intended audiences. It will also be responsible for project planning, including setting priorities and determining roles and responsibilities for visualization projects.

Additionally, the user group will help ensure appropriate data management and will review data products. Ongoing peer-to-peer training will ensure sustainable capacity building across the department.

Future plans and projects

The MSDE is planning new visualizations based on identified needs to share information on topics including

student course information, curriculum resources, teacher induction, early child care programs, and at-risk student groups. Through its user group, the department also is establishing standards related to data accuracy, privacy, visual style, and effectiveness that will govern future data products.

Hawai'i: Sparking Conversations with Data

The Hawai'i Department of Education (HIDOE) maintains the K12 Longitudinal Data System (LDS) to guide school improvements and provide its educators with information and tools they can use to support students. HIDOE's overarching goal for data use is to help educators improve the quality of instruction and ensure that factors like poverty and race are not barriers to student achievement.

The LDS contains a wealth of data, and HIDOE is seeking ways to engage its educators more deeply in finding and telling stories with those data. Data visualization has become an important part of that effort.

Data visualization tools and support

HIDOE uses Tableau software to explore and visualize LDS data. The learning curve for data visualization tools can be steep, especially for educators with limited data analysis experience. To help state and local staff members build expertise with the tool, HIDOE created the Tableau Learning Community. Community members include a data coach, three complex area leaders, a vice principal, and an analyst from HIDOE's Data Governance and Analysis Branch. The group received Tableau training and meets regularly to learn more about the tool, share strategies, and plan ways to encourage data visualization and use throughout the state.

The Tableau Learning Community uses an iterative process to create data visualizations and dashboards to answer educators' questions about programs, instruction, and student outcomes. In addition to identifying data to include in visualizations, community members work with educators to determine parameters such as

- the level of detail of information needed;
- which types of visualizations will work best;
- the functionality desired, including sorting, filtering, illustration of trends, and drill-down capabilities; and
- necessary data calculations.

Community members also consider design principles and standards such as fonts, colors, and dashboard layout when creating visualizations.

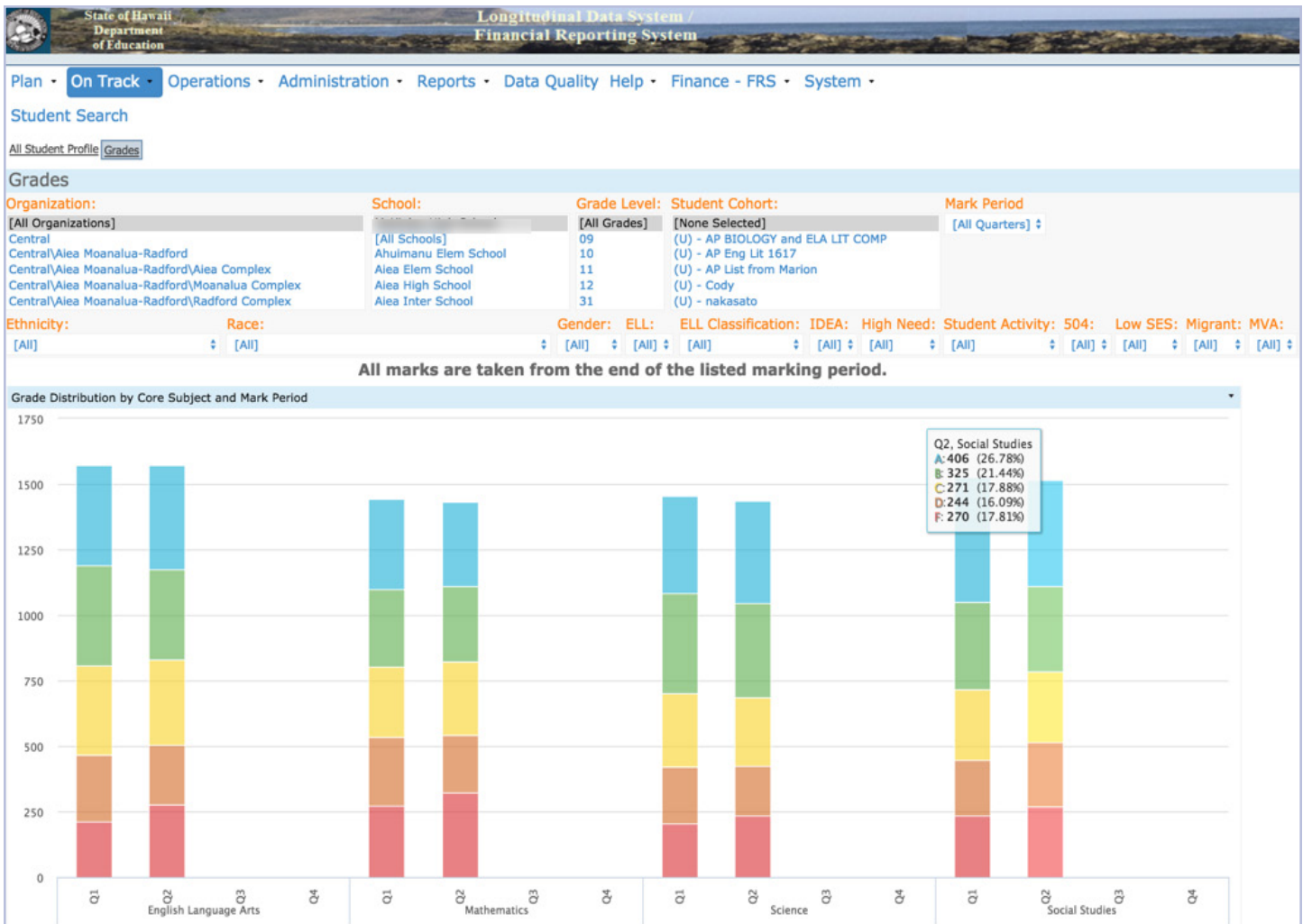


Figure 4. Student letter grade data in HDOE's On Track Dashboard can be filtered by school, grade level, and student cohort to help educators identify students who are struggling.

Impact of data visualizations

Tableau Learning Community members have created and refined a number of new reports and dashboards that highlight statewide topics as well as the experiences of specific groups of students. The On Track report (see figure 4) shows letter grades earned by students in multiple subject areas. Educators with appropriate access can explore the underlying data to see where their students fall in the letter-grade distribution. The data in easy-to-use format of the report help educators identify struggling students more quickly and spend more time working with those students directly.

Other visualizations on student academic performance, such as the analysis of changes in student assessment scale scores in figure 5, have prompted conversations among educators about instructional rigor and support for teachers. Visualizations that spotlight specific programs or student populations, such as homeless students (see figure 6 on page 6), have inspired additional advocacy for policies and program funding.

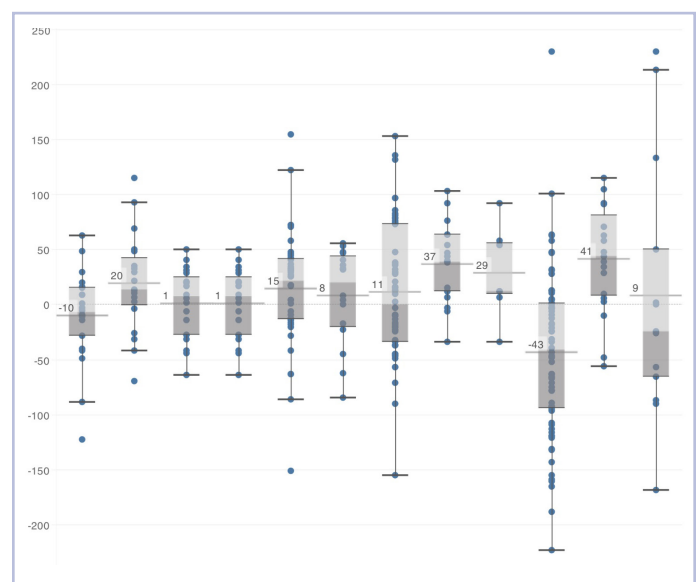


Figure 5. A series of box-and-whisker plots shows changes in students' assessment scale scores by classroom teacher. The mean change in scale score for each teacher is labeled.

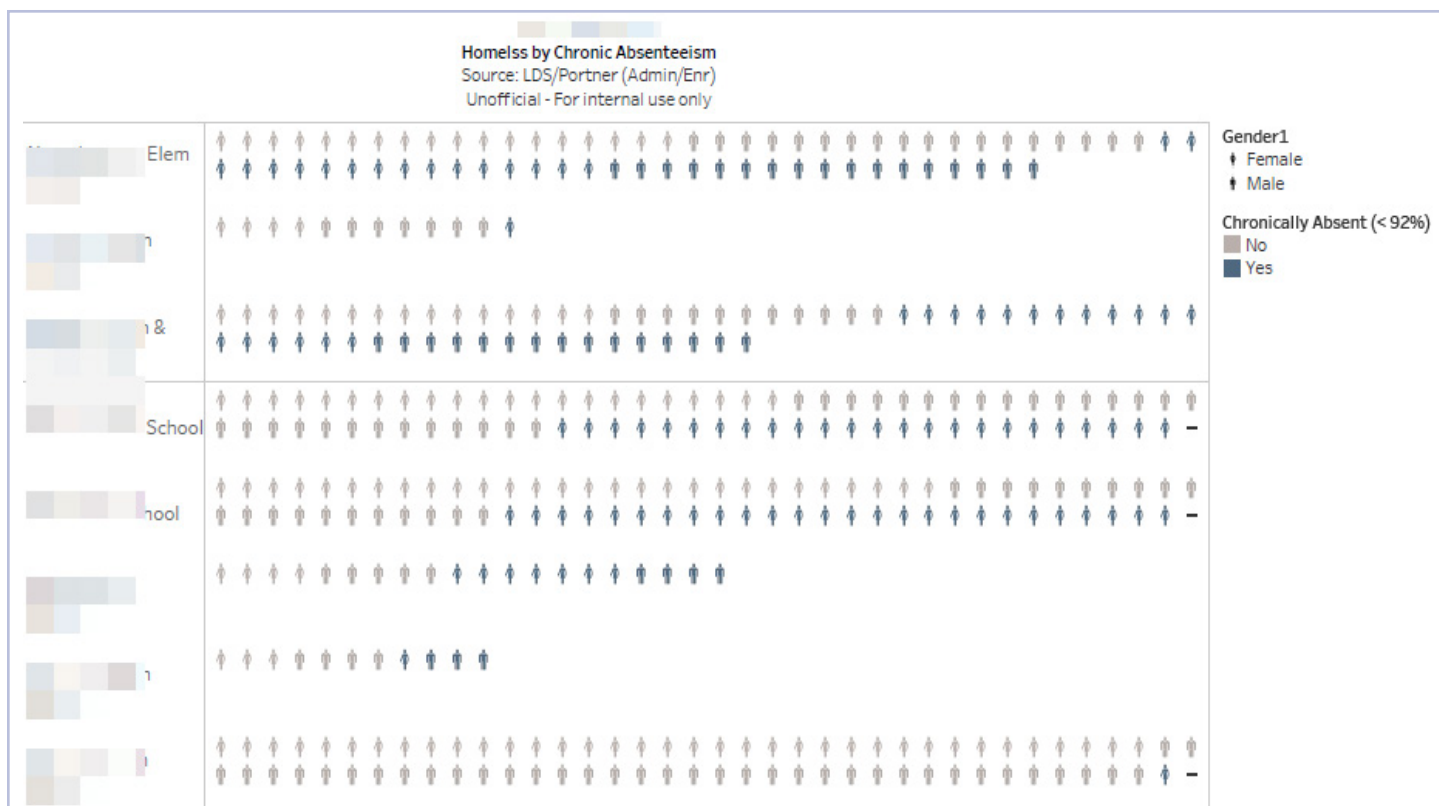


Figure 6. Visualizations such as this chart of chronic absenteeism among homeless students have inspired conversations among Hawai'i educators and administrators about how they can better serve students. School names in the chart have been blurred.

Continuing Challenges and Lessons Learned

SLDS programs can face a number of challenges when evaluating potential data visualization tools and building reports. Data privacy and disclosure avoidance are ongoing concerns. Depending on the capabilities of their visualization tools, SLDS programs might need to remove data about small populations before creating visualizations or configure their tools not to display potentially identifiable information. Ensuring that data products are accessible for people with disabilities might require that data visualizations be accompanied by the same information in tables or another accessible format. When data are extracted from the SLDS and stored in another location for visualizations, data can lose their timeliness if not updated regularly. Limited staff time, skills, money, and technological capacity can also make it difficult for SLDS programs to meet user demand for visualizations.

Representatives from Michigan, Maryland, and Hawai'i offer the following advice for other SLDS programs planning and building data visualizations.

Focus on the data first

Data visualizations are only as good as the data they use. One of the first challenges for Hawai'i's Tableau Learning Community was to determine which LDS data to visualize and how to export data for use in the visualization software.

Use multiple tools

A single visualization tool probably cannot meet all stakeholder needs for seeing and using data. Michigan's MI School Data portal uses several tools to create different types of charts and maps with the interactive features that users want.

Start small

Begin by creating simple visualizations and gradually build up the skills and infrastructure needed for more complicated data displays. In Maryland, analysts are starting their visualization work with datasets that do not have privacy or suppression concerns. This initial work will lay the foundation of standards and processes for larger visualizations.

Communicate

Establish close communications among data visualization developers and users to ensure that the desired visualizations are technically feasible and useful to stakeholders. Hawai'i's Tableau Learning Community includes educators who understand the messages they want to convey through visualizations and the impact they want the visualizations to have. Additionally, HIDOE's LDS manager visits schools to gain feedback from educators on how the visualizations should work to support their information needs.

Additional Resources

Attributes of Effective Data Products Checklist

<https://slds.grads360.org/#communities/pdc/documents/13395>

Considerations for Selecting Dynamic Reporting Tools: SLDS Issue Brief

<https://slds.grads360.org/#communities/pdc/documents/14139>

Data Use Through Visualizations and Narratives: SLDS Spotlight

<https://slds.grads360.org/#communities/pdc/documents/2637>

Forum Guide to Data Visualization: A Resource for Education Agencies

https://nces.ed.gov/forum/pub_2017016.asp

Hawai'i Department of Education

<http://www.hawaiipublicschools.org/>

Maryland State Department of Education

<http://www.marylandpublicschools.org/>

Michigan Center for Educational Performance and Information

<http://www.michigan.gov/cepi/>