

Faculty Attitudes toward COBOL and its Place among Other Programming Languages in the AACSB Business College Curriculum within the United States

Paula Ruby

Computer and Information Technology
College of Business
Arkansas State University
State University, AR 72467
pruby@astate.edu

ABSTRACT

This research examines the literature regarding COBOL and reports on a survey sent to MIS/CIS department chairs of AACSB colleges of business within the United States. The survey measured faculty attitudes regarding COBOL, identified the status of COBOL in the curriculum and identified what other programming languages are being taught. Results indicate that COBOL still plays an important role in the curriculum. However, Microsoft's Visual Basic has taken the lead in the programming curriculum.

Keywords: COBOL, Programming Languages, Programming, MIS Curriculum, CIS Curriculum

1. INTRODUCTION

A common theme running through the literature regarding programming languages is that COBOL is dead, or if not dead, certainly dying. COBOL has been reported to have been the king of custom applications until the early 1990's (Ehie 2002; Fougere et al. 2003; Maier and Gambill 1996). Businesses have used this strength as a strategic driver. When enterprise applications such as customer relationship management, supply chain management, and knowledge management systems came into being, COBOL lost its standing because these systems were designed to support organization-wide process coordination and integration and they took advantage of corporate intranets and Web technologies to transfer information within the firm and to partner firms. Because of this, the business world could no longer rely on custom applications for its strategic advantage (Babcock 2003; Hayes 2002; Laudon and Laudon 2004). As businesses increase using the Web for applications, those with a lot of COBOL code are concerned because they will be forced to retrain a COBOL-only workforce (Reeves 2002).

But is COBOL really dead? The Institute of Electrical and Electronic Engineers, Inc. states that COBOL running on mainframes still process more than 95 percent of all financial and insurance data, 75 percent of all production transactions, and 83 percent of all transactions worldwide (Radcliff 2000). Estimates of the amount of code that is currently in use range from 180 billion to 2 trillion lines of code. Fifteen percent of

all new applications will be written in COBOL through 2005 (Babcock 2003; Bell 2000; Fougere et al. 2003; Ulrich 2001). In addition, the military still heavily relies on mainframe computing. COBOL is a language that has become an indispensable part of business applications and there is still a demand for COBOL in the work place (Reeves 2002; Ulrich 2001). Leveraging it will help meet today's strategic business requirements by integrating it into the new enterprise application architecture.

As the debate continues in industry as to whether COBOL should continue to be a strong presence in the enterprise, colleges and universities that offer comprehensive and current degree programs work to plan curriculums that meet the needs of local and regional businesses on a regular basis. Gathering information on what similar colleges and universities are doing is a starting point for planning and updating curriculums. It is also important to identify national employment needs in the field of information systems (Gorgone et al. 2002).

A literature review using periodical databases such as ABI Inform, LEXISNEXIS, Academic Search Premier, and ERIC did not result in any articles that investigated the status of COBOL in terms of faculty attitudes or current course offerings in colleges and universities accredited by the Association to Advance Collegiate Schools of Business (AACSB). This information is vital for both doctoral granting institutions as well as masters level institutions in determining course offerings and in preparing students with

the skills required to be competent in meeting demands. Thus, the study has two broad objectives. The first objective is to identify the status of programming languages, especially in terms of the coverage and faculty attitudes of COBOL in AACSB accredited business schools in the United States. The second objective is to identify what programming languages are being taught. An attempt will also be made to investigate the impact the type of institution and its location may have on the status of COBOL and other programming languages in terms of faculty attitudes and coverage.

There is justification for investigating the status of programming languages and coverage and attitudes of COBOL as influenced by type of institution, investigated here as the Carnegie type of institution. The institution profile on the AACSB International Web site classifies the colleges by their 2000 Carnegie Classification. The Carnegie Foundation for the Advancement of Teaching, describes the classification as "...the leading typology of American colleges and universities. It is the framework in which institutional diversity in U.S. higher education is commonly described" (List of Institutions by Carnegie Classification, Control, and State Accessed, pp. 1). For example, AACSB has different accrediting requirements for doctoral granting institutions and masters level institutions (Carnegie type) that might have an effect on the attitudes of their faculty and choice of software in the curriculum. The curriculum in doctoral granting institutions has a very strong research focus in addition to teaching managerial level courses. On the other hand, the curriculum in masters level institutions focuses on preparing students to solve business and managerial level problems (AACSB International 2004). There is also justification for investigating the status of programming languages and coverage and attitudes of COBOL as impacted by geographic regions. There is conjecture that the use of COBOL relates to specific regions of the United States. This is perhaps because of the location of traditional industries such as financial institutions and insurance or because of the attitudes of the people among the regions. This study examined faculty attitudes toward COBOL, the possible need for changing and/or updating the programming curriculum and knowledge of what colleges and universities are offering in their programming curriculum.

This study provides a literature review of the current state of COBOL among businesses, academia, and government. Next, the research methodology is presented. The results of the research are presented, and finally a discussion is provided based on the results.

2. BACKGROUND

2.1 COBOL and Business

Given that no single system has totally rejected the need for COBOL, it is reasonable to assume COBOL's use in business in the near future. Insurance technology experts believe that COBOL will remain in insurance systems for some time and COBOL is an appropriate language for handling financial transactions as well (Bell 2000; Betts 2003 Gibbs, 2000). COBOL is in demand with e-business

integration and recent revisions of COBOL have made it more user-friendly; therefore, COBOL can work with the more modern languages (Gaskin 2000, Langley 1999).

2.2 COBOL and Academia

Many professionals believe that COBOL is dead or at least dying because it is not as widely taught in college curriculums. At the University of Texas, for example, enrollment in the information systems major more than doubled once COBOL was removed from the curricula and replaced with classes in client/server-based languages, such as C++ (Goff 1997). In addition, *U.S. News and World Report* published a list of the top colleges and universities in the United States. Among them were the likes of MIT and Cal Tech. When the top 10 institutions on the list were polled, results showed that COBOL was mentioned only anecdotally as a history lesson in the classroom (Borck 2001). According to *The Career Guide to Industries* (Bureau of Labor Statistics 2003), employers prefer to hire workers who can work with the hot technologies of the day such as Java and the .NET languages. This is likely to cause problems down the road for industries that rely upon COBOL programmers, whom some people think have become outdated and disposable, even if for maintenance tasks.

While teaching COBOL as the only programming language is not wise, it can exist as a supplemental language to languages such as Visual Basic, Java, and C++ (Riley 1998; Young 2000). In a survey conducted by Ehie (2002), business practitioners felt that MIS/CIS graduates should have programming fundamentals and when asked to identify one programming language, they noted that object-oriented programming languages such as C++ would be beneficial to the client/server architecture and Java programming would be suitable for Web-enabled and e-commerce applications. Visual Basic was mentioned third. Sixty-two percent of the practitioners believed that COBOL had a place in the curriculum. Another study of college recruiters indicated that COBOL is a language of major importance to their business applications and that COBOL will continue to be a major language in their business computing (Fougere et al. 2003). In a study by Gill and Hu (1999), COBOL was the most popular programming language taught in 1996, with C++ being second. However, the researchers expected that as the Y2K problem declined, so would the importance of teaching COBOL. In a 1996 survey, 92% of the respondents required COBOL (Maier and Gambill 1996).

2.3 COBOL and Governmental Publications

The Bureau of Labor Statistics, *Career Guide to Industries*, 2002-03 Edition, downplays the importance of COBOL when it states, "While some still work with traditional programming languages like COBOL, object-oriented programming languages, such as C++ and Java, Computer-aided software engineering (CASE) tools, and artificial intelligence shells now are being used to create and maintain programs" (pp. 4).

Occupational Outlook Handbooks were reviewed in an effort to find the presence or absence of the mention of COBOL as

a primary programming language for computer programmers as well as to identify what other languages were mentioned. In the 1984-85 Handbook, COBOL was listed as a language commonly used for business applications for programmers along with assembler, BASIC, and FORTRAN (Bureau of Labor Statistics). Assembler and FORTRAN were removed from the Handbook in 1986-87 (Bureau of Labor Statistics). In the 1990-91 Handbook, BASIC was removed; however, FORTRAN was once again mentioned, this time in the framework of scientific programming (Bureau of Labor Statistics).

A major change came about in the 1994-95 Handbook when COBOL was removed as a primary language. However, knowledge of COBOL was mentioned as being highly desirable (Bureau of Labor Statistics). The 1998-99 Handbook emphasizes that while knowledge of COBOL is still important, increasing emphasis is being placed on object-oriented languages (Bureau of Labor Statistics).

COBOL is mentioned once again as a primary language in the 2000-01 Handbook along with Prolog, Java, C++, and Visual Basic (Bureau of Labor Statistics). In the 2002-03 Handbook COBOL receives the same treatment as in the previous Handbook (Bureau of Labor Statistics). It is likely that the Y2K issue prompted the return of COBOL being listed as a primary language in the 2000-01 Handbook, and the estimates that the labor force of COBOL programmers is declining may have been a reason for its emphasis in the most recent Handbooks (Bureau of Labor Statistics). As Dix (2003) reported, there were an estimated 90,000 COBOL programmers in North America in 2002; however, by 2006 that number will decline by 13%. The latest Handbook, 2004-2005 Edition, refers to COBOL as a conventional programming language commonly used for business applications (Bureau of Labor Statistics).

In summary, the mid nineties saw a decline in the importance of COBOL; however, the Y2K issue prompted its return to prominence. Since 2002, COBOL's importance has declined once again as it is referred to as a conventional programming language. Because of this it seems that studying the faculty attitudes toward COBOL, its place in the curriculum, and what other programming languages are being taught is essential in meeting the goals of MIS/CIS departments in the near future. This discussion leads to the following research questions to be investigated in this study.

2.4 Research Questions

Based on the purposes of the study, previous discussion about the status of COBOL, and other programming languages, the following exploratory research questions have been developed.

1. What are faculty attitudes regarding COBOL?
2. Is there a difference between faculty attitudes regarding COBOL for doctoral granting institutions and masters level institutions (Carnegie type)?
3. Is there a difference between faculty attitudes regarding COBOL when classified regionally?
4. What programming languages are being taught at respondents' institutions?

5. Is there a difference between what programming languages are being taught for doctoral granting institutions and masters level institutions (Carnegie type)?
6. Is there a difference between what programming languages are being taught when respondents are categorized by region?

3. METHODOLOGY

3.1 Population

The AACSB Web site lists 409 accredited United States institutions. Three hundred and eight universities were identified as having MIS/CIS departments or a concentration in either area. Therefore, 308 questionnaires that measured faculty attitudes about the status of COBOL, the status of COBOL in the curriculum, and what other programming languages are being taught were mailed to the department chairs of the MIS/CIS departments or concentration areas in colleges of business in the United States. A second mailing was sent to non-respondents with a friendly reminder to respond to the questionnaire. After the two mailings, 136 questionnaires were received resulting in a 44% rate of return.

Table 1 identifies the Carnegie classification type, frequency, and percentage of the respondent institutions. To create groups that consisted of a sufficient sample size Doctoral/Research – Extensive and Doctoral/Research – Intensive were combined for the doctoral level institutions. Master's Colleges & Universities I and Master's Colleges & Universities II were combined for the masters level institutions. The Baccalaureate Colleges – General and Specialized Institutions – School of Business & Management were not included in the two categories.

The respondent institutions have also been categorized into regions. The Regional Deans Associations divide the states into seven regions (AACSB International 2003). The frequencies of the states within the seven regions were widely disbursed ranging from seven states in one region to thirty states in another. After presenting the findings to several information systems journal reviewers at a regional conference, the researcher followed the suggestion of these experts to collapse the seven regions into three so that the data analysis would provide results that are more meaningful. The United States was divided visually into the three regions by the researcher. Table 2 identifies the three regions and includes the states that are in each region along with frequency and percentage of respondents by region.

3.2 Questionnaire

The researcher developed a three-part questionnaire to assess the current state of COBOL, to identify COBOL's place in the curriculum as well as faculty attitudes about the future of COBOL, and to determine what other programming languages are being taught in MIS/CIS curriculums. In the first part of the questionnaire, 14 statements drawn from the literature were arranged randomly in a Likert type scale (The survey is in Appendix 1). The statements included both positive (9 items) and negative (5 items) attitudes regarding

Table 1. Frequencies of the Carnegie Classification of the Respondent Institutions

Type	Frequency	Percentage
Doctoral/Research – Extensive	33	24
Doctoral/Research – Intensive	33	24
Master’s Colleges & Universities I	66	49
Baccalaureate Colleges – Liberal Arts	0	0
Baccalaureate Colleges – General	2	1
Specialized Institutions – School of Business & Management	1	0.7
Master’s Colleges & Universities II	1	0.7

the current state of COBOL. The scale ranged 1 to 5 with 1 being “strongly disagree” and 5 being “strongly agree.”

Part two of the questionnaire asked if COBOL was required or an elective in the curriculum as well as how many sections (or levels) of the course are being offered. Eight programming courses were identified in Part three of the questionnaire with a ninth for other languages. The respondents were asked if these languages were required and/or elective or not taught. The respondents were also asked to make comments about their perceptions of COBOL’s status in academia and business.

3.3 The Domain of the Construct-Attitude towards COBOL

In an effort to measure the psychometric properties of the 14-item attitude measures, the items were subjected to alpha reliability analysis and factor analysis using a varimax rotation. The construction of the attitude scale followed the steps recommended by Churchill (1979). First, the domain of the construct “Attitude towards COBOL” was defined as “attitudes of faculty about the current status of COBOL”. Second, an item pool of 35 items was generated based on literature that was available in academic journals and professional and trade publications. The statements were taken in full, part, or paraphrased from published literature. Thirty-five statements were originally selected, but after consulting with four experts in the area, 14 statements were selected for the final version of the questionnaire. Based on the published statements concerning COBOL, it appeared that faculty attitudes about the status of COBOL might be multidimensional in that certain statements measured “attitudinal issues” and the remaining statements measured “curriculum issues”.

Third, the data collected for the 14 statements from Part I of the questionnaire were subjected to reliability analysis using alpha coefficients. All items having a low item-to-total correlation with the construct were dropped from further analysis. This resulted in 10 items that provided an alpha coefficient of 0.87.

In the fourth stage, the ten items were subjected to a factor analysis using a varimax rotation to determine the dimensionality of the Attitude towards COBOL construct. The results revealed two dimensions that explained 61.83% of the variation in the Attitude towards COBOL construct. These results indicate that the attitude towards COBOL construct is multidimensional. As can be seen in Table 3, the first dimension was labeled Factor1 – Business Attitudes of COBOL. The second dimension was labeled Factor 2 – Curriculum Attitudes of COBOL. Seven statements measured faculty attitudes as they relate to business with an alpha coefficient of 0.88, which is an acceptable reliability as per Nunnally (1978). The seven items that measured the attitude dimension were averaged together to form a composite measure that was 3.11, meaning that the business attitudes of COBOL are generally more positive than neutral. An (R) at the end of the statement indicates the statements where the values were reversed.

For the second dimension, three statements measured attitudes toward COBOL as they relate to curriculum issues with an alpha coefficient of 0.73. This measure exhibits acceptable reliability as per Nunnally (1978). The three items that measured the curriculum dimension were averaged together to form a composite measure that was 1.69. This indicates that the Curriculum Attitudes of COBOL statements are generally less positive than neutral.

Table 2: Frequencies of the Regional Breakdown of the Respondent Institutions

Region	Frequency	Percentage
Region 1 – West (AK, AZ, CA, CO, HI, IA, ID, KS, MO, MT, NE, ND, NV, OR, SD, UT, WA, WY)	30	22
Region 2 – East (CT, DC, DE, IL, IN, KY, MA, MD, ME, MI, MN, NH, NJ, NY, OH, PA, PR, RI, VI, VT, WI, WV)	55	40
Region 3 – South (AL, AR, FL, GA, LA, MS, NC, NM, OK, SC, TN, TX, VA)	51	38

Table 3: Item-to-total Correlations, Reliability Coefficients, and Mean Values for the Ten Items that Measure the Attitudes about COBOL

Dimension	Item-to-Total Correlation	Reliability Coefficient	Mean of Sub-Scale		
Factor 1 – Business Attitudes (COBOL)					
Not only is COBOL not dead, it is very much alive.	.79	.88	3.11		
COBOL is no longer a viable business programming language. (R)	.76				
COBOL seems to have a future even in the newfangled world of Web services.	.72				
COBOL programmers have become outdated and disposable. (R)	.71				
COBOL is a language that is well suited to the business applications that have become an indispensable part of our everyday lives.	.70				
COBOL programmers are still in great demand to convert mainframe programs and applications into new technologies.	.52				
COBOL can exist as a supplemental language in courses that teach Visual Basic and Java.	.41				
Factor 2 – Curriculum Attitudes (COBOL)					
Fewer colleges require COBOL now than a few years ago. (R)	.68			.73	1.69
Fewer colleges offer COBOL as an elective now than a few years ago. (R)	.59				
Students assume COBOL's importance has declined in the business world. (R)	.41				

For the second dimension, three statements measured attitudes toward COBOL as they relate to curriculum issues with an alpha coefficient of 0.73. This measure exhibits acceptable reliability as per Nunnally (1978). The three items that measured the curriculum dimension were averaged together to form a composite measure that was 1.69. This indicates that the Curriculum Attitudes of COBOL statements are generally less positive than neutral.

4. FINDINGS

4.1 Attitudes toward COBOL

Research Question One investigated the attitudes of faculty regarding COBOL. A one sample t-test was employed to test for significant differences from neutral. Three was used as the test value since it reflected a neutral attitude. Anything more than three would indicate that the respondent would be in agreement with the statement. The results of the ten items are shown in Table 4 and appear in the same order as Table 3.

Research Question Two investigated if there is a difference between faculty attitudes regarding COBOL based on Carnegie type. An independent t-test was employed for the analysis of the ten items. Table 5 shows the statements in the same order as Table 3.

Research Question Three investigated the difference

between faculty attitudes regarding COBOL when classified regionally. Table 6 shows the results of the one-way between subjects ANOVA for the ten items.

4.2 COBOL among Other Programming Languages

Research Question Four investigated what programming languages are being taught at the respondents' institutions. The frequencies and percentages are shown in Table 7 and are ordered from highest number to lowest number taught.

For purposes of data analysis, Microsoft Visual Basic .NET and Microsoft Visual Basic 6.0 were collapsed into a category referred to as Microsoft Visual Basic. Sun Microsystems Java 1.4 and Microsoft Visual J++ were collapsed into the Sun Java & Microsoft J++ category, and Microsoft Visual C++ Version 6.0 and Microsoft C++.NET were collapsed into Microsoft C++.

Research Question Five investigated if there is a difference between what programming languages are being taught between Carnegie types. Table 8 shows the results of the Chi Square Test of Independence.

Figure 1 is a bar chart that presents the programming languages that are taught when the data is arranged based on Carnegie type. The languages are ordered from highest to lowest percentage as shown in the population (Table 7).

Table 4. Results of One-Sample t-Tests for the Ten Items that Measure the Attitudes about COBOL

Dimension	MEAN	SD	t	P
Factor 1 – Business Attitudes (COBOL)				
Not only is COBOL not dead, it is very much alive.	3.08	1.18	.80	.423
COBOL is no longer a viable business programming language. (R)	3.36	1.28	3.23	.002*
COBOL seems to have a future even in the newfangled world of Web services.	3.02	1.13	.15	.878
COBOL programmers have become outdated and disposable. (R)	3.45	1.02	5.31	.000*
COBOL is a language that is well suited to the business applications that have become an indispensable part of our everyday lives.	3.07	1.16	.74	.461
COBOL programmers are still in great demand to convert mainframe programs and applications into newer technologies.	2.99	.98	-.09	.930
COBOL can exist as a supplemental language in courses that teach Visual Basic and Java.	2.81	1.127	-1.99	.048*
Factor 2 – Curriculum Attitudes (COBOL)				
Fewer colleges require COBOL now than a few years ago. (R)	1.63	.67	-23.62	.000*
Fewer colleges offer COBOL as an elective now than a few years ago. (R)	1.77	.75	-19.02	.000*
Students assume COBOL's importance has declined in the business world. (R)	1.66	.72	-21.71	.000*

Note: The statements were ranked on a scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The one sample t-test was run to establish the mean versus neutral importance (3 on a scale of 1 to 5). *Significant importance at the 95% confidence level.

Table 5. Results of Independent t-Tests for the Ten Items that Measure the Attitudes toward COBOL Based on Carnegie Type

Dimension	Doctoral		Masters		t	p
	MEAN	SD	MEAN	SD		
Factor 1 – Business Attitudes (COBOL)						
Not only is COBOL not dead, it is very much alive.	2.86	1.17	3.27	1.18	-2.00	.047*
COBOL is no longer a viable business programming language. (R)	3.18	1.32	3.52	1.24	-1.49	.138
COBOL seems to have a future even in the newfangled world of Web services.	2.95	1.12	3.06	1.16	.54	.591
COBOL programmers have become outdated and disposable. (R)	3.32	1.10	3.67	.90	-1.99	.048*
COBOL is a language that is well suited to the business applications that have become an indispensable part of our everyday lives.	3.00	1.11	3.12	1.23	-.59	.554
COBOL programmers are still in great demand to convert mainframe programs and applications into newer technologies.	2.95	.999	3.08	.95	-.72	.471
COBOL can exist as a supplemental language in courses that teach Visual Basic and Java.	2.71	1.16	2.88	1.11	-.83	.408
Factor 2 – Curriculum Attitudes (COBOL)						
Fewer colleges require COBOL now than a few years ago. (R)	1.68	.73	1.58	.61	.88	.381
Fewer colleges offer COBOL as an elective now than a few years ago. (R)	1.79	.71	1.75	.80	-.29	.775
Students assume COBOL's importance has declined in the business world. (R)	1.59	.76	1.74	.69	-1.18	.242

Note: The statements were ranked on a scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The independent t-test was run to establish the mean differences. *Significant importance at the 95% confidence level.

Table 6. Results of the ANOVA for the Ten Items that Measure the Attitudes toward COBOL When Classified Regionally

Statement	MEAN SCORES			F	Scheffe Test Results
	Region 1 West	Region 2 East	Region 3 South		
Factor 1 – Business Attitudes (COBOL)					
Not only is COBOL not dead, it is very much alive.	2.83	2.84	3.49	5.24*	W & S E & S
COBOL is no longer a viable business programming language. (R)	3.28	3.02	3.76	4.85*	E & S
COBOL seems to have a future even in the newfangled world of Web services.	3.04	2.72	3.31	3.76*	E & S
COBOL programmers have become outdated and disposable. (R)	3.59	3.15	3.75	5.12*	E & S
COBOL is a language that is well suited to the business applications that have become an indispensable part of our everyday lives.	3.35	2.66	3.38	6.54*	W & E E & S
COBOL programmers are still in great demand to convert mainframe programs and applications into newer technologies.	2.93	2.78	3.26	3.32*	E & S
COBOL can exist as a supplemental language in courses that teach Visual Basic and Java.	2.83	2.62	3.00	1.52	
Factor 2 – Curriculum Attitudes (COBOL)					
Fewer colleges require COBOL now than a few years ago. (R)	1.45	1.68	1.69	1.41	
Fewer colleges offer COBOL as an elective now than a few years ago. (R)	1.59	1.89	1.75	1.56	
Students assume COBOL's importance has declined in the business world. (R)	1.52	1.63	1.76	1.17	

Note: The statements were ranked on a scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The one-way between subjects ANOVA was run to establish the mean differences among the regions. *Significant importance at the 95% confidence level.

Table 7. Frequencies of the Programming Languages Currently Taught

Programming Language	Taught		Not Taught	
	Frequency	Percentage	Frequency	Percentage
Microsoft Visual Basic	119	88	16	12
Sun Java & Microsoft J++	103	76	32	24
Microsoft C++	86	63	49	36
COBOL	56	41	79	59
Standard C	34	25	101	75
Microsoft C# .NET	29	21	106	79
Other (ie, ASP, HTML, etc.)	17			

Table 8. Comparison of the Programming Languages Currently Taught between Carnegie Type

Programming Language	Carnegie Type		χ^2	p
	Taught	Not Taught		
Microsoft Visual Basic				
Doctoral	57 (88%)	8 (12%)	.004	.948
Masters	59 (88%)	8 (12%)		
Sun Java & Microsoft J++				
Doctoral	52 (80%)	13 (20%)	1.255	.263
Masters	48 (72%)	19 (28%)		
Microsoft C++				
Doctoral	30 (46%)	35 (54%)	5.102	.024*
Masters	44 (66%)	23 (34%)		
COBOL				
Doctoral	20 (30%)	46 (70%)	5.762	.016*
Masters	34 (51%)	33 (49%)		
Standard C				
Doctoral	21 (32%)	44 (68%)	3.290	.070
Masters	12 (19%)	53 (82%)		
Microsoft C# .NET				
Doctoral	18 (28%)	47 (72%)	2.446	.118
Masters	11 (16%)	56 (84%)		

Note: The languages are ordered from highest to lowest frequency as shown in the population (Table 7). The Pearson Chi-Square was run to establish differences between doctoral and masters level institution. *Significant importance at the 95% confidence level.

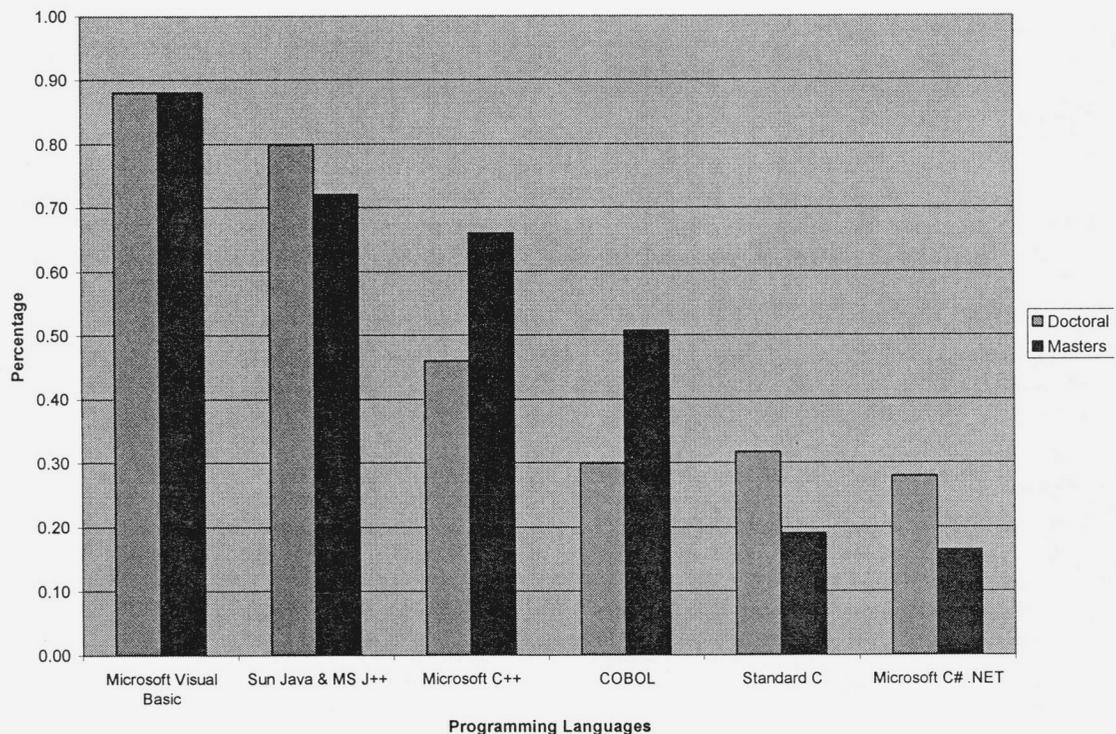


Figure 1. What Programming Languages are being Taught among Institution Type

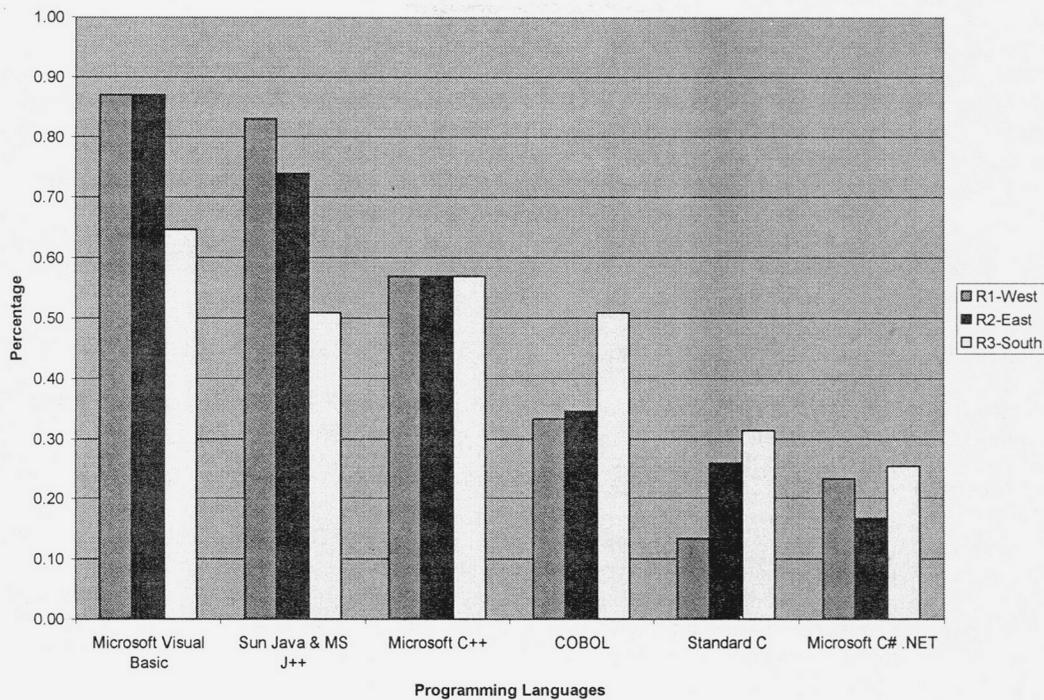


Figure 2. What Programming Languages are being Taught among Regions

Research Question Six investigated the difference between what programming languages are being taught when categorized by region. The Chi Square Test of Independence was employed and indicated no significant differences at the 0.05 level of significance. Figure 2 is a graphical representation of the programming languages arranged among the three regions.

5. DISCUSSION AND IMPLICATIONS

To date, there has been no formal research conducted to measure the validity of the published statements regarding attitudes about COBOL. This study will provide a means for measuring these published statements and will enable institutions of higher education TO make decisions about curriculum issues and courses to be offered.

The first three research questions centered on faculty attitudes toward COBOL. There appears to be a consensus that while COBOL is not the powerhouse language that it used to be, it is still a necessary business language. In particular, the first research question was "What are faculty attitudes regarding COBOL?" The results indicate that there is a difference between the faculty attitudes and the published statements when the means were compared to neutral with six of the ten statements significantly different. The faculty agree with the published statements that COBOL is a viable business language for today and that COBOL programmers have not become outdated and disposable. They are only very slightly less than the mean with their

belief that COBOL can exist as a supplemental language in courses that teach Visual Basic and Java. The three statements regarding Factor 2 – Curriculum Attitudes were all significant below neutral indicating that fewer colleges require COBOL and offer it as an elective now than a few years ago. The faculty also believe that students assume COBOL's importance has declined in the business world.

The second research question was "Is there a difference between faculty attitudes regarding COBOL for doctoral granting institutions and masters level institutions?" Two of the ten statements were significant between doctoral and masters level institutions. The faculty at masters level institutions had more favorable attitudes that COBOL is still very much alive. As well, the masters level faculty disagree more strongly that COBOL programmers have become outdated and disposable.

The third research question was "Is there a difference between faculty attitudes regarding COBOL when classified regionally?" The majority of the six significant differences between the three regions were between Regions 2-East and 3-South. Region 3-South seems to believe more strongly in the importance of COBOL in business than does Region 2-East. One statement from Region 1-West was significant. "COBOL is a language that is well suited to the business applications that have become an indispensable part of our everyday lives." Both Regions 1-West and 3-South felt more strongly than Region 2-East regarding this statement. Overall, Region 3-South believes more strongly in the value

of COBOL than the other two regions. Based on the results of the first section of this research wherein faculty attitudes regarding COBOL were measured, it can be concluded that COBOL is not dead. Perhaps the responsibilities of the programmers are changing from principle systems developers to that of systems maintenance and support, but that is not a lesser role by any means. The curriculum should be designed to meet the needs of the employers who hire a school's graduates, whether this is in a development role or a maintenance role.

The second set of research questions focused on the programming languages that are being taught in the curriculum. While COBOL is still in the curriculum, it is positioned at or below the center point of the languages. This is evidenced in the fourth research question, which was "What programming languages are being taught at respondents' institutions?" The top two languages that are being taught are Microsoft Visual Basic (88%) and Sun Java & Microsoft J++ combined (76%). COBOL is taught 41% of the time for the respondents. Both doctoral granting institutions and masters level institutions seem to favor the newer languages as indicated by Microsoft Visual Basic being taught most often (each 88%). As well, the results of this research are in agreement with other curriculum studies that indicate that COBOL is important for MIS/CIS students (Ehie 2002; Fougere et al. 2003; Gill and Hu 1999; and Maier and Gambill 1996).

The fifth research question was "Is there a difference between what programming languages are being taught for doctoral granting institutions and masters level institutions (Carnegie type)?" The results of the Chi Square Test of Independence revealed two significant differences. Sixty-six percent of the masters institutions teach Microsoft C++, while only 46% of doctoral institutions do. The second significant difference is in the teaching of COBOL where 51% of masters institutions still teach the language as opposed to 30% for doctoral institutions. Clearly, masters level schools cover Microsoft C++ and COBOL more than doctoral level schools. Even though not significant, 28% of doctoral granting institutions are teaching the newest .NET language, C#, while only 16% of the masters level institutions reported teaching the language. These results appear to suggest that doctoral granting institutions are quicker in adapting to new programming languages while masters level institutions appear to stay longer with the stable or tried and true languages.

The sixth research question was "Is there a difference between what programming languages are being taught when respondents are categorized by region?" No significant differences existed between the three Regions for what programming languages are taught. It should be noted, however, that Region 3-South, teaches COBOL more often than the other two regions (Figure 2). This finding is consistent with the results of Research Question 3 when it was shown that Region 3-South rates COBOL's importance in business more highly than the other two regions. This suggests that the Southern region may hold to a more traditional view of what programming languages are taught

than do their Eastern and Western counterparts. One southern university dropped COBOL from the curriculum for some of the reasons of the published research statements including the statements that "COBOL is no longer a viable business programming language," and "students assume COBOL's importance has declined in the business world," only to find their students were not being hired by regional companies because the companies needed COBOL programmers. The university has now reinstated COBOL as a course, albeit an elective, in the curriculum. This could become a growing trend if universities continue to drop the traditional COBOL course for the sake of attracting students by offering only the newest languages.

6. DIRECTION FOR FUTURE RESEARCH

Estimates of existing COBOL code range from 180 million to 2 trillion lines and since new versions of COBOL have object-oriented features, and companies like Microsoft and Sun Microsystems are developing programs that can integrate COBOL code, then COBOL will have a future in business. Results from this study also show that faculty believe that COBOL has a place in business. Therefore, for MIS/CIS graduates to have a place in these organizations, a working knowledge of, not necessarily expertise in, COBOL programming can do nothing but increase their chances of entering the workforce.

While the presented research questioned department chairs of MIS/CIS programs regarding their attitudes toward COBOL and their current programming language usages with a response rate of 44%, further research should be conducted with two additional groups of individuals. First, surveying software developers regarding their attitudes toward COBOL and their opinions of what programming languages should be taught would be an interesting comparison of the two groups. This would give more reliability to the statements that have been made in the literature and would give a close up view of the skills that are needed in the development environment. Second, a further study might involve recent graduates (3-5 years) of MIS/CIS programs. The attitudes of the graduates who took a COBOL class and the attitudes of the graduates who did not would determine the value they place on the language based on their experiences with it (or lack thereof) since graduation. Also the scope of this research was limited to the United States. However, expanding the study to colleges and universities outside the United States would be useful since programming is an international field of study. Finally, this study can be expanded to include Computer Science/Software Engineering departments, community/junior colleges, and technical schools, since many of their MIS/CIS curriculums emphasize technical aspects such as programming over theoretical courses.

7. ACKNOWLEDGEMENT

The author wishes to thank Dr. Sarath Nonis for his help with the statistics and data analysis and for making improvements to this paper.

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AUTHOR BIOGRAPHY

Paula Ruby is an Assistant Professor at Arkansas State



University. Paula has an Ed.D. from the University of Tennessee, Knoxville. Some of her teaching and research interests are programming, systems analysis and design, and e-learning. She has proceedings in several meetings including the Decision Sciences Institute and the Southeast Decision Sciences Institute.

**Appendix 1
Survey Instrument**

Part I - The Current State of COBOL

Please read each statement and then circle the number that represents your level of agreement or disagreement.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. As Internet and client/server architectures have become prominent, mainframe operating systems have declined in importance.	1	2	3	4	5
2. COBOL can exist as a supplemental language in courses that teach Visual Basic and Java.	1	2	3	4	5
3. COBOL is a language that is well suited to the business applications that have become an indispensable part of our everyday lives.	1	2	3	4	5
4. COBOL is no longer a viable business programming language.	1	2	3	4	5
5. COBOL is still the king of programming languages taught to information systems majors.	1	2	3	4	5
6. COBOL programmers are still in great demand to convert mainframe programs and applications into newer technologies.	1	2	3	4	5
7. COBOL programmers have become outdated and disposable.	1	2	3	4	5
8. COBOL seems to have a future even in the newfangled world of Web services.	1	2	3	4	5
9. Java will be the COBOL replacement on non-Microsoft operating systems.	1	2	3	4	5
10. Not only is COBOL not dead, it is very much alive.	1	2	3	4	5
11. Students assume COBOL's importance has declined in the business world.	1	2	3	4	5
12. Students favor classes that cover the hot topics of the day.	1	2	3	4	5
13. Fewer colleges require COBOL now than a few years ago.	1	2	3	4	5
14. Fewer colleges offer COBOL as an elective now than a few years ago.	1	2	3	4	5

Part II - COBOL's Place In The Curriculum

Please respond to the following questions regarding COBOL in your curriculum.

1. Is COBOL a required course in your curriculum? _____
2. If Yes, how many COBOL courses are required [e.g., COBOL I, COBOL II, COBOL III, etc.]? _____
3. Is COBOL an elective course in your curriculum? _____
4. If Yes, how many COBOL courses do you offer [e.g., COBOL I, COBOL II, COBOL III, etc.]? _____
5. If COBOL is in your curriculum, do you plan on integrating it with the .NET Framework? _____
6. If COBOL is in your curriculum, which version do you use? _____

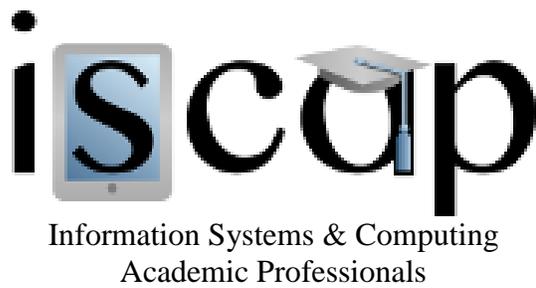
Part III - What Other Programming Languages Are Being Taught

For each programming language listed below, please circle the letter that represents the level of instruction in your program.

	Required	Elective	Both	Not Taught
1. Standard C	R	E	B	N
2. Microsoft Visual C++ Version 6.0	R	E	B	N
3. Microsoft C++ .NET	R	E	B	N
4. Microsoft Visual Basic Version 6.0	R	E	B	N
5. Microsoft Visual Basic .NET	R	E	B	N
6. Microsoft Visual J++ Version 6.0	R	E	B	N
7. Sun Microsystems Java 1.4	R	E	B	N
8. Microsoft C# .NET	R	E	B	N
9. Please List Others:				

Please use the back of the page to comment on your perceptions of COBOL's status in academia and business.

Thank you for completing this questionnaire. Please return in the stamped envelope provided.



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ISSN 1055-3096