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SAS Programming: Current State and Implications for the Future

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ABSTRACT

Managing a programming department can be challenging. Day-to-day managers focus on getting/helping individual programmers to complete specific tasks within specific timelines. It can be helpful to step back from managing people to consider a broader perspective on the work that programmers do and the environment in which they do it. Using data from the US Department of Labor as a starting point, this paper presents a larger perspective on the programmer occupation, how it fits into organizations, how it is changing, and what managers and programmers should consider in planning for the future.

INTRODUCTION

Looking at the current situation of the SAS programmer and the natural tendency of organizations to seek to control over costs and processes, we can make some assumptions about how this occupation, and the companies that employ people in this occupation, will change over time. Companies, managers, and programmers need to be aware of how these changes may affect them. Suggestions for preparing for the future are discussed.

THE PROGRAMMING OCCUPATION

A good starting place for looking at an occupation is with the US Department of Labor which, with the Bureau of Labor Statistics, collects and posts statistics about a wide range of job-related issues. Those interested in employment numbers or wages can get a breakdown by industry, occupation, and geographic area by using the Occupational Employment Statistics Query System at the department's website.

The US Department of Labor defines programmers as people who: "Create, modify, and test the code, forms, and script that allow computer applications to run. Work from specifications drawn up by software developers or other individuals. May assist software developers by analyzing user needs and designing software solutions. May develop and write computer programs to store, locate, and retrieve specific documents, data, and information."

Although the job of a SAS programmer can easily creep into areas of support, such as setting or reviewing timelines and budgets or mentoring other programmers, the core of their job is to program. The Dept of Labor describes the programmer's core job as, "Computer programmers write programs. After computer software engineers and systems analysts design software programs, the programmer converts that design into a logical series of instructions that the computer can follow."

They expand on this core job to include other activities. These include:

- update, repair, modify, and expand existing programs;
- use libraries of basic code that can be modified or customized for a specific application;
- use "programmer environments," applications that increase productivity by combining compiling, code walk-through, code generation, test data generation, and debugging functions;
- use computer-assisted software engineering tools to automate much of the coding process.

Although the description provided by the Dept of Labor is for programmers in all programming languages, it seems to fit for SAS programmers as well. It should be noted that these additional activities are not so much programming as they are ways to reduce the number of hours spent programming by providing tools and guidelines to increase productivity. This rationalization of programming is a trend among modern organizations (and some programmers) as they seek to make programming more efficient and cost effective.

This tendency for companies to seek to improve productivity through process control has been around for more than a century. Of course, programming as an occupation is not nearly so old. We can learn about managing within a more rationalized occupation by looking at the lessons learned by those older industries. One lesson may be to know that staff appreciate a certain level of control if it increases their productivity; but there is usually a threshhold where too much control leads to boredom and a lack of engagement.

THE LIFE OF A PROGRAMMER

According to the Dept of Labor, most programmers work 40 hours a week, but about 11 percent of programmers worked more than 50 hours a week in 2008.

Median annual wages of wage-and-salary computer programmers were $69,620 in May 2008. The middle 50 percent earned between $52,640 and $89,720 a year. The lowest 10 percent earned less than $40,080, and the highest 10 percent earned more than $111,450 (Occupational Outlook Handbook, 2010-11 Edition). Since the median family income in 2009 was just under $50,000, programming jobs would seem to provide a fairly good salary.

Information from the May 2009 Occupational Employment and Wages survey indicate that wages increased over the year.

Table 1 presents the number of people employed as programmers and their annual wage in 2010.

Employment	Employment RSE	Mean hourly wage	Mean annual wage	Wage RSE
367,880	1.2 %	$35.91	$74,690	0.7 %

Table 1. Employment and mean wage estimates for programmers.

Table 2 presents the percentiles for programmer wages in 2010.

Percentile	10%	25%	50% (Median)	75%	90%
Hourly Wage	$19.54	$25.78	$34.10	$43.75	$54.51
Annual Wage	$40,640	$53,620	$70,940	$91,000	$113,380

Table 2. Wage estimate percentiles for programmers.

The Dept of Labor reports that there were about 426,700 computer programmers in 2008. Although computer software engineers and computer programmers can be found in a wide range of industries about 32 percent were employed in computer systems design and related services. About 48,200 computer software engineers and computer programmers were self-employed in 2008.

THE FUTURE OF PROGRAMMING

The Dept of Labor expects “employment of computer programmers in the US to decline slowly, decreasing by 3 percent from 2008 to 2018, a loss of about 12,000 positions. They attribute this to advances in programming languages and tools, the growing ability of users to write and implement their own programs, and the offshore outsourcing of programming jobs.” Their analysis includes both rationalization of the programming work and the effects of companies seeking to use less expensive staff.

They explain the portability of programming jobs with, “because they can transmit their programs digitally, computer programmers can perform their job function from anywhere in the world, allowing companies to employ workers in countries that have lower prevailing wages. Computer programmers are at a much higher risk of having their jobs offshored than are workers involved in more complex and sophisticated information technology functions, such as software engineering.”

They continue with a caveat that, nevertheless, “employers will continue to need some local programmers, especially those who have strong technical skills and who understand an employer's business and its programming requirements. Furthermore, a recent trend of domestic sourcing may help to keep a number of programming jobs onshore. Instead of hiring workers in foreign locations, some organizations have begun to contract with programmers in low-cost areas of the United States. This allows them to reduce payroll expenses, while eliminating some of the logistical issues that arise with offshore outsourcing.”

They conclude by noting that, “although employment of computer programmers is projected to decline, numerous job openings will result from the need to replace workers who leave the labor force or transfer to other occupations. Prospects for these openings should be best for applicants with a bachelor's degree and experience with a variety of programming languages and tools. As technology evolves, however, and newer, more sophisticated tools emerge, programmers will need to update their skills in order to remain competitive.”

While we can't be sure how closely SAS programming will follow the Dept of Labor predictions for programmers in general, they appear to be valid for our sub-occupation also.

THE MATURATION OF SAS PROGRAMMING

Although programming is a skilled occupation, it still is somewhat impacted by modern organizational ideas about organizing work. From the time of the industrial revolution and carrying through the Scientific Management and Fordism of the early 20th century, companies have sought to make work more structured, efficient, and profitable. The goal of this trend is to reduce individual differences in work output and bring all workers up to a common level of productivity. While SAS programming as an occupation is still young and maturing, we can observe many examples of this trend.

Some of these examples are summarized in Table 3:

	Past	Future
SAS Software	Some functionality, but expert SAS and general programming knowledge was required for most tasks.	Increase functionality to allow routine manipulations using simple functions; also, program engineering tools to allow non-programmers to work with SAS datasets
Companies	Relied on face-to-face interactions between programmers and customers to design and develop custom programs.	Increased documentation of processes and development of tools automate and control most programming needs.
Managers	Were programming resources to mentor staff in programming techniques and planning.	Increased emphasis on managing processes and non-programming activities. Focus is on ensuring that staff understand and use programming tools.
Programmers	Studied manuals and talked to other programmers to learn programming techniques and SAS tricks.	Emphasis in becomming competent in SAS, but not experts. Learn company processes and tools and how to manipulate them to perform tasks.

Table 3. Effects of occupation maturation on SAS programming.

At each level, from the SAS® software to the SAS programmer, there is a movement away from knowledge and skill that is based on individual aptitudes toward improvement in overall tools and processes. This is not to say that highly skilled SAS programmers will be forced to reduce their quality and productivity, only that less highly skilled staff will be given the tools to help them quickly perform at target levels.

At the SAS software development level, each newly released version of SAS provides a bit more functionality and requires a bit less knowledge of tricks and snippets of code to perform tasks. SAS® Version (6) had 146 functions included in the paperback reference manual. In Version (9) there are more than 400. To further illustrate the importance of functions to the modern SAS programmer, there is even a book by Cody devoted solely to listing and describing SAS® Functions. The skill needed to perform data manipulations increasingly relies less on the general knowledge of programming logic and more on the knowledge of the function that can perform the same manipulation. Even an expert programmer, armed with concatenation symbols and trim functions, would have trouble competing against the CATX function. Beyond these Base SAS enhancements that make programming simpler, SAS also provides SAS® Enterprise Guide® software that allows novices to build programs for manipulating and displaying data.

At the company level, there is a growing trend toward building tools to increase productivity and so decrease time spent on tasks. This is useful in reducing development costs and in making production as routine as possible. To

accomplish this, custom code written by experienced programmers is documented, validated, and provided to other programmers to use. Macros are built to handle common data manipulations across the organization. Process documents are written to give programmers a recipe to follow in order to perform complex tasks. Less experienced programmers only need sufficient skill to follow the directions and set the correct macro parameters to produce results.

At the department level, the mix of programmers is changing. Departments may see a decline in the need for SAS experts and an increase in SAS journeymen as the need for skill is replaced by enhancements to the SAS system, combined with the tools developed by the more experienced programmers. With more control by tools and processes, departments can more easily rely on remote programmers rather than require all staff to be in one location. The role of manager may change from that of a technical mentor to a traditional overseer of processes and staff.

For many programmers, learning to use the tool sets provided by their companies may be as important as indepth knowledge of SAS. As the technical playing field becomes more level, the decision to hire may be related more to experience in a particular industry. This is already common in several fields that employ SAS programmers, for example pharmaceutical research, where the programming may become more routine, but the knowledge of what is appropriate to present to regulatory agencies is less easily provided in a process document.

IMPLICATIONS FOR BUSINESSES, MANAGERS, AND PROGRAMMERS

Businesses, including those who employ SAS programmers, are constantly striving to increase productivity and lower costs for providing services. This goal leads to the expanded job tasks listed by the Dept of Labor, above. These activities, from modifying code to using software-engineering tools can be viewed as a progression of tasks, from complex to simple. Business will need to adjust to the new work environment by focussing on building and maintaining repositories of programming and process tools that can be accessed by programmers. With an increasing number of programmers working remotely, companies will need to invest in:

- connectivity software to allow efficient access to software and databases;
- departmental tools and process documents to control task performance; and,
- communication channels like instant messaging and teleconference providers to keep the staff connected.

As departments mature they provide greater structure and programming work becomes more rationalized. The number of tools becomes more extensive, the library covers more examples, and the programming skill needed to perform adequately becomes more stable and less challenging. Departments can hire more mid-level programmers to perform tasks and even have them done by programmers working from remote locations. The culture of offices will shift from face-to-face interaction among programmers to a more virtual office.

THIS WILL IMPACT BOTH MANAGERS AND STAFF.

For managers, one lesson to learn from early attempts at controlling work is that it can make for a fairly non-stimulating workplace. Managers will need to balance maintaining process control with providing opportunities for programmers to learn new skills or exchange ideas. It is easy for programmers to focus exclusively on their work and managers will need to help them strike a healthy balance of work and personal interaction.

The competencies needed by managers will shift as the mix of tools and skills changes. Managers will need to work hard at matching programmers' skills to the department's needs. The expert programmers in the department will need further challenges to keep them interested. Less experienced programmers may want the opportunity to build tools of their own. A bit of planning will be needed to keep everyone content. For the manager of staff with a wide mix of skill levels, the goal will be to keep work interesting for the expert programmers and manageable for the average programmers. This is illustrated in Table 4.

Skill versus Task			
Work needed	**Custom coding/ Tool building**	**Modification of programs/tools**	**Use of tools**
Programmer level			
Expert	Good fit – uses expertise to provide custom code based on needs	Questionable fit – could provide break from higher level work and give chance to consider changes to existing programs	Poor fit – high chance of boredom and frustration
Journeyman	Questionable fit – could provide opportunity to expand skill or could lead to frustration if skill discrepancy is too great.	Good fit – uses solid knowledge to make updates to programs and tools	Questionable fit – could provide break from higher level work and give chance to consider changes to existing programs
Novice	Poor fit – very little chance of success; very high chance of frustration.	Questionable fit – could provide opportunity to expand skill or could lead to frustration.	Good fit – provides inputs into tools to generate results

Table 4. Matching skill to task.

Managers will also need to:

- spend a greater percentage of their time communicating with remote staff, making sure that staff are knowledgeable about the tools available to them, and following guidances to ensure common practices and results
- work harder at integrating and tying remote staff to the department
- be disciplined in getting and giving updates to keep projects running smoothly
- learn how to communicate effectively by telephone, email, or instant messaging and be tuned into non-visual clues to assess their staff's morale or possible conflicts. Remote communication also requires more preparation since presentations need to be sent ahead of time for all parties to access.

This increased rationalization may also affect the culture of the department. As processes become more routine, there will be less need for expert programmers to share information and engage in problem solving. Control and productivity will increase, but the ability to solve problems will decrease as expertise is contained in an ever smaller pool of experts. Programming department should be careful to have enough expert programmers to build or change tools to handle new problems that arise.

The good news for programmers is that their jobs aren't going away anytime soon. Plus, they will have increasing opportunities to working from remote locations. However, they need to be aware that change requires them to adjust to keep up with industry needs.

The experts will need to recognize that they must stay current on SAS enhancements, rather than relying on existing programs to handle tasks. Being an expert in SAS® Version (6) isn't very helpful for most tasks. Those with general knowledge in building programs and tools will still find a good use for those skills as their companies look to build and enhance their tools and processes. Also, the experts will have the background to understand industry standards, which will make them highly valued by companies.

The increasing functionality of the SAS® software makes it less necessary for expert programmers to write code to perform routine functions. As the SAS® system of software continues to mature, it will be easier for new programmers to learn SAS and, perhaps, to find jobs as SAS programmers. They can document their skills through certification, but with the technical playing field leveled, competition for jobs will hinge more on knowledge of the industry in which their programming is being used rather than on their ability to write code. As writing programs becomes easier, knowing the industry standards for analyzing and displaying information will become more valuable to businesses. Getting this experience will be key in these industries, perhaps through interships.

Programmers who work remotely will need to take greater responsibility for staying connected to their departments by giving frequent updates on what they are doing and staying current on departmental issues. Since mentoring is difficult across remote locations, they need to be aware of resources available to help them handle any programming problems that they encounter. There are online SAS communities that they can use to get help with programming problems. Programmers in larger cities may also have access to local SAS User Groups, where they can interact with other programmers. Remote programmers also need to be prepared for being relatively isolated and to honestly assess their ability to work in an unsupervised atmosphere. Some programmers may find it helpful to maintain close contact with a small pool of programmers that they can use as a sounding board for ideas or even just encouragement. They may even need to purchase their own connectivity software to facilitate these relationships.

CONCLUSION

The projections by the Dept of Labor predicts some interesting trends for the programming occupation. Coupled with what we have learned from other industries, we can make some predictions about how the SAS programmer occupation may change.

As the SAS programming occupation matures, it will have an impact on programmers and the businesses that employ and manage them. Increased functionality in SAS; improved libraries of sample programs and macros; extensive tools for performing tasks; and more complete process guidances will change the mix of departments and impact the role of the programming manager.

Departments that succeed will be prepared for the future by being aware of and preparing for these trends. Managers that succeed will broaden their competencies beyond SAS to managing to skill level and across regions. Programmers will enhance their prospects through learning industry standards while maintaining a solid knowledge of SAS functions and departmental tools.

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