Analysis of Salary Data Across UNC System Schools

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***Abstract*—As a graduating student who is majoring in both Computer Science and Studio Art, I have noticed differences in the way the departments are funded over the past four years. I analyzed the disparity in university funding across departments primarily using the UNC salary database. I used this database to create a series of visualizations that highlight differences in salary funding across UNC System Schools and draw comparisons between UNC-Chapel Hill Departments. The visualizations are available in this paper as well as in interactive form on Tableau Public.**

I. Introduction

As a graduating student who is majoring in both Computer Science and Studio Art, I have noticed differences in the way the departments are funded over the past four years. I analyzed the disparity in university funding across departments primarily using the UNC salary database. I used this database to create a series of generalizations that highlight differences in salary funding across UNC System Schools and draw comparisons between UNC-Chapel Hill Departments.

According to The Well, "the University gets its funding from a variety of places: research grants, tuition and fees, state appropriations, gifts, investment returns and income generated through housing, dining, and other services." UNC spends over $3 billion in a year, and these various funding sources are used to pay salaries across departments within the university.[1] UNC-Chapel Hill spends just over half of its income on personnel, with the rest of the funds going toward supplies as well as facilities.

II. Related Work

I ran into difficulty finding prior research that represents the topic covered here. A majority of information that I came across was funding reports and news articles, which did not feel representative of the direction in which I was trying to take this project. My analysis of UNC system salary data stands on its own and does not necessarily need to be built upon prior research. Even when I did find research working around a similar problem, it was often outdated, and with the value of money constantly changing, there was not any salary or funding research that represented UNC right now.

III. Project

The UNC System Salary Database contains the names, position titles, and salaries of permanent employees of each University in the UNC system [2]. The database is updated quarterly and is available for public consumption. The database is interactive and allows users to input queries that return the results of their searches. This on its own was not sufficient functionality for the construction of visualizations. The database allows for an Excel sheet to be extracted from any query, which can be used in Tableau. I came across some technical issues when using Excel sheets in Tableau so I converted the salary data to a CSV file, which made for a more optimal experience in constructing visualizations.

The driving motivation for my research was the differences I noticed in the Computer Science and Art departments at UNC-Chapel Hill as I was involved in both. Before drafting visualizations on this topic, I decided to widen the scope of the research and look at salaries across all UNC System schools.

Figure 1 is a pie chart measuring the total salary expenditure for each school in the UNC system. The pie chart makes it clear that UNC-Chapel Hill is spending significantly more than any other school in the UNC system. UNC-Chapel Hill spends over $1.5 billion out of a total $4.3 billion across all UNC system schools. It is also important to note that UNC-Chapel Hill has a large student body, but comparable to other UNC system schools so the number of faculty members should not be significantly more.

An interactive version of Fig. 1 can be found here: https://public.tableau.com/views/

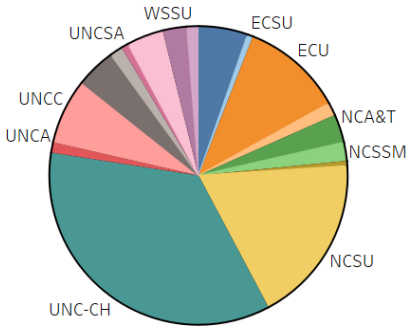

Fig. 1: Total salary expenditure across UNC System schools, visualized with a pie chart

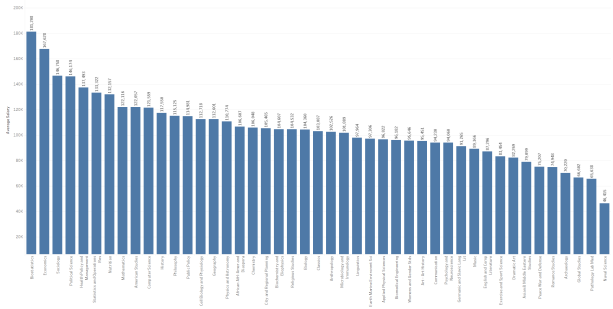

Fig. 2: Average salary for each department at UNC-Chapel Hill, visualized with a bar chart

TotalSalaryExpenditurebySchool/totalsalarybyschool?:language=en-US&:sid=&:display_count=n&:origin=viz_share_link

I brought the scope back into UNC-Chapel Hill and then created Figure 2, a bar chart showcasing the average salary across all departments at UNC-Chapel Hill. I found this visualization to be inaccessible and unhelpful outside of its interactive form as there are too many departments for the information to be legible to a viewer. I then began to brainstorm ways to display this information in a more accessible way.

An interactive version of Fig. 2 can be found here: https://public.tableau.com/views/UNCCHSalaryData/Sheet1?:language=en-US&:sid=&:display_count=n&:origin=viz_share_link

Figure 3 features the total salary expenditure across UNC-Chapel Hill departments, which is a better metric than average for determining funding. The data is displayed so that departments with larger funding are

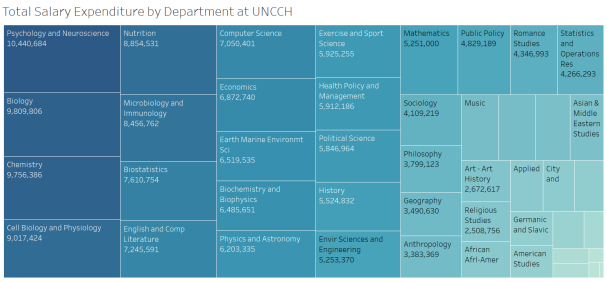

Fig. 3: Total salary expenditure across UNC-Chapel Hill departments

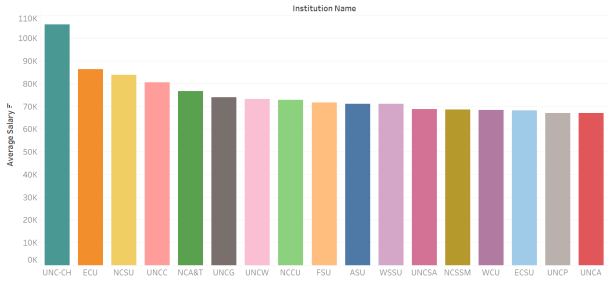

Fig. 4: Average salary for each UNC system school, visualized with a bar chart

a darker shade of blue and take up a larger rectangle. The interactive version of this visualization is also more engaging than the bar chart.

An interactive version of Fig. 3 can be found here: https://public.tableau.com/views/TotalSalaryExpenditurebyDepartmentatUNCCH/TotalSalaryExpenditure?:language=en-US&:sid=&:display_count=n&:origin=viz_share_link

In experimenting with the different representations of funding based on salary data, I created Figure 4, which displays the overall average salaries for UNC system schools in a bar chart. UNC-Chapel Hill holds the largest average salary, but not by as large of a margin as the pie chart with total salary expenditure. This reveals that UNC-Chapel Hill likely has more personnel than other universities in the UNC system, which explains the large difference in total salary expenditure. The bar chart also reveals that UNC-Chapel Hill still pays its employees more on average compared to other UNC system schools.

An interactive version of Fig. 4 can be found here: https://public.tableau.com/views/AverageSalarybySchool/avgsalarybyschool?:language=en-US&:sid=&:display_count=n&:origin=viz_share_link

I began experimenting with more distinctive visual-

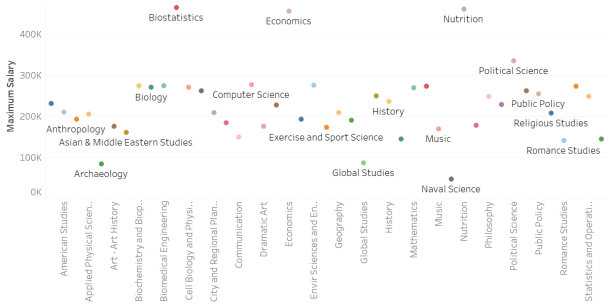

Fig. 5: Maximum salary across each department at UNC-Chapel Hill, visualized with a dot plot

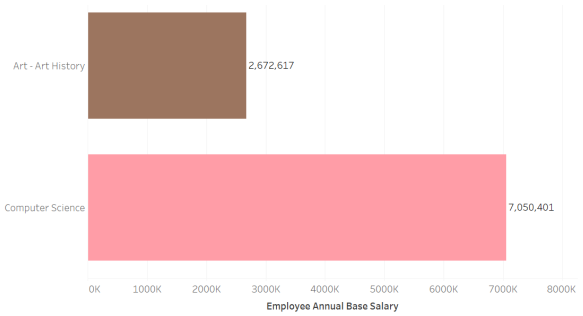

Fig. 6: Total salary expenditure for Computer Science and Art department at UNC-Chapel Hill, visualized with a bar chart

izations when I created Figure 5. This visualization is a dot map that displays the maximum salary across each department at UNC-Chapel Hill. I learned that this was not the best way to display this information but it has an engaging appearance and brings the viewer closer to the subject, especially when viewing it in its interactive form.

An interactive version of Fig. 5 can be found here: https://public.tableau.com/views/MaximumSalaryforDepartmentsatUNCCH/AvgSalaryExpenditure?:language=en-US&:sid=&:display_count=n&:origin=viz_share_link

After analyzing data regarding UNC-Chapel Hill and the UNC system as a whole, I decided to create a visualization that was representative of my original motivation for research. Figure 6 is a bar chart showcasing the total salary expenditure for the Computer Science and Art departments at UNC-Chapel Hill. The visualization shows that the computer science department receives more than twice as much salary funding as the art department.

An interactive version of Fig. 6 can be found here: https://public.tableau.com/views/TotalSalaryExpenditureComputerScienceArtDepartments/Sheet3?:language=en-US&:sid=&:display_count=n&:origin=viz_share_link

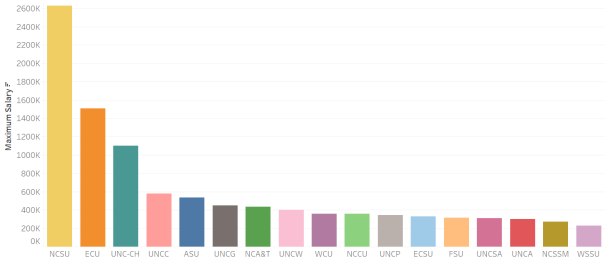

Fig. 7: Maximum salary for each school in UNC system, visualized with bar chart

I created Figure 7 as I was experimenting to learn about and get more comfortable with the database. The visualization shows the maximum salary for each school in the UNC system as a bar chart. The visualization does not reveal anything about UNC-Chapel Hill's funding however, it reveals that NCSU and ECU's total expenditures may have been skewed by these outliers as seen in Figure 1.

An interactive version of Fig. 7 can be found here: https://public.tableau.com/views/LargestSalaryforUNCSystemSchools/maxsalarybyschool?:language=en-US&:sid=&:display_count=n&:origin=viz_share_link

All of the discussed visualizations can be found in this Github Repository: https://github.com/COMP790-InfoVis/final-projects-malakhannosh

IV. Discussion

Going into this research I had expectations that STEM-related departments would be the most heavily funded. I hadn't previously considered department size as a factor in funding until comparing total salary expenditure to average salary expenditure. I learned that total salary expenditure is the most accurate way to determine funding from a database like this one. Comparing average salary is helpful for recognizing disparities in pay which is also important to this research.

STEM-related departments did trend at a higher average salary than most humanities majors. I found that the departments with the highest total salary expenditure had greater variation in the field of study. The English and Comparitive Literature department, for example, has one of the highest total salary expenditures, but was very low in the ranking for average salary. This reveals that this

department is large, but doesn't offer personnel as much pay as other departments.

Many comparisons can be drawn between Figure 2, Figure 3, and Figure 4 to better understand funding for departments. There are also more visualizations that could be made to bring forth some of the connections that the above figures do not.

To really understand the intricacies of university funding, more research would need to be conducted and more comprehensive visualizations would need to be created. The work outlined in this paper is a jumping-off point and there is room for more research to be done on the topic. Future work would benefit from creating a visualization dashboard that allows users to draw comparisons between different metrics of data analysis.

REFERENCES

[1] University of North Carolina at Chapel Hill. "Carolina's money: Where we get it, how we spend it." Retrieved from https://www.unc.edu/discover/carolinas-money-where-we-get-it-how-we-spend-it/#:~:text=The%20University%20gets%20its%20funding,housing%2C%20dining%20and%20other%20services.

[2] University of North Carolina Data. "UNC System Employee Salaries." Retrieved from https://uncdm.northcarolina.edu/salaries/index.php.