

Becoming a more efficient programmer with SAS® Studio

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ABSTRACT

SAS Studio is a web-based interface to SAS. It is similar to PC-SAS; however, SAS Studio provides additional features to make SAS programming easier. These features include auto-generation of SAS code and output, automatic formatting of SAS code, syntax checking, and better ways of handling SAS errors and warnings. SAS studio is even capable of predicting and suggesting the next word a SAS user may wish to type. SAS Studio makes it easier to run, maintain and document SAS programs with Process Flows feature.

This paper describes how a SAS user can become more productive with SAS Studio.

INTRODUCTION

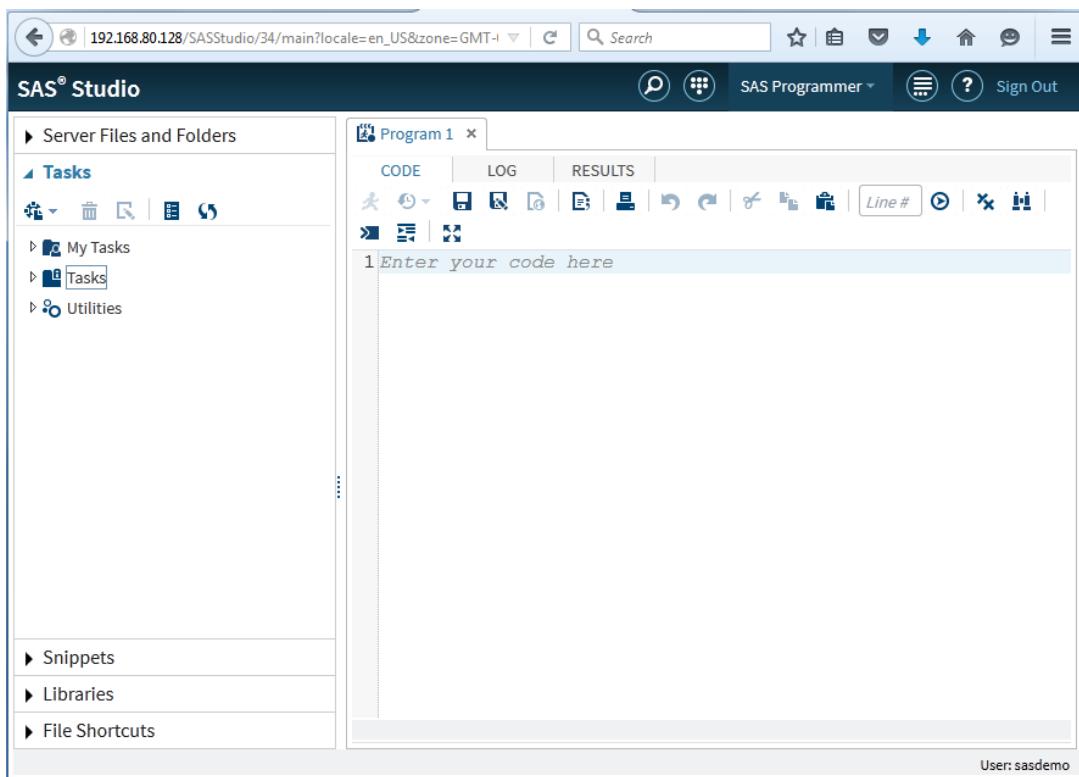
SAS studio is a web-based tool for SAS development. SAS Studio allows access to various code, data and output files. It is similar to PC-SAS or Enterprise Guide, however, it contains additional tools to increase productivity of SAS users. SAS Studio provides new useful features for quick and easy review and correcting of SAS syntax. It has a number of predefined tasks for data analysis including generation of graphics. SAS Studio 3.4 is available as part of a normal SAS installation. This paper is based on SAS Studio 3.1 which can be downloaded for free as part of SAS University package.

Since SAS Studio is a web-based application, it can only be accessed via a web server. SAS studio connects to a SAS server hosted in a cloud environment or located in a local machine. All program, data and output files can be downloaded or uploaded to and from the server.

The set of features available in SAS Studio depends on a **perspective**. The SAS programmer and the Visual Programmers are two different perspectives in SAS Studio. SAS Programmer is the default perspective and it contains features most commonly needed for developing a SAS program. The Visual Programmer perspective contains tools needed for managing various processes.

SAS Studio layout has three parts:

1. Application name and buttons in the top of the window.
2. Navigation panes in the left side of the window.
3. Primary tabs in the right side of the window. Tabs include windows for SAS program editor, results and data.



Display 1. SAS Studio layout

Most of the SAS Studio features are similar to PC-SAS features. However, SAS studio has a number of tools which can increase the efficiency and productivity of a SAS user which are not available in PC-SAS.

AUTOMATIC GENERATION OF SAS CODE

One of the most useful features of SAS studio is the option to automatically generate SAS code without having to learn any SAS syntax. This feature is a good way to quickly analyze data or learn SAS syntax. This is done by using the **task** section of SAS studio. The tasks are based on many common SAS procedures and require a SAS user to provide input data and predefined parameter values.

The following example demonstrates the generation of SAS code for a simple line chart plot of mean BMI values over time grouped by a treatment group. The Line Chart task will use the following data set:

```
data bmi_data;
length Drug $1 ;
input Drug $1 Month 3  Mean 4-9 n 11-14 std 15-19 high 20 -24 low 25-30 ;
datalines;
A 1 0 200 2.6
B 1 0 200 2.8
A 2 -12.5 170 2.6 -9.8 -15.1
B 2 -4.08 170 2.7 -1.2 -6.87
A 3 -19.4 140 2.5 -16.9 -22.0
B 3 -4.15 140 2.7 -1.4 -6.8
A 4 -22.5 130 2.4 -20.1 -25.07
B 4 -0.15 130 2.7 2.62 -2.95
;
run;
```

DRUG	MONTH	MEAN	N	STD	HIGH	LOW
A	1	0	200	2.6	.	.

B	1	0	200	2.8	.	.
A	2	-12.5	170	2.6	-9.8	-15.1
B	2	-4.08	170	2.7	-1.2	-6.87
A	3	-19.4	140	2.5	-16.9	-22
B	3	-4.15	140	2.7	-1.4	-6.8
A	4	-22.5	130	2.4	-20.1	-25
B	4	-0.15	130	2.7	2.62	-2.95

Table 1. Mean BMI values over time

The creation of a line chart using Tasks is an easy and straightforward process. The line chart task can be found in the Graph folder in navigation panel of SAS studio under the **Tasks** section. Double click to open the area to the right of the work area populated with DATA, OPTIONS and INFORMATION tabs. A variable can be selected in the DATA tab for each pre-defined parameter.

The screenshot shows the SAS Studio interface with the 'Line Chart' task selected. The left sidebar displays 'Server Files and Folders' and the 'Tasks' section, where 'Line Chart' is highlighted. The main workspace shows the 'Line Chart' task configuration with the 'OPTIONS' tab selected. The configuration includes:

- Category variable:** Month (selected item)
- Response variable:** Mean (selected item)
- Group variable:** Drug
- URL variable:** Column

The 'DATA' tab shows a list of variables: 1 /*, 2 *, 3 * Task, 4 *, 5 * Gener, 6 * Gener, 7 * Gener, 8 *. The 'INFORMATION' tab is also visible.

Display 2. LineChart Task

Clicking the symbol of the running man will generate the plot in Figure 1.

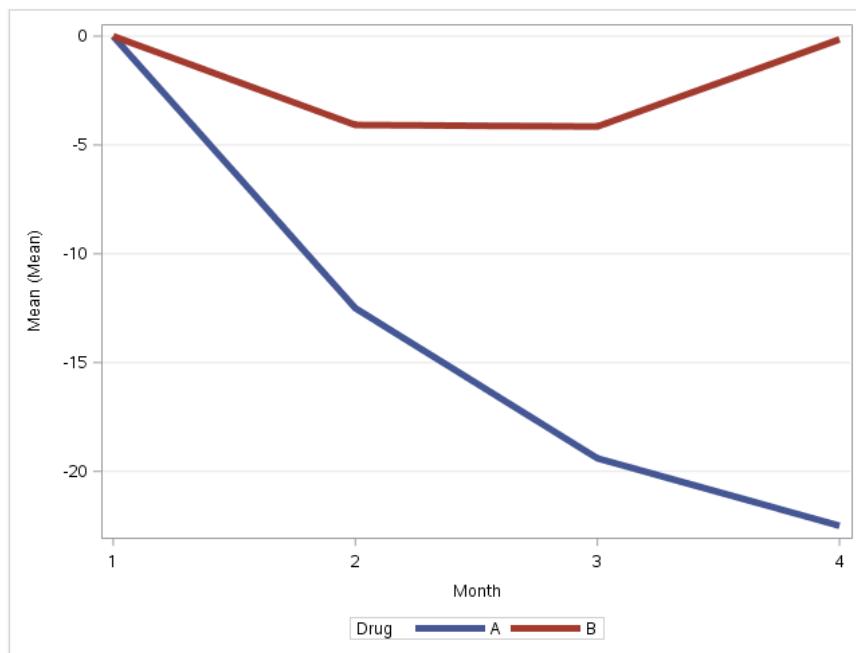


Figure 1. Graph generated by LinePlot Task

The graph can be further customized in option and information tabs. The generated code can be viewed by clicking the code tab.

The screenshot shows the SAS Studio interface with two tabs open: '*Program 1' and '*Line Chart'. The '*Line Chart' tab is active and displays the SAS code for generating the line chart. The code is as follows:

```
35 /*--SGPLOT proc statement--*/
36 proc sgplot data=WORK.BMI_DATA;
37 /*--Line chart settings--*/
38 vline Month / response=Mean group=Drug lineattrs=(thickness=5) stat=Mean
39   name='Line';
40
41 /*--Response Axis--*/
42 yaxis grid;
43 run;
```

Display 3. The SAS code for Figure 1

This code can be studied or re-used later.

AUTOMATIC CODE-FORMATTING FEATURE

SAS Studio can be used to quickly and consistently format any SAS program by adding line breaks and properly indenting each line based on its nesting level. Assume a SAS user quickly wrote a simple program to sort, manipulate and display SASHELP.CLASS data. This program works but the code contains multiple SAS statements on one line and is not easy to follow.

The screenshot shows a SAS Studio interface with a window titled "Program 1". The "CODE" tab is selected. The code area contains the following SAS code:

```
1 proc sort data=sashelp.class out=class;by name sex; run;
2 data class2; set class; run;
3 proc print data=class;run;
```

Display 4. This SAS code is difficult to read

The SAS program will look much better after the automatic code-formatting feature is used:

The screenshot shows the same SAS Studio interface with the "LOG" tab selected. The code area now displays the same SAS code, but it is automatically formatted:

```
1 proc sort data=sashelp.class out=class;
2   by name sex;
3 run;
4
5 data class2;
6   set class;
7 run;
8
9 proc print data=class;
10 run;
```

Display 5. The SAS code after use of automatic code-formatting feature

This is a very efficient way to make any SAS code look professional.

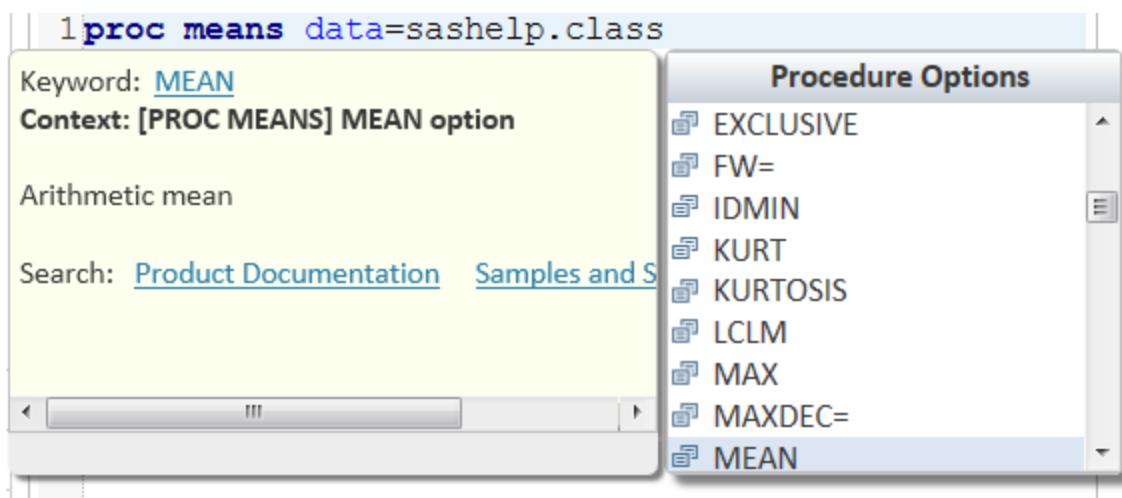
AUTOCOMPLETE FEATURE

The autocomplete feature of SAS Studio is capable of predicting and suggesting the next word a SAS user may wish to type. Such words include SAS procedures, procedure options, libraries, variable names, formats, or many other SAS keywords.

The screenshot shows the SAS Studio interface with the "CODE" tab selected. A portion of the code is visible: "1 proc sort data =sashelp.". A dropdown autocomplete menu is open, listing several data sets from the SASHELP library, each preceded by a small icon:

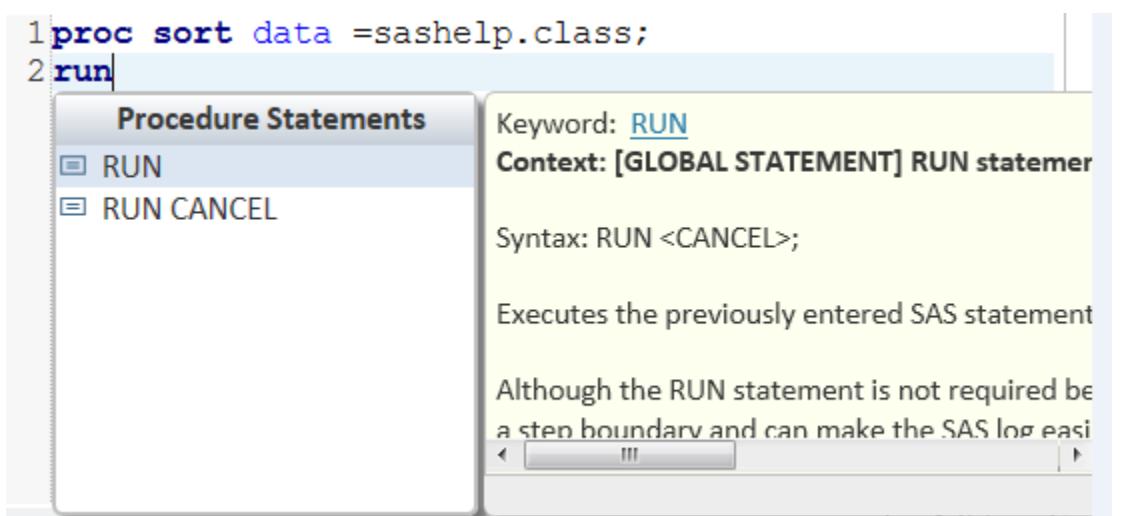
- AIR
- APPLIANC
- ASSCMGR
- BASEBALL
- BEI
- BMIMEN
- BMT
- BURROWS
- BUY

Display 6. The auto complete feature suggesting a list of data sets in SASHELP library



Display 7. The auto complete feature predicting possible PROC MEANS options

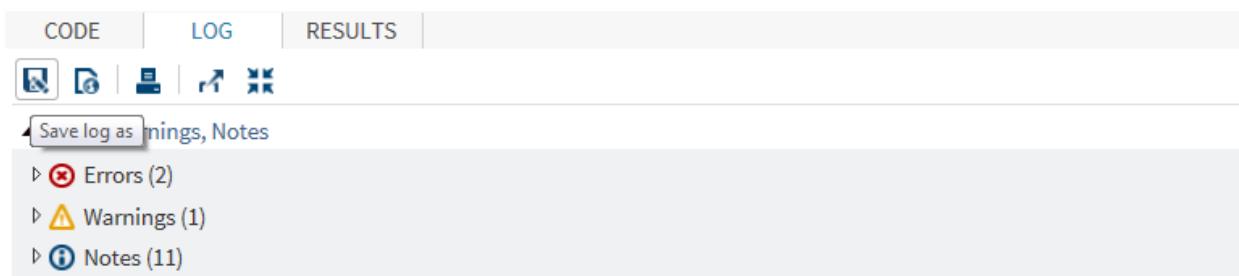
SAS Studio also displays brief SAS syntax in addition to syntax suggestions.



Display 8. Brief SAS syntax help

ERRORS, WARNINGS AND NOTES SECTION

SAS Studio displays all errors, warnings and notes in one section with the summary.



Display 9. Errors, warnings and notes section

This new approach of notes handling allows a SAS user to avoid searching the log file for any errors or warnings.

The screenshot shows the SAS Studio interface with the 'LOG' tab selected. At the top, there are three tabs: 'CODE', 'LOG', and 'RESULTS'. Below the tabs are several icons. Under the 'LOG' tab, there is a section titled 'Errors, Warnings, Notes' with a sub-section 'Errors (2)'. It lists two errors: 'ERROR 73-322: Expecting an =' and 'ERROR 76-322: Syntax error, statement will be ignored.' There is also a section for 'Warnings (1)'.

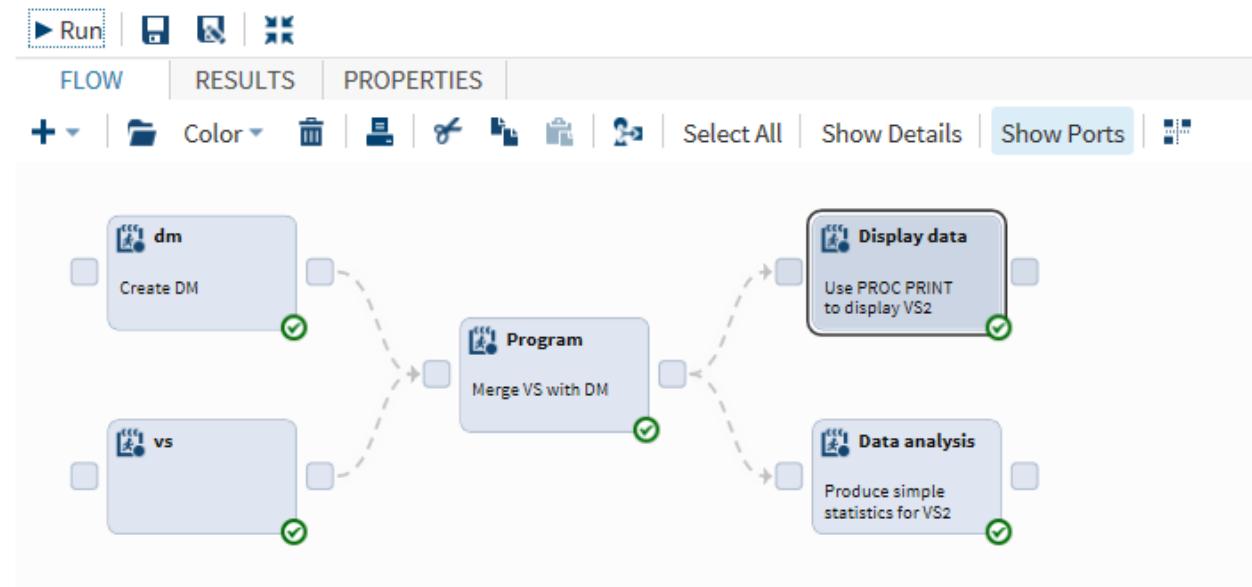
Display 10. A list of errors can be expanded

PROCESS FLOWS

A process flow is a feature of SAS Studio that allows SAS users to put together a SAS based process. The process is usually a SAS program, a set of various SAS programs or SAS statements, input data or results of a query or a task. The Visual Programmer perspective is needed to use process flows.

The process flow below is an example of a very simple process which includes the following steps:

1. Creation of DM data set
2. Creation of VS data set
3. Merging DS with VS data sets into a new VS2 data set
4. Displaying VS2 data
5. Data analysis of VS2 data set



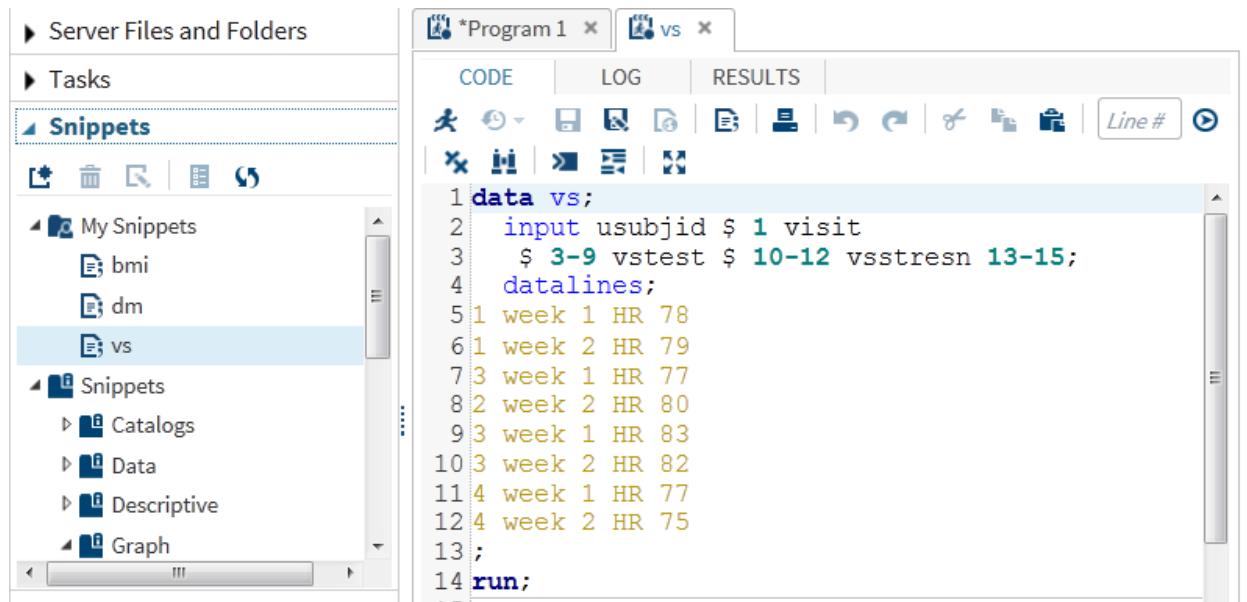
Display 11. Sample process flow

Each of these steps (nodes) can be run separately or together. Each node can be based on a stand-alone program or series of SAS statement. A process flow helps to visually document the information about how such processes work. It also makes the processes easier and more efficiently to maintain.

CODE SNIPPETS

Code snippets are stand-alone SAS programs which can be saved, re-used or customized. These SAS programs can be very complex or consist of just few lines of code. They can be used as reference programs or elements of a major complex SAS process.

SAS Studio is shipped with many code snippets including SAS code for creation of graphs, data management, output formatting, macro statements and IML code. The code snippets can be found in the **Snippets** section of the navigation panel. In order to create a user-defined snippet a SAS user needs to select a section of the code, choose the **Add to My Snippets** dialog, enter a name for the snippet and click **Save**.



Display 12. Creating user-defined Code Snippets

The snippet will be available in the My Snippets folder. A code snippet can be used in a program by using a drag-and-drop operation, double-clicking the name of the snippet or right-clicking the name of the snippet, and selecting **Insert**.

WORKING WITH SAS OUTPUT

SAS studio makes it easy to save output in PDF, HTML or RTF formats without having to write any SAS code. A simple Save As option allows users to choose the desired format.

The screenshot shows the SAS Studio interface with a window titled "Program 1". The "RESULTS" tab is selected. Below it is a toolbar with icons for copy, paste, cut, and other operations. A button labeled "Download results as a PDF file" is visible. The main area displays a table with 10 rows of data:

Obs	Name	Sex	Age	Height	Weight
1	Alfred	M	14	69.0	112.5
2	Alice	F	13	56.5	84.0
3	Barbara	F	13	65.3	98.0
4	Carol	F	14	62.8	102.5
5	Henry	M	14	63.5	102.5
6	James	M	12	57.3	83.0
7	Jane	F	12	59.8	84.5
8	Janet	F	15	62.5	112.5
9	Jeffrey	M	13	62.5	84.0
10	John	M	12	59.0	99.5

A modal dialog box is displayed in the foreground, asking "Do you want to open or save Program 1-results.pdf from 192.168.80.128?". It has "Open", "Save", and "Cancel" buttons. The "User: sasdemo" is shown in the bottom right corner.

Display 13. Saving SAS output

CONCLUSION

SAS Studio provides numerous ways to make SAS programming easier and more efficient, even for a novice user. Additionally, SAS Studio is an excellent way to learn and experiment with various features of SAS. The maintenance and documentation of a complex SAS process is greatly simplified with SAS Studio.

REFERENCES

Monaco and Dexter, Introduction to SAS® Studio, SUGI, 2014. Available at <http://support.sas.com/resources/papers/proceedings14/SAS302-2014.pdf>.

CONTACT INFORMATION

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