

## Accessibility and SAS® University Edition: Tips for Students and Professors

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### ABSTRACT

Accessibility has become a hot topic on campus due to a flurry of recent investigations of discrimination against students with disabilities by the U.S. Department of Justice and the U.S. Department of Education. This paper provides an update on the latest improvements in SAS® University Edition that are specifically targeted to enable students with disabilities to excel in the classroom and beyond. This paper covers the entire SAS University Edition user experience including installation, documentation, training, support, using SAS® Studio, and the new accessibility features in the fourth maintenance release of SAS® 9.4.

### INTRODUCTION

At SAS, we believe that every student should be able to achieve their full potential in the classroom and in the 21<sup>st</sup>-century knowledge economy. A disability should not be a barrier to success. As a result, we continue to invest in accessibility across our product lines, and we are delighted to share recent improvements in SAS University Edition.

This paper is ideal for students with disabilities, professors, and disability support services staff at institutions of higher education. The paper provides an overview of accessibility for all aspects of SAS University Edition including tips for students with specific types of disabilities and pointers to a growing body of support material that enables students with disabilities to learn data science using SAS University Edition.

### ABOUT SAS UNIVERSITY EDITION

SAS University Edition is free SAS software that can be used for teaching and learning statistics and quantitative methods. If you are a student, learning SAS is a great way to prepare for your future. If you are an educator, teaching SAS is a great way to attract top students and equip them with the quantitative skills they will need to succeed in the 21st-century knowledge economy. SAS University Edition includes SAS Studio, Base SAS®, SAS/STAT® software, SAS/IML® software, SAS/ACCESS® Interface to PC Files, and several time series forecasting procedures from SAS/ETS® software. These are the exact same products used at more than 80,000 potential employers of students that graduate with SAS skills. Learn more about SAS University Edition at [www.sas.com/universityedition](http://www.sas.com/universityedition).

### ABOUT ACCESSIBILITY

We define accessibility as an absence of barriers to user interfaces and digital content. There are two types of accessibility standards: technical and functional. Technical criteria can be objectively tested. However, conformance with technical standards does not ensure that users with disabilities have equal access. So functional standards require that users with specific disabilities can have equal access. For example, a functional performance criterion may require that there is a mode of operation that allows users with no vision to perceive, understand, and operate the user interface.

SAS uses the [Web Content Accessibility Guidelines \(WCAG\) version 2.0](http://www.w3.org/WAI/WCAG20/quickref/) as the technical standard for all SAS software, documentation, training, and support materials. WCAG 2.0 consists of four principles, twelve guidelines, and sixty-one testable success criteria. There are three levels of conformance: A, AA, and AAA. Our goal is to conform to WCAG 2.0 at the AA level of conformance. This level of conformance is consistent with the standards used in higher education in the United States and many other countries.

In addition to WCAG 2.0, SAS strives to ensure that users with specific disabilities can functionally use our software, documentation, training, and support materials. This goal is aligned with functional accessibility standards. The specific disabilities include the following:

- mobility impairments. Users with mobility impairments may not be able to access pointing devices or standard physical keyboards. Users with mobility impairments may use speech-to-text software, keyboard emulation software, or other specialized input devices.
- no vision. Users with severe visual impairments or total blindness cannot see the screen. As a result, they typically do not use a pointing device. They typically operate software strictly using a keyboard. They also typically use specialized programs called screen readers which speak text on the screen out loud using text-to-speech software. They may also read text on the screen using a refreshable braille display.
- low vision. Users with low vision have difficulty seeing the screen due to poor acuity, loss of visual field, color blindness, poor contrast perception, light sensitivity, or other symptoms. Users with low vision may need to increase the size of text, change color or contrast settings, or use an on-screen magnifier.
- hearing impairments. Users with hearing impairments may not be able to hear audio or video content. They may use captions or transcripts.
- cognitive impairments. Users with cognitive impairments may have difficulty with memory, attention, or comprehension. They may benefit from consistency, simplicity, or reduced visual clutter.

## INSTALLATION

The beginning of a new semester can be a stressful time for students with disabilities. They must learn a new schedule, new buildings, new professors, new software, and acquire instructional materials in accessible formats. All of these items are potential barriers that must be overcome before a student with a disability starts the real work of learning the material that is taught in class.

Students with visual impairments are particularly exposed to potential barriers in software and instructional materials because most software and instructional materials are visual by nature. For this reason, SAS has worked very hard to remove barriers that might prevent students with visual impairments from accessing SAS University Edition. We have also published the [SAS® University Edition: Quick Start Guide for Students with Visual Impairments](#). The quick start guide removes much of the uncertainty of getting started with SAS University Edition by defining a “happy path” that students with visual impairments can follow to get up and running quickly. It will be updated with each new release of SAS University Edition.

## SAS STUDIO

SAS Studio is the primary user interface for SAS University Edition. It is a browser-based development environment for SAS programmers. As of the time this paper was published, SAS Studio 3.6 is included in SAS University Edition. SAS Studio 3.6 is the most accessible version of SAS Studio to date. It includes excellent keyboard accessibility that is important for students with mobility impairments and students with no vision. It includes support for screen readers that are used by students with no vision. It also supports a variety of display customizations that are beneficial for students with low vision. All of these features and more are described in [SAS Studio 3.6: Accessibility Features](#).

## SAS OUTPUT THAT FACILITATES COLLABORATION AND INCLUSION

Professors may create SAS output that they share with the entire class or they may require students to create SAS output that can be shared with other students. The output may include text, tables, and graphs. SAS Studio can produce output that facilitates collaboration and inclusion for students with a broad range of abilities and disabilities. However, the author of the SAS output must follow best practices for accessibility.

[Creating Accessible SAS® 9.4 Output Using ODS and ODS Graphics](#) is a new SAS publication that provides step-by-step instructions and sample code for creating output that is accessible to the entire class. This document includes the following primary topics:

- recommendations for tools that can be used to determine whether your SAS output conforms to

WCAG 2.0 AA

- general guidance for SAS output including page title, table of contents, layout, text, lists, etc.
- guidance for creating accessible tables
- guidance for creating accessible graphs
- guidance for using styles to best meet the needs of users with low vision

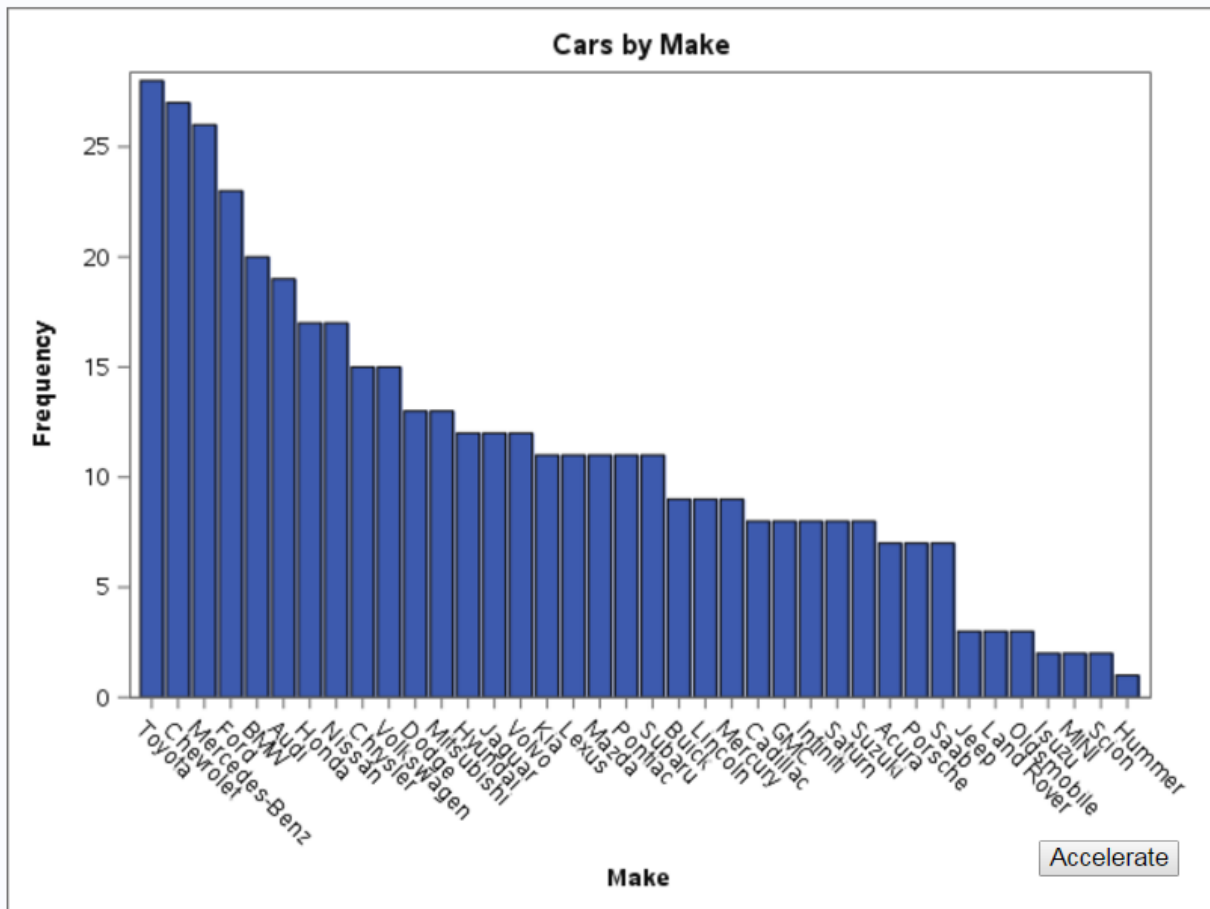
## SAS® GRAPHICS ACCELERATOR

Historically, digital data visualizations such as charts and graphs have been completely inaccessible for students with no vision and very difficult to access for students with low vision. In February 2017, SAS announced radically innovative technology that provides unprecedented access to charts and graphs for students with no vision or low vision.

SAS Graphics Accelerator is a browser extension for Google Chrome and Mozilla Firefox. SAS Graphics Accelerator enables alternative presentations of SAS data visualizations that have been created using the ACCESSIBLE\_GRAPH option that was added to the ODS HTML5 destination in the 9.4M4 release of SAS. Alternative presentations include text descriptions, tabular data, and interactive sonification. Sonification uses non-speech audio to convey important information about the graph.

Using SAS Graphics Accelerator, students with visual impairments can interactively explore data visualizations such as bar charts, line charts, histograms, scatter plots, and heat maps using sound. Together, SAS Graphics Accelerator and SAS University Edition allow students with visual impairments to independently analyze and explore their own data. They can also collaborate effectively with sighted peers and professors because the charts and graphs created by SAS can be perceived by everyone.

Display 1 shows a graph which has been recognized by the SAS Graphics Accelerator – notice the **Accelerate** button on the bottom right.



**Display 1. Graph Recognized by SAS Graphics Accelerator**

Display 2 shows the alternative presentation of graph once the user has selected the **Accelerate** button.

chrome-extension://ockmipfaiiahknplinepcaogdillgoko/main/description.html?arg=14

### Bar Chart

Title: Cars by Make

X axis: Label is "Make". Type is categorical. There are 38 categories. Categories are Toyota, Chevrolet, Mercedes-Benz, Ford, BMW, Audi, Honda, Nissan, Chrysler, Volkswagen, Dodge, Mitsubishi, Hyundai, Jaguar, Volvo, Kia, Lexus, Mazda, Pontiac, Subaru, Buick, Lincoln, Mercury, Cadillac, GMC, Infiniti, Saturn, Suzuki, Acura, Porsche, Saab, Jeep, Land Rover, Oldsmobile, Isuzu, MINI, Scion, Hummer.

Y axis: Label is "Frequency". Range is from 1 to 28. Type is continuous. Scale is linear.

This Bar Chart contains 38 bars.

### Sonification

Explore this bar chart using sound. Use right and left arrow keys to navigate along the X axis. The Y value of each bar is represented by pitch of the corresponding piano note. Press 'H' for additional keyboard commands.

### Data

Displaying up to the first 20 rows of data.

Data in tabular format

Make	Frequency
Toyota	28
Chevrolet	27
Mercedes-Benz	26
Ford	23
BMW	20
Audi	19
Honda	17
Nissan	17
Chrysler	15
Volkswagen	15
Dodge	13
Mitsubishi	13
Hyundai	12
Jaguar	12
Volvo	12
Kia	11
Lexus	11
Mazda	11
Pontiac	11
Subaru	11

Download Data as CSV

## Display 2. Alternate Presentation of Graph by SAS Graphics Accelerator

To enable SAS Studio to create accessible charts and graphs:

1. Click the **More application options** button at the top of the SAS Studio workspace.
2. Select **Preferences** from the menu.
3. Click the **Results** tab.
4. Select **Enable accessible graph option (pre-production)**.
5. Click the **Save** button.

Now the graphs you create with SAS Studio will be recognized by the SAS Graphics Accelerator. Add the SAS Graphics Accelerator plugin to your browser, or ask those consuming your graphs to add it to their browser. Once the plugin is installed, you will hear a tone when an accessible graph is detected and the **Accelerate** button will be added to allow you to access the alternative presentations of the graph.

See the [SAS Graphics Accelerator product page](#) on support.sas.com for more information including sample graphs, documentation, tutorial videos, links to download the plugin, and more.

## DOCUMENTATION

In addition to the accessibility-specific documentation already mentioned, SAS University Edition users can access the online documentation for the SAS Studio user interface and other SAS products included in SAS University Edition from the Help menu within SAS Studio or directly on support.sas.com. This documentation includes accessibility features such as headings, proper table markup, alternative text for images, and more. We continue to improve the accessibility of product documentation with each product release.

## TRAINING

SAS University Edition includes free access to two eLearning courses:

- SAS® Programming 1: Essentials covers the basics of SAS programming.
- SAS® Statistics 1: Introduction to ANOVA, Regression, and Logistic Regression covers statistical analysis using SAS/STAT® software with a focus on t-test, ANOVA, linear regression, and logistic regression.

These eLearning courses are delivered in a browser-based eLearning container that was designed with accessibility in mind. As a result, users with a wide range of abilities and disabilities can navigate the course content, operate the video player, etc. The videos within the courses include closed captions and transcripts. Each transcript includes a text version of the sample code and output that is displayed in the corresponding video. The transcripts may be particularly useful for students with visual impairments because they can read the code and output using a screen reader or magnifier. They may also be useful for students who require more time to read and understand material.

SAS University Edition users can get started with these courses by going to the [eLearning page](#) on support.sas.com.

## SUPPORT

SAS University Edition includes access to the [SAS Analytics U community](#) on communities.sas.com. Students with disabilities can engage with a global community of experts on the accessibility board at [communities.sas.com/accessibility](#).

## CONCLUSION

Students with disabilities, professors, and disability support services staff at institutions of higher education have many resources available to ensure that students with disabilities are successful at learning data science using SAS University Edition.

## CONTACT INFORMATION

Your comments and questions are valued and encouraged. Contact the authors at:

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