Minorities' Attitudes toward Computer Majors

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Introduction

As technology continues to dominate the world, it is crucial to shape our curricula to provide students with adequate academic skills to join the workforce. Computing technology is constantly changing the world economy, creating significant demand for programming skills in all professions. Computing technology jobs are in high demand with few competent candidates.

It is estimated that Information Technology (IT) workers earn 74 percent more than the average worker. Even beyond IT jobs, computational skills will make individuals more valuable to employers.

Minorities in Computer Science

In comparison to Whites and Asian Americans, the number of minorities working in computer science fields or computing in general, continues to be low. This is inspite of:

➢ Media focus on high correlation of education and high earning power.
➢ Availability of jobs in computer Science coupled with fast growing salaries.

In this talk, we will :
✓ Discuss minority groups in computers,
✓ Analyze minorities' attitudes toward computers,
✓ Analyze remedies to improve minority representation in computer science professions

Florida Memorial University Overview

- Florida Memorial University is one of the oldest academic centers in the state, and the only Historically Black University in South Florida.

- The university offers 27 undergraduate degree programs and 3 master's programs.

- Florida Memorial University is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools (SACS). Many of its departments are also accredited. For example, the Computer Science, Mathematics and Technology is accredited by the Accreditation Board for Engineering and Technology (ABET)

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- Currently, there are approximately 1050 students enrolled. 74% African American, 7 % Hispanic, 1% white, 18% International.
- There are about 360 students in STEM majors.
- Over 90% of the students receive some form of financial assistance.
- There are 3 Bachelors in computer majors: Information Systems, Computer Science, and Cybersecurity.
- starting salary is above $70,000.00 for a recipient of any of these 3 majors.
- For each of the past 4 years, the highest annual student enrollment per year for the combined 3 majors is 75; Maximum graduation per year is 20.
- There are many initiatives underway to improve retention and recruitment of computer major and STEM students.

Labor Force Statistics from the Current Population Survey

HOUSEHOLD DATA
ANNUAL AVERAGES
11. Employed persons by detailed occupation, sex, race, and Hispanic or Latino ethnicity
[Numbers in thousands]

Occupation	2020					
	Total employed	Percent of total employed				
		Women	White	Black or African American	Asian	Hispanic or Latino
Total, 16 years and over	147,795	46.8	78.0	12.1	6.4	17.6
Management, professional, and related occupations	63,644	51.7	78.7	9.7	8.6	10.4
Management, business, and financial operations occupations	27,143	44.6	81.7	8.8	6.7	10.9
Management occupations	18,564	40.4	83.4	8.0	5.8	10.7
Chief executives	1,669	29.3	88.0	4.3	5.4	7.4
General and operations managers	1,057	30.5	84.4	7.1	4.5	12.4
Legislators	25	-	-	-	-	-
Advertising and promotions managers	56	52.1	80.5	14.7	3.9	3.5
Marketing managers	554	60.7	84.1	5.5	7.6	9.9
Sales managers	521	30.9	87.6	5.8	4.2	7.6
Public relations and fundraising managers	95	66.4	91.0	4.3	2.3	7.6
Administrative services managers	65	71.7	83.4	9.5	6.5	16.9
Facilities managers	134	25.0	90.1	4.9	2.4	12.6
Computer and information systems managers	744	26.6	75.5	7.0	15.5	5.2
Financial managers	1,309	52.6	79.4	9.7	8.2	9.9
Compensation and benefits managers	18	-	-	-	-	-
Human resources managers	287	76.8	81.0	12.0	4.9	14.0
Training and development managers	52	55.8	85.4	9.2	0.2	10.1
Industrial production managers	272	22.6	84.3	5.9	7.2	13.5
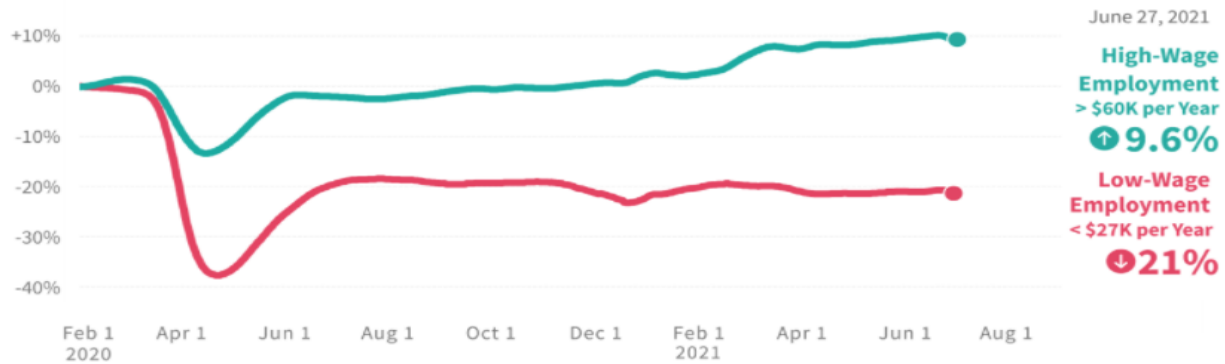
2020 US Population Survey

The 2020 population survey data confirmed that minority groups are still dismal in the computer science professions. In other words, women and minorities such as African-Americans and Hispanics, remain severely underrepresented in computing and STEM (Science, Technology, Engineering, and Mathematics) professions. This under-representation is also observed among faculty in the higher education teaching STEM degree programs.

African-Americans In Computer Science

Even though African-Americans comprise around 14% of the U.S. population, their current representation in computer science is not proportional. This underrepresentation is visible in industry as well as academic employment sectors of computer science.

Computer Science Impacts on Minority Groups

Increased representation of minority groups in computer science or STEM fields in general would increase their earning power, thereby improving social economic development in general, which in turn, would alleviate National Security Treats.

There is a significant body of literature that has examined attitudes toward Computer Science within schools and in society in general.

Attitudes toward Computer Science

In the 2019 Proceedings of ACM Conference on Innovation and Technology in Computer Science Education, Michael J. Lee presented his research conducted on middle schoolers.

He provided middle school students with a full day (7 hours) of programming activities to learn about their initial attitudes toward computing and how a short intervention might change these attitudes. He ran two separate one-day events, serving a total of 34 minority students (21 males and 13 females; grades 6 and 7) from a low-income, urban area.

The research findings indicated that students' initial attitudes toward computing were high, and that one day of learning programming increased their reported attitudes in computing even more.

Attitudes toward Computer Science Cont'd

   Similarly, Rachel S. Phillips, Ph.D. and Benjamin PC Brooks, in their work on the Impact on Attitudes Toward Computers and Self-Efficacy with Computer Science, found that after completing one Hour of Code activity, students' positive attitudes toward computer science increased along with feelings of computer science self-efficacy, especially for female students.

   These findings suggest that using particular activities in the right context can produce large changes in attitudes toward Computers and Self-Efficacy with the computer.

Attitudes toward Computer Science Cont'd

This increase of attitudes toward computers in these studies pointed out a change in our academic curricula. In fact, Guzdial (2020), whose research in the past focused on broadening participation in Computer Science, was to get more women and underrepresented minorities into Computer Science Education. He is now acknowledging that "our goal should be to change Computer Science Education so that everyone is welcomed and supported."

Educational Intervention

To graduate from high school, students are required to show proficiency in certain subjects. There is currently a broad debate on including computer coding as one of those subjects. In other words, exposing students to computer science education early on.

Supporters say coding is good for students in an increasingly digital world.

Opponents say public schools should not serve as job-training sites for tech companies.

Perceptions on Computer Science Learning

On the other hand, research by Parker (2019) looked into supports and barriers to Computer Science learning in the high schools in the state of Georgia. He identified perceptions among students that Computer Science was a difficult subject to learn. Those perceptions are confirmed by findings from other research studies suggesting that even though minority students reported positive attitudes toward computers, their attitudes reflected anxiety, lack of confidence, and college readiness.

Impacts of these perceptions are significant to curriculum change leading to higher achievement in Computer Science Education or STEM fields in general, with respect to underrepresented populations.

Gatekeepers or School Management

There is a body of research that indicates that school leadership is important in student learning (Fullan, 2007; Leithwood et al., 2004) and that career guidance counselors and higher institution advisers can act as gatekeepers to different subjects. However, there is little evidence in the literature related to perceptions of the learning of the Computer Science exploring the role of gatekeepers or school management within the secondary educational system, and the role it plays in influencing the perceptions of Computer Science majors.

Attitude Influence

Our perception or opinion on any particular academic major tends to define our behavior toward that major. It is largely acceptable that attitudes influence behavior including performance. Therefore, our performance in any academic subject is correlated to our attitudes toward that subject. The more positive attitudes we have toward any academic major, the better we tend to perform in that major. However that performance is most often limited to our academic readiness in the major.

Needless to say, high positive attitudes toward computer Science Education, does not necessarily translate into earning a degree in Computer Science.

Computer science

Computer science is the **study of computers and computing** as well as their theoretical and practical applications. Computer science applies the principles of mathematics, engineering, and logic to a plethora of functions, including algorithm formulation, software, hardware development, and artificial intelligence. Employers expect to offer 2021 computer science graduates an annual average salary of $73,550: a more than 7% increase compared to the year prior, according to recent data from the National Association of Colleges and Employers, a professional association in Bethlehem, Pa.

Computer Language

It is commonly known that computer processors only understand the language of ones and zeros and our natural language is completely different from this binary language. Thus, we need to translate the commands that we want to execute into the language of processors. Coding is that translation of natural language into machine commands. Coders use an intermediary language to direct the step-by-step action the machine needs to take.

While coding means writing codes from one language to another, programming means to program a machine with a given set of instructions to run.

Depending on the programming language, effective coding requires some skills such as the syntax, main keywords, and the basic logic behind the language of your choice.

Trend in Programming

The most important trend in programming for the next decade will be using machine learning and artificial intelligence (AI) to automate much of coding. AI and machine-based learning can automate coding and help programmers write faster and better.

To help uncover the mystery of the translation of the natural language into the processor language, computer scientists have come up with puzzle-like games to help everyone learn to code the computer language.

Learning how to code

Scratch: Scratch uses the drag and drop method, and allows learners to design interactive games, stories, and animation. Scratch has a step-by-step guide, a downloadable User's Manual, and Scratch Cards which are mini-lessons learners can follow to create simple subroutines. Learners can share their creations with others in the Scratch online community.

Stencyl: Similar to Scratch, also uses drag and drop.

Snap (Berkely.edu): Similar to Scratch, uses drag and drop as well.

Learning how to code Cont'd

Hackety Hack: Teaches about Ruby, an open-source programming code.

Code Monster: Particularly good for children, Code Monster works like a WYSIWYG program but in Javascript. . In one box, you type code. In the other, you can see what the action looks like.

Minecraft: This is a programming game.

Advantages of Coding

Research backs up the benefits of coding for children especially in the classroom. students who learn coding and programming logic are better problem solvers, have stronger analytical reasoning skills, and become more involved, inquisitive learners and have a drive to construct knowledge.

Coding is not only a skill critical for a global economy driven by technology, but also enhances academic foundation and preparedness to improve or succeed in:

➢**Mathematics and logical problem solving**
From the mathematics perspective, coding is known to help students visualize more abstract concepts in a fun format that lets them apply mathematics to real-life problem solving. Computer science and coding is not just about developing a program to solve or perform tasks. It is also about logical problem solving, using the core basics of mathematics.

➢**Writing skills and creativity**

When developing video games with Scratch, the learners get to code their own stories by enriching their imagination and creativity with strange environments and characters. This can help them to deal with real-life situations.

Research shows that the type of brain activity that takes place during fictional moments is almost the same as the brain activity shown in real-life scenarios.

By reading, acting, or solving a problem in a fictional environment, learners will not only learn how to solve problems in reality, but also improve critical thinking, writing, as well as reading and spoken language skills.

➢ **Daily applications**

    Nowadays, almost every device we interact with on a daily basis is powered by a computer. Whether that's a smartphone, domestic appliance, cash machine, a traffic light system when crossing the road including, the car we drive, as well as the medical equipment used to perform surgery.

    We believe that it is important for children to understand that someone has written coding instructions for computers to help us with everyday challenges and tasks we perform.

    That will help students to envision the possibilities for how coding and technology can solve problems of the future.

➢**Language of the world**

   Software is a critical component that touches so much in our lives, and in fact, could be seen to be the language of the world.

   Now obviously, not every future job is going to require coding skills, but we still believe it is crucial for children to learn the basics of coding as it will help them with their computational thinking.

➢**Life skills**

Once children start to learn to code, they will move through more and more complex processes and problems. As they develop more complicated code, they should naturally also develop improved focus and organizational skills.

Coding can also help them to improve their resilience and communication.

➢ **World Transformation**

Children who start early learning coding from a young age are going to be the transformers of the future. They could go on to change lives by working on apps, robotics, and other computing programs that help to shape our future to improve education, health, energy, and other social sectors.

➢**Confidence**

　Much of the appeal in learning to code is the challenge and reward that comes when students see their code come to life. They are eager to share artifacts with peers.

　Parents with children who took coding courses or classes often report that their child's confidence and communication have improved and developed highly positive attitudes toward computer science studies.

➢**Achieving American Dreams**

Dan Costolo, the CEO of Twitter said: *"If you can program a computer, you can achieve your dreams. A computer doesn't care about your family background, your gender, just that you know how to code. But we're only teaching it in a small handful of schools, why?"*