

Our visualisations address the following question, from the perspective of the teacher: “How are the students in my class performing across math domains?” We have selected data from the week beginning the 13th September 2021 from a grade 5 class, namely class 2141, in a specific school.

The first priority for our visualisations was to keep everything simple and intuitive to read for an audience who may not have much experience reading complicated plots. Secondly, we wanted to display useful information in a clear and concise manner.

Plot A presents the performance of students in class 2141 across 19 math domains. On the y-axis, the average q-score of that class is plotted against the domain categories on the x-axis. We have included three different references for the teacher to compare her class to: the average q-score of other grade 5 classes in the same school, average q-scores from grade 5 classes in other schools and the target q-score expected of the student for the end of grade 4 and the end of grade 5. The target q-score for the end of grade four is especially interesting to the teacher at this time of year because the academic year has only just begun and so they can already have an idea of which students are starting on the back foot.

From plot A we choose problem domains to visualise in more detail.. The teacher may want to know the following: What does the distribution of q-scores within my class look like? Is everyone on the same level or are some students struggling more? In visualisation B we plot the 10 domains with the lowest average q-score from the first visualisation against the q-score for each student. It's also possible to see how the student fares against the target q-score. Initially we plotted this data as a boxplot, however, with our audience in mind we decided that the rich information a boxplot offers about dispersion may not actually be used by the teacher and would be a high price to pay for potentially causing confusion or worse, misinterpretation of the data. As a result we kept it simple and just displayed the data points themselves. We are confident you still get a good idea of the dispersion. Within each domain we classified outliers by the $1.5 \times \text{IQR}$ rule. Students who fall outside this domain are given a name label to alert the teacher to their score. This is a nice feature that allows the teacher to note, in a quick glance, who is falling behind or who might benefit from more challenging material. A student who is falling behind relative to their classmates may no longer be able to follow the class properly or may slow down the class progression because they require more assistance from the teacher. This feature gives the teacher some warning of individuals who begin to deviate from the rest of the class. Another important addition to this plot is a distinction between “active” and “inactive” domains. This is something we classified ourselves based on whether more than 5 students were playing items in the domain this week. It acts as a form of warning about the reliability of the measures. Plot C is a simple visualisation of how many students are playing in each domain this week. The teacher can track how much exposure students are getting to each domain. .

The plots in panel D act as a summary of student performance in a particular domain across a particular week. We envision a teacher logging in on a Monday morning and having access to a simple and concise review of their student's progress across math domains last week. Throughout all three plots, student names are plotted on the y-axis for enhanced readability and to maintain some consistency across this section. Our goal was for teachers to be able to take useful information away from the visualisation in a quick glance, therefore, we decided a simple bar chart was the best way to visualise this data. Three questions are addressed. Firstly, how much practice have my students put in this week? Student names are plotted against the number of items played in a specific domain. This informs the teacher on how familiar the student is with this domain and adds some context to the information in the following plot: their q-score change this week. This plot is our answer to: How much progress have my students made in this domain this week? This visualisation clearly displays who is doing well and who is not. The final plot zooms out to their overall q-score at the end of that week and asks: How are my students doing overall in this domain, by the end of this week? The teacher can easily see who is excelling, and who is behind. Once more we include a reference to the target q-scores for the end of grade 4 and the end of grade 5 giving them an idea of who is on track and who may require more guidance. Given the opportunity, we would develop this particular panel further and allow an option to select which domain to display data from. This could be done in a shiny app.

We have found an effective way to communicate important information about class performance and individual student progress across different domains. These visualisations are simple, intuitive and aesthetically pleasing. We believe they could be implemented into a teaching workplace with great success.