Statistical Analysis of Different Types of Writing on Education in the Media

Assignment #1 - Dr. Glazer

Karen J. Cotter

New Jersey City University

Statistical Analysis in Different Types of Writing on Education in the Media

Statistical inferences in the media abound as journalists, reporters and writers use numbers to support their research. There are many different ways these numbers can be made into models that visually display the data. Data visualization (Blitz, 2017) can be modeled in the form of a line, bar, column, pie, area, and funnel charts. Others include pivot and bubble tables, scatterplots, indicators, as well as tree or area maps, and fisheye distortions charts. Organizing the data into a simple, easy to read trends or patterns allows the author to give the reader another way to understand and "see" the data. But how does the reader interpret this data? Is it consistent between articles? Do they illustrate specific and accurate results? Can they be compared in a way that is representative of what is actually happening?

Introduction

This paper will look at two different examples of statistical inferences in the media related to education. Each example uses data visualization in different ways to describe, explain and analyze the data the authors are trying to convey. Two articles, one from the popular press The New York Times titled "In School Together but Not Learning at the Same Rate" (Harris, 2018) (Appendix A) and a scholarly article in Statistics Education Research Journal, "Gamification of an Undergraduate Psychology Statistics Lab: Benefits to perceived Competence" (Hazan et al., 2018) (Appendix B) use inferential statistics to convey the findings of their research. A discussion of how each test was conducted and the outcome of the tests will be examined. Additionally, the strengths and weaknesses of each analysis will be explored, and

finally, their methods will be compared and contrasted with one another including suggestions or strategies for improvement will be made.

Mainstream Media

Academic gaps continue to exist between the poor and middle-class students as well as between Black and Hispanic students and their White and Asian peers. Harris' article "In School Together, but Not Learning at the Same Rate" (Harris, 2018) posits that true integration occurs when students, no matter their race or economic income, must "be in the same classrooms, have the same quality teachers and be disciplined in the same way." While her observations are based on the article "The of Race and Class: A New Look at the Achievement Gap in New York City Schools" (Mader & Costa, 2018), the focus of that research briefly mentions that assertion. The use of Interactive Data Visualization (Figure 1) (Appendix C) is meant to "allow parents, educators, and policymakers to see just how large that gap is among students" (Mader & Costa, 2018).

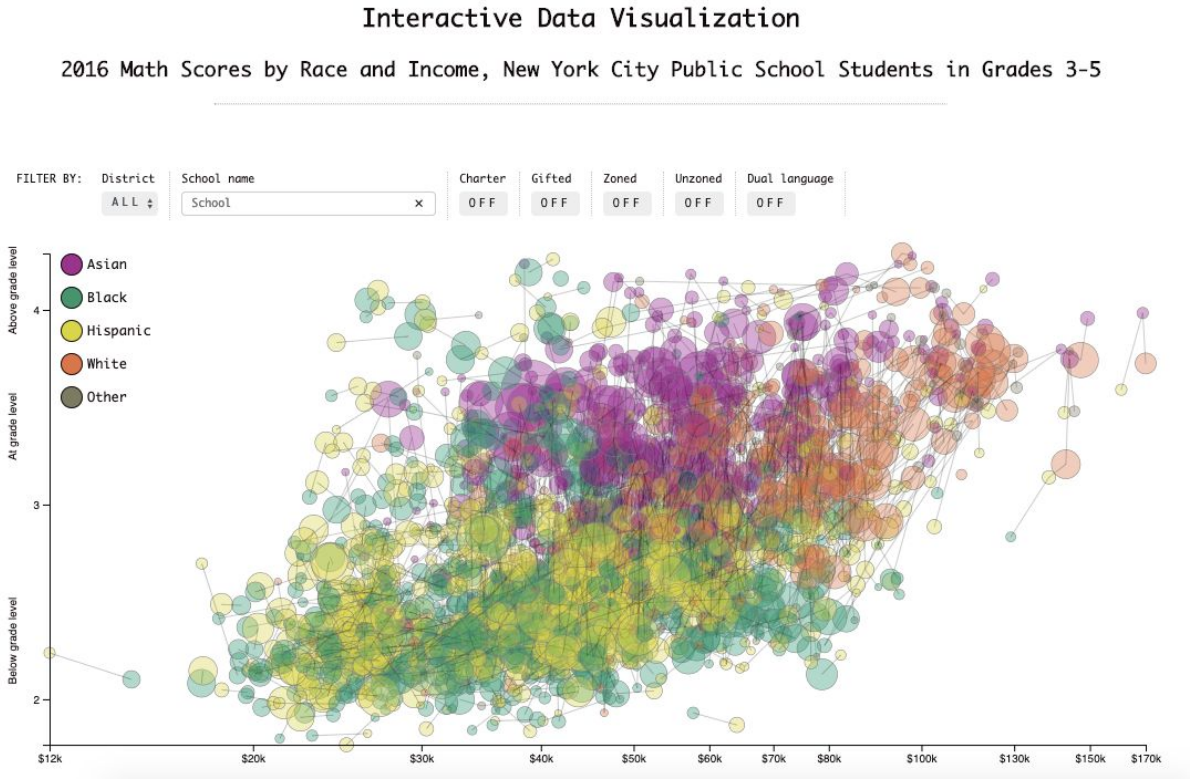

Figure 1. Interactive Data Visualization. 2016 Math Scores by Race, Income, New York City Public Schools Students in Grades 3-5

The analysis was conducted by the Center for New York City Affairs using standardized test scores. Data was collected from New York City's 220,000 public (district and charter) elementary school students, in grades three to five, in 2016. This data was then compiled into an Interactive Data Visualization (Maher & Costa, 2018).

Harris' (2018) analysis concludes that income and race are closely tied with academic performance and that true integration (as opposed to just diversity) is needed in all classrooms to close the achievement gap. She also asserts that all students need equal access to the same classrooms, quality of teachers, and should be disciplined in the same way. Generally, Harris makes broader generalizations about the findings while the conclusions of the Maher & Costs (2018) of the Interactive Data Visualization tool go into many more specifics about other variables that may have affected these results.

While this interactive tool allows for a closer look at how differently children perform as it relates to their income and race, it does not go into much detail about the different school environments or individual classroom differences within the same school. Harris (2018) gleans from the report that estimated household incomes (which were collected from census data based on student addresses) of Black and Hispanic children with family incomes of less than $30,000 "tended to perform lower on the math test within the same schools than White and Asian students." Anecdotally, she mentions two extremes "P.S. 8, a school with one of the wealthiest Parent-Teacher Associations in the country and one of the more diverse schools in the city had a 64% pass rate on the mathematics test while the city pass rate was 36% and, throughout the city "Black students, living in homes with significantly lower household incomes, performed at

nearly a full proficiency level behind their White peers on the same test" (Harris, 2018). It is easy to ascertain with a quick look at the Interactive Data Visualization how students' race and incomes performed relative to their incomes. The higher the income (and if students are White or Asian) the better the performance related to lower income (Hispanic and Black) peers. It is also evident, with the use of color, to identify outliers.

The ability to interact directly with the data is a definite strength. Visually the use of color for the circles to indicate the race is helpful. It is unclear what the size of the circle represents. It could indicate the relative size of the school so not having that information easily apparent is a weakness in the analysis.

There are two potential weaknesses of the research that could undermine the analysis. Relying solely on a standardized test for only a single year and assuming that socioeconomic and racial integration of classrooms (or schools) improves student classroom performance (Maher & Costa, 2018). A single year of standardized test scores should not be used in isolation. Not only can these tools be imperfect when measuring school success and student performance, but there are many aspects of school and home life, that contribute to one's success. Standardized testing, at it's best is only one measurement of one point in time. Finally, even though racial and economic diversity has been identified within schools as potentially impacting improved test scores, it does not take into account that other factors such as differences within individual classrooms, what the "teaching talent" might be like, within schools and across school districts, or how equitably resources are allocated within the schools (Maher & Costa, 2018).

Scholarly Article

Undergraduate psychology statistics courses are challenging for students and professors alike. The study "Gamification of an Undergraduate Psychology Statistics Lab: Benefits to perceived Competence" by Hazan et al. (2018) takes a look at how adding gamification elements may affect student perceptions of perceived competence and intrinsic motivation. Gamification was used in the laboratory experience of a psychology statistics class.

Students independently registered for one of four different laboratory classes as part of their psychology statistics course. Two of the labs were conducted using the traditional lab curriculum while the other two used gamification strategies. Each of the graduate lab instructors was both additionally trained in online gamification certification programs. and taught one traditional and one gamification lab using the same objectives and curriculum. The research included the collection of both subjective and objective data. Students completed self-reported variables that included perceived competence, interest/enjoyment, and effort/importance value statements from the Intrinsic Motivation Inventory (IMI). Objective data was collected from course assessments. Pre- and post-tests were given for both at 1 and 6 and within the first six weeks of a 15-week semester.

The conclusion of the study found that the traditional group had a weak correlation for perceived competence and the findings were not statistically significant indicating that traditional lab instruction may not improve perceived competence. As seen in *Table 1. Pearson correlations for objective pretest scores and self-report variables* the *p-values* for the gamified group were closest to zero in week 1 for Interest Enjoyment (0.007), Perceived Competence (0.000), and week 6 for Perceived competence (0.0009). Similarly, *Table 2. Pearson correlations for*

objective posttest scores and self-report variables shows similar low *p-value* scores in the gamified group for week 1 in Interest Enjoyment (0.006), Perceived Competence (0.002), and Perceived Competence for week 6 (0.001).

Table 1

Pearson correlations for objective pretest scores and self-report variables (Hazan et al., 2018)

	Gamified group *r* (*p*)	Traditional group *r* (*p*)	Test of difference of correlations, *z* (*p*)
	Pretest (%)		
1 Pretest (%)	1	1	
2 Interest Enjoyment (week 1)	0.45 (.007)	-0.10 (.627)	2.17 (.03)
3 Perceived Competence (week 1)	0.66 (.000)	0.04 (.858)	2.83 (.005)
4 Effort Importance (week 1)	0.19 (.275)	-0.10 (.599)	1.11 (.267)
5 Interest Enjoyment (week 6)	0.11 (.556)	-0.24 (.384)	1.08 (.280)
6 Perceived Competence (week 6)	0.47 (.009)	-0.12 (.678)	1.88 (.060)
7 Effort Importance (week 6)	-0.27 (.153)	-0.24 (.399)	-0.11 (.912)

Table 2

Pearson correlations for objective posttest scores and self-report variables (Hazan et al., 2018)

	Gamified group *r* (*p*)	Traditional group *r* (*p*)	Test of difference of correlations, *z* (*p*)
	Posttest (%)		
1 Posttest (%)	1	1	
2 Interest Enjoyment (week 1)	0.50 (.006)	0.16 (.471)	1.44 (.149)
3 Perceived Competence (week 1)	0.55 (.002)	-0.18 (.391)	2.98 (.003)
4 Effort Importance (week 1)	0.08 (.678)	-0.10 (.659)	0.66 (.509)
5 Interest Enjoyment (week 6)	0.31 (.087)	-0.18 (.495)	1.51 (.131)
6 Perceived Competence (week 6)	0.56 (.001)	0.24 (.365)	1.14 (.254)
7 Effort Importance (week 6)	-0.22 (.223)	-0.19 (.484)	-0.10 (.920)

These low *p-values* may indicate a correlation for greater perceived confidence among students who engaged in the lab course with the gamified elements. However, the scores for the objective post-tests resulted in higher *p-values* and yielding no statistically significant difference between groups. Additional tests (ANCOVA and multiple regression) supported finding to

"partially support the hypothesis for the objective post-test scores" (Hazan et al., 2018). Overall, the study hypothesized that "students in the gamified group would score higher on objective and subjective test measures as compared to the traditional learning group was not supported."

I believe that there is strong evidence for the conclusion of this study. The authors ran a number of different types of analysis after the initial results that further supported or refuted, their findings. Additionally, they identified a number of factors that may have impacted the study that they did not initially consider in designing the study.

The nature of this study seems to be reliable in that it could be reproduced in order to corroborate their findings. Suggestions by the author to evaluate each game component separately, run the study for greater than six weeks, have a larger sample size as well as the lack of randomization are all variables that would help to make future studies more fine-tuned.

Conclusion

In conclusion**,** statistical inferences in the media, related to education and other topics, abound. Different writers compose for the audience they are trying to reach. Whether they write for a broad audience or a very small, specific population it is important that the reader is able to what the author is trying to communicate. Similarly, the writer must often use statistics not only to support the viewpoint they are trying to get across but in a way that their audience will understand.

A comparison of these two articles, their similarities and differences will be reviewed as well as any suggestions that may be warranted. When an author uses statistics in their writing it behooves them to make sure their audience has a clear understanding of how the numbers will

support the author's viewpoint. Additionally, the author needs to communicate, and explain if necessary, the statistical methodology so the reader is as informed as possible.

Both authors are similar in that Harris (2018) and Hazan et al. (2018), use research to strengthen their positions as well as statistics to support their assertions, and they also report out/write geared to specific to their target audience. However, they differ in the types of research they used as well as the detail in which it is reported out in the articles.

Each article uses some type of research to support the author's view or opinion they are trying to convey. In the case of Harris (2018), she uses research from the Center for New York City Affairs for her article "In School Together, but Not Learning at the Same Rate." She posits that income and race have an effect on students academic performance and uses a few data points to support her claim. The different colors and sizes of the circles on the graph help the reader understand data in general terms. But Harris (2018) seems to interpret the data somewhat differently than the researches may have intended. She uses a few numbers in isolation My understanding (very simplified) of the NYT article was that lower income's, especially as they relate to households of varying races, underperform on standardized tests (generally - the actual research was done on one year of 3-5th graders). While the author may have had a word limit, I may have made sure to include information that included more detail about the outliers and other variables that may have affected the outcome of the research.

These statistics are very basic for the NYT article (illustrated in an Interactive Visualization Tool) which allow for most readers to understand what the study is trying to convey as well as support the author's point of view. There are no obvious descriptive statistics stated by the author but she does give an example, which when identified on the graph does not

seem to be the “average” or mean income, but an income that is used support her understanding of the information. The online article had no tables or graphs and I am not sure if the graph is illustrated in the print article. I would make sure to have the graph both in print and on the online article for easy reference. This would make it easier for the reader to “follow along” with what the author is trying to show.

On the other hand, the article by Hazan et al. “Gamification of an Undergraduate Psychology Statistics Lab: Benefits to perceived Competence” uses original research to support or reject the hypothesis they put forth. The authors used surveys that were carefully prepared and edited to make sure they were testing for exactly what they were looking at. They did pre- and post-testing and then reported out the results of their research using numerous tables and detailed explanations. They also ran additional statistical tests to further corroborate their findings. Because the audience is aimed at professionals the statistical reporting was very thorough. There were tables of descriptive statistics, Pearson correlations tables for both pre and post-tests, unstandardized and standardized coefficients, as well as ANCOVA results. Additionally, the results were discussed in detail such as statistical significance, whether and why hypothesis was supported, not supported, or partially supported as well as limitations of the study, suggestions for future studies. It is difficult to make suggestions because we have not covered a lot of what was reported out in this article. It does seem that the authors were very thorough with their methodology on all counts.

Finally, each article “speaks” to a very different audience. The NYT audience reaches over 4 million subscribers as of November of 2018 (Peiser, 2018) while the International Association for Statistical Education has a global membership of about 208 (IASE Reports.

(n.d.). Not only does the audience size dictate how the article is written, but the type of reader needs to be taken into consideration so that the audience is reading at the level of their expertise. In both cases, the authors have written for their audience, whether it is wide-reaching or specific and very technical.

This paper has looked at two different articles and their approach to using statistical inferences as they relate to education. Each example uses data visualization in different ways to describe, explain and analyze the information the authors are trying to convey. A discussion of how each test was conducted and the outcome of those tests was examined. Finally, the strengths and weaknesses of each analysis were explored, and details about the different methods were compared and contrasted with one another including suggestions and strategies for improvement.

References

Blitz, S. (2017, November 15). 10 Useful Ways to Visualize Your Data (With Examples) [Web log post]. Retrieved March 19, 2019, from https://www.sisense.com/blog/10-useful-ways-visualize-data-examples/

Harris, E. A. (2018, January 31). In School Together, but Not Learning at the Same Rate. *The New York Times*. Retrieved March 20, 2019, from https://www.nytimes.com/2018/01/31/nyregion/study-black-white-achievement-gap-schools.html Appeared in print February 1, 2018 page A19

Hazan, B., Zhang, W., Olcum, E., Bergdoll, R., Grandoit, E., Mandelbaum, F., . . . Rabin, L. A. (2018). Gamification of an Undergraduate Psychology Statistics Lab: Benefits to Perceived Competence. *Statistics Education Research Journal,17*(2), 255-265. Retrieved February 5, 2019, from https://www.researchgate.net/profile/Ecem_Olcum/publication/325719278_Gamification_of_an_undergraduate_psychology_statistics_lab_Benefits_to_perceived_competence/links/5bfec2ce299bf1a3c153bcd4/Gamification-of-an-undergraduate-psychology-statistics-lab-Benefits-to-perceived-competence.pdf

IASE Reports. (n.d.). Retrieved 2019, from https://iase-web.org/Reports.php

Mader, N., & Costa, A. S. (2018). [Interactive Data Visualization - A Look at the Achievement Gap in New York City Schools]. Unpublished raw data.

Peiser, J. (2018, November 1). New York Times Tops 4 Million Mark in Total Subscribers. . Retrieved March 22, 2019, from https://www.nytimes.com/2018/11/01/business/media/new-york-times-earnings-subscribe

rs.htmlPeiser, J. (2018, November 1). New York Times Tops 4 Million Mark in Total Subscribers. *The New York Times*. Retrieved March 22, 2019, from https://www.nytimes.com/2018/11/01/business/media/new-york-times-earnings-subscribers.html

Salkind, N. J. (2017). *Statistics for People Who Think They Hate Statistics Statistics for People Who Think They Hate Statistics Interactive Ebook 6th Ed. Access Code*(6th ed.). Thousand Oaks, CA: Sage Pubns.

Appendix A

In School Together, but Not Learning at the Same Rate

Appendix B

Gamification of an Undergraduate Psychology Statistics Lab: Benefits to Perceived Competence

Appendix C

The Calculus of Race and Class: A New Look at the Achievement Gap in New York City Schools Interactive Data Visualization