Trends in Women's Participation in Computer Industry Subfields

Tristyn Maalouf

Liberty University

Abstract

The participation of women in specific subfields of computer science (CS) and information technology (IT) will be investigated to determine the existence of any trends that may exist indicating special interest amongst women. Specifically, the subfield of database administration will be considered to determine if women tend to enter this subfield more frequently than other subfields. Research will also acknowledge statistics regarding male participation in database administration and other relevant subfields to determine if any trends in women's participation are unique to women or if they exist across the board. Conclusions will be drawn based on the data and any topics for further research gleaned from the results of this investigation will be discussed.

Keywords: Database Administration, STEM, Women in STEM, Computer Science, IT

Trends in Women's Participation in Computer Industry Subfields

This research project was brought about by the comments and insights of several industry professionals in the fields of CS and IT who have noticed certain trends in the participation of women in CS subfields but have not had their insights confirmed or denied by statistical research. The trend that has been informally communicated by such professionals is that many women who work in the fields of CS and IT pursue careers in the subfield of database administration as opposed to other fields such as networking, research, and software development. These insights, formerly the result of personal experience, can be tested using data gathered from verified sources, which will be the purpose and subject of this report.

Scope and Hypothesis

It is important to first clarify the research question and its scope, as there are many similar questions in the field of computer science that can be easily confused with the subject at hand. Specifically, this report will investigate and analyze the participation of women in the CS subfield of database administration as compared to women's participation in other subfields. While much research exists and is underway comparing the participation of men versus women in CS as a whole as well as in certain subfields, this report seeks only to determine the most frequently pursued subfield of CS by women as compared to other women and will only consider male participation in order to determine if the results of this investigation are unique to women or if they apply to all individuals in CS and IT. Additionally, the scope of this investigation is constrained to trends within the United States, which has been determined by the data sets available.

The hypothesis of this investigation is that research will indicate a higher female participation in the field of database administration than other subfields and that this trend will

not hold for men, making it unique to the female subset of CS industry professionals. If confirmed, this report will not seek to provide an absolute cause for the existence of this trend, but several ideas will be discussed.

Research Findings

EMSI Data Analysis

Due to the scope of this investigation being limited to the United States, the most concrete and revealing statistics can be found in U.S. Department of Labor Statistics records. Using the help of EMSI, a private-sector data analytics company that uses U.S. government labor market data to derive useful and current conclusions based on multiple U.S. databases, research as early as 2013 indicates the validity of the hypothesis in question ("About our data", n.d.). In an EMSI report published in 2013, which only included standard-wage and salaried employees, not the self-employed or extended proprietors, a comparison of women's participation in 14 subfields of CS and IT showed that database administration ranked first, where 39% of the subfield of database administration is made up of women (Wright, 2013). Figure 1 displays the breakdown of the 14 major categories of CS and IT that were included in this report.

Based on the structure of this report, it also provides insight on the comparison of men's participation. Since these figures represent the percentage of women's participation in each of these fields, the difference between each percentage and 100% indicates male participation in each subfield. Thus, it is safe to conclude that the trend of female interest in database administration does not carry over for men in the CS and IT industries. On the contrary, due to the high rates of female participation in this subfield, it ranks relatively lower on the male interest spectrum.
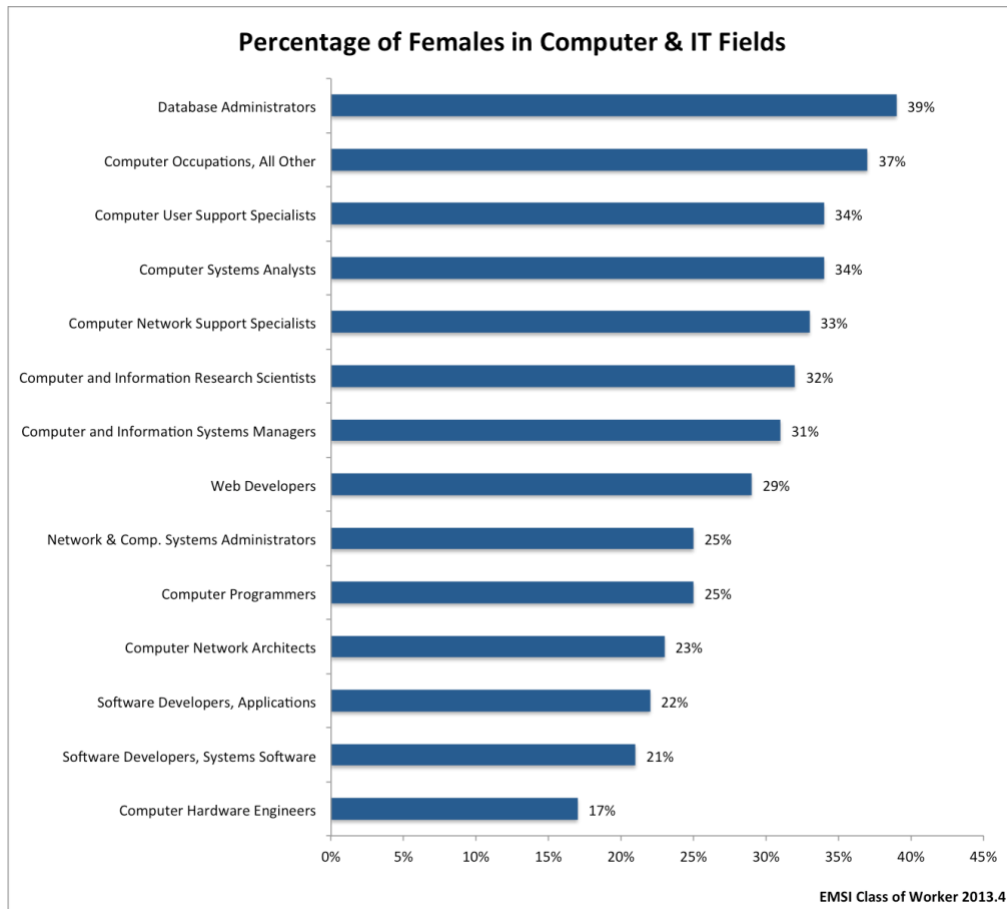
Figure 1. EMSI data gathered in 2013 displaying women's participation in 14 subfields of CS and IT. Reprinted from *economicmodeling.com,* 2013, Retrieved November 4, 2018, from https://www.economicmodeling.com/2013/10/30/the-percentage-of-women-that-occupy-computer-and-it-fields/

Further confirmation of this trend can be found by analyzing the corresponding 2018 data to see if the trend continued over a five-year span. As shown in figure 2, database administration still ranks in first position for women at 38%, followed by computer systems analysts at 35% and web developers at 31.5% (Wright, "IT"). The one percent difference between 2013 and 2018 may be negligible, or may indicate a change in the trend that is currently underway. While further data in the next 5-10 years will show where the trend is headed, it can currently be said

that database administration is still the most pursued subfield of CS and IT by women based on the 2018 EMSI data.
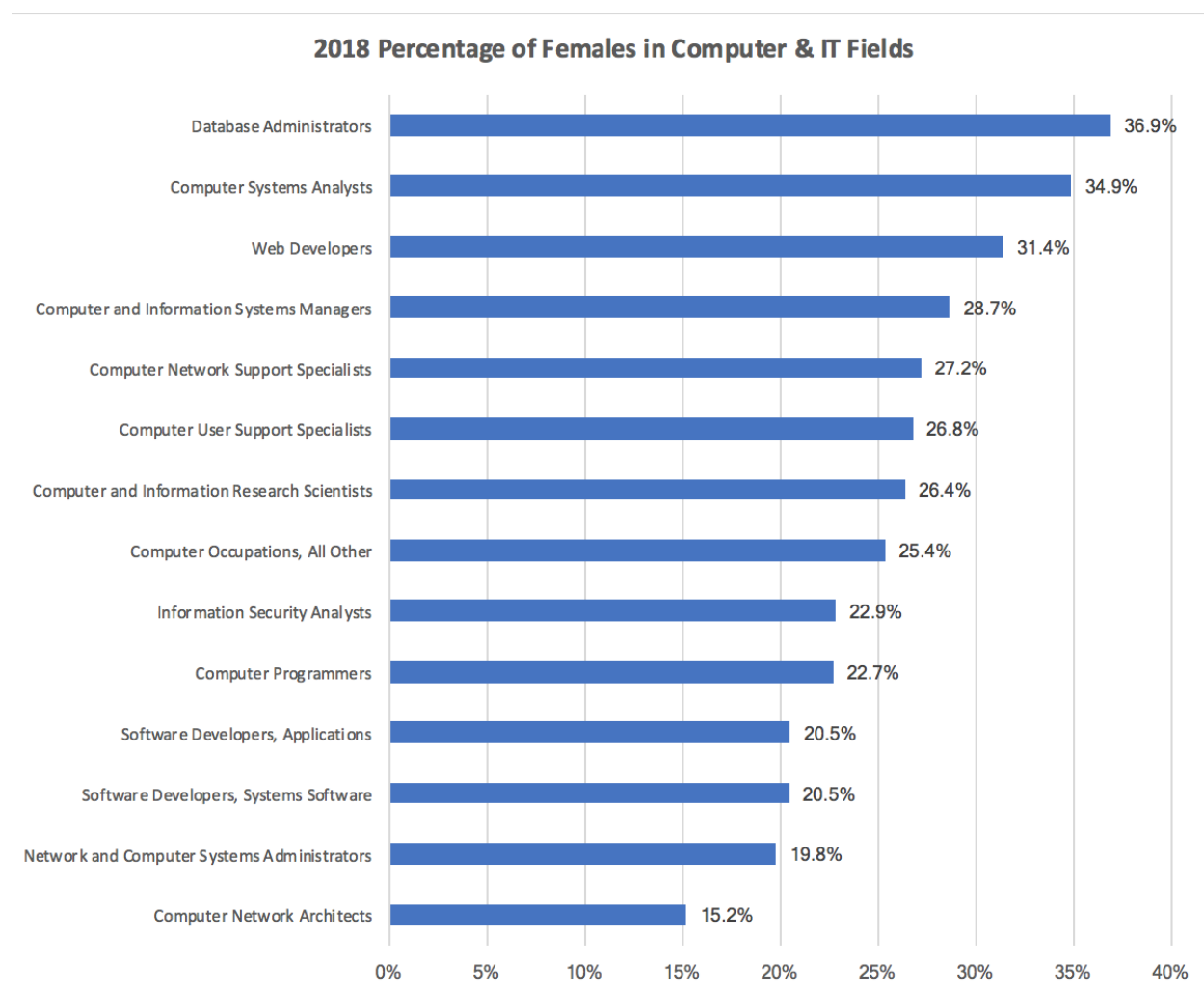

2018 Percentage of Females in Computer & IT Fields

Field	Percentage
Database Administrators	36.9%
Computer Systems Analysts	34.9%
Web Developers	31.4%
Computer and Information Systems Managers	28.7%
Computer Network Support Specialists	27.2%
Computer User Support Specialists	26.8%
Computer and Information Research Scientists	26.4%
Computer Occupations, All Other	25.4%
Information Security Analysts	22.9%
Computer Programmers	22.7%
Software Developers, Applications	20.5%
Software Developers, Systems Software	20.5%
Network and Computer Systems Administrators	19.8%
Computer Network Architects	15.2%

Figure 2: EMSI data gathered in 2018 on the percentage of females in the subfields of CS and IT. Adapted from Joshua Wright. Unpublished raw data.

One notable change between 2013 and 2018 is that web developers rose 5 positions and changed a total of 2.5 percent. While the percentage change seems small, further data from Data USA indicates that this may be a field that will compete with database administration for the top spot in future years, as discussed below.

Data USA Data Analysis

Data USA, another private-sector data analytics company, confirms the EMSI results with specific male-female comparisons for each subfield, with the one possible exception of the web development subfield ("About", n.d.). Combining Census Bureau data with U.S. Department of Labor statistics as well as considering the 25% overall participation rate of women in the fields of CS and IT as a whole, the relative significance of the following results can be weighed ("Computer", 2016). When comparing database administration to software development, two subfields that show drastically different participation based on the EMSI report, Data USA confirms the results with 2016 data reporting a 60-40 male-female split in database compared to an 80-20 male-female split in software development ("Database Administrators", 2016). Figure 3 displays the wide gap in female participation between these subfields.
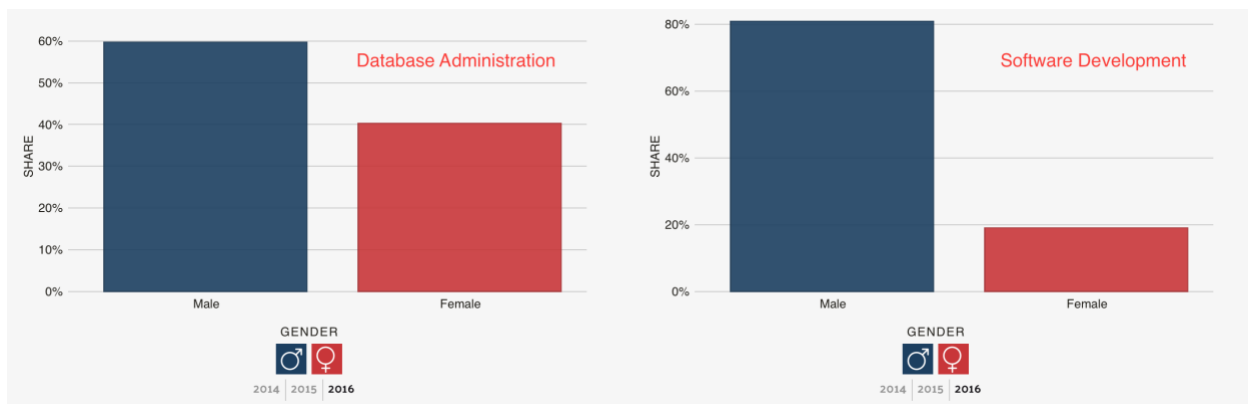

Figure 3: Database administration & Software development gender gap. Adapted from Database administrators & Software Developers, 2016, Retrieved November 18, 2018, from https://datausa.io/profile/soc/151141/?compare=15113X

The 2016 Data USA results are consistent across the 14 subfields with one notable exception, which may indicate either changing trends or a difference in the data sets used by EMSI and Data USA. Where EMSI data reports that only 29% of the web development subfield

positions were occupied by women in 2013 and 31.5% in 2018, Data USA reports that 38% of

this subfield's positions were occupied by women in 2016, showing significantly higher levels of

female participation, as displayed in Figure 4 ("Database administrators", 2016).
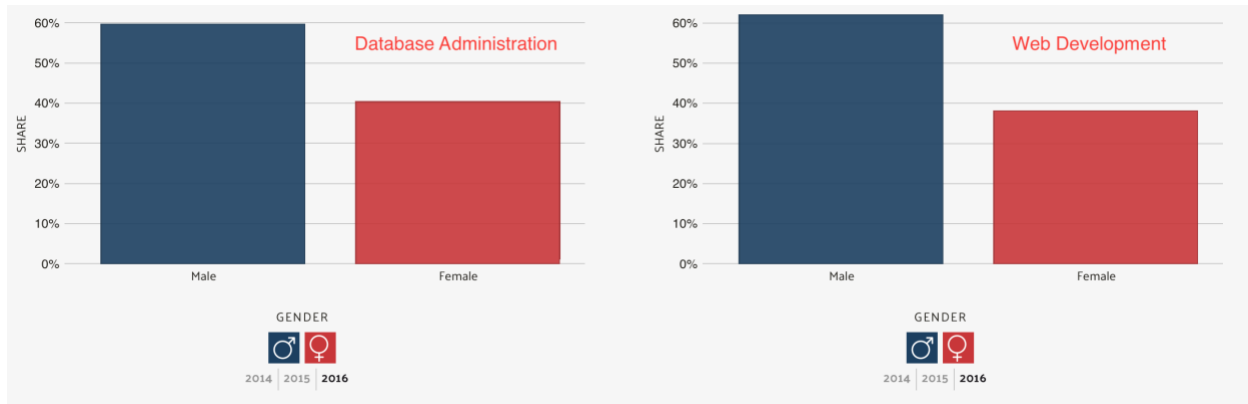

Figure 4: Database administration vs. Web development gender gap. Adapted from Database

administrators & Web developers. (n.d.). Retrieved November 11, 2018, from

https://datausa.io/profile/soc/151141/?compare=151134

If web development is as close to database administration as the Data USA data suggests,

there are several possibilities for this result. Since web development consumed 48% more

workers than database administration in 2016 and also had a 15% 10-year growth projection

compared to database's 11.6% 10-year growth projection at that time, increased interest in this

larger and faster-growing field could have taken place over the years considered in these studies

and may still be underway ("Database administrators", 2016). A second possibility is the recent

explosion of free, self-guided online courses and tutorials in the field of web development, which

outnumber similar opportunities for learning database concepts and applications, as well as

platforms such as WordPress and Squarespace which have dramatically simplified the process of

web development making it more accessible to individuals not formally trained in the subject. A

similar magnitude of resources for self-guided learning and user-friendly platforms is simply not

present in the field of database as it is inherently more technical and is not implemented as simply and independently from other systems as web development tends to be.

One final possibility is that Data USA included self-employed individuals and extended proprietors in their report, which could affect results since as many as 1 in 6 web developers operate in a self-employed fashion according to Bureau of Labor Statistics reporting ("Web Developers", 2018). However, the inclusion of self-employed web developers was not indicated by Data USA. Thus, it is unclear whether the EMSI or Data USA results are more accurate due to the lack of clarity in the Data USA results. Nonetheless, due to current statistics on the number of web developers operating as self-employed, it can be assumed that the EMSI results include a lower percentage of female participation in web development than is accurate, which implies that web development participation rates amongst women in CS and IT may be comparable to those of database administration.

Conclusions

Several conclusions can be drawn from the research results, first and foremost being that the hypothesis is confirmed, with the caveat of a possibly similar participation rate for females in web development. Nonetheless, database administration can be considered one of the highest pursued CS subfields amongst women and this trend can be considered unique to women when compared against men. Thus, it is no longer a matter of personal experience by industry professionals but rather a statistical fact that women in CS and IT do tend to pursue careers in database more frequently than in most other subfields.

A second conclusion of this research is that women typically pursue IT-related fields compared to CS-related fields, as displayed in the EMSI data. While there is some overlap between IT and CS in fields such as networking and database administration depending on the

specific job description of the employee, women show less interest in CS positions like software development and programming that revolve around coding and steer more towards IT positions that involve soft skills such as management and systems support roles.

Topics for Further Research

Two main topics for further research are produced from this research. First, the obvious questions of why and how these results came to be must be explored. While research exists for the consideration of gender gaps in the subfields of other industries, similar research should be conducted for the subfields of CS and IT. There are many benefits of such research, namely more targeted advertising for universities and institutions attempting to encourage women to enter CS and IT careers. By knowing that women tend towards certain subfields of CS and IT and why that is, such institutions can be more intentional in recruiting women into their programs and waste less time advertising career paths that women tend not to be interested in. More awareness of these trends will also help educators and advisors provide more effective and applicable guidance to young women who may be suited to CS and IT careers.

The second topic of further research follows from the first and considers the specific recruitment strategies currently in place to attract young women and girls to CS and IT careers within the broader context of current female recruitment into Science, Technology, Engineering, and Math (STEM) efforts. While there are events, clubs, and organizations that exist for the purpose of exposing young women and girls to STEM through specific CS and IT applications, research should be done to figure out how educators and leaders of such organizations can incorporate more database applications into such programs. For example, while many user-friendly drag-and-drop coding applications exist to demonstrate to kids the basics of programming, such as Scratch, a simplified coding language produced by MIT for elementary

and middle schoolers, comparable applications do not currently exist with database applications ("Scratch", n.d.). While it is unclear now how database concepts might be presented to youth in an understandable and enjoyable way, research should be done to this end so that the existing CS and IT recruitment programs can expose more content to young women and girls than what is currently available, most of which is geared towards the subjects that least interest women in CS and IT.

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