

# Using Circuit Playground and Maps To Visualize Migration Data

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**Abstract:** This paper shares the design and process of development for a data visualization project that centers computing squarely in social studies classroom instruction for social justice. Circuit Playground Express are programmed to engage students in engaging with and creating visualizations of the Great Migration of Black folk from the American South during the Jim Crow era.

## Introduction

Most state's fourth grade social studies focuses on state history; for example. Utah 4<sup>th</sup> grade history focuses on the Mormon migration west while in California the history of the California Missions takes center stage. However, in the teaching and learning of this history a paucity of discussion exists around the peoples displaced by the incoming group. This creates an inherently white centered history and erases whole swaths of people from the telling of history. Engaging young people in difficult conversations around immigration, migration, and forced relocation is a challenge for history and social studies teachers. Students often lack the depth of perspective to understand the complex reasons peoples move. The ramifications of these movements are often not explored intersectionally. The Great Migration Visualization engages elementary students in learning about the migration of Black people from the southern United States during the 1900s.

## Background: Data visualization in social studies

Data visualization is increasingly central to social studies education. As data visualizations become increasingly present in daily reading and media consumption, teaching students how to represent and interpret data visualizations becomes an increasingly important educational goal for social studies teachers (Schreiner, 2018). While there are differing approaches to both visualizing data and teaching data visualization (e.g. Borner & Polley, 2014), consensus exists around the importance of engaging youth in the process of making sense of data through visualizations. While research on the teaching of upper elementary students through timelines and maps indicates limitations regarding student comprehension around issues of scope, relationality, and temporality (Blow, Lee & Shemilt, 2012; Wills, 2012), strategies are emerging for the successful and meaningful learning of this content. Current study findings indicate that explicit instruction in the data visualization literacy is most effective in supporting student content understanding (Van't Hooft et al, 2012); these findings are in keeping with decades of educational psychology research regarding direct and explicit instruction (Kirchner, Sweller, & Clark, 2006).

Design of the Great Migration Map Project: As part of a larger curriculum unit, the primary goal of this project is engaging an interdisciplinary approach to the education and instruction surrounding immigration, migration, and forced relocation. Students are tasked with creating a map that uses Circuit Playground Express boards to display population changes over time in various locations within the United States. In order to center justice and equity for students, we've chosen to highlight stories of immigration, migration, and forced relocation that are also the stories of marginalized people.



**Figure 1.** Great Migration Circuit Playground Map 1910 vs 1940 population data.

In this case, the story students will display and tell is of the Great Migration, a mass migration of African-Americans from the rural South to urban areas in the Northeast, Midwest, and West between 1916 and 1970. This

movement was largely in response to the Jim Crow South and low economic opportunity in the South for specifically Black folk. This design method can be easily adapted for other stories of immigration, migration, and forced relocation, such as Japanese Internment or the events of Native American removal.

IPUMS, a name that is no longer an acronym but originally stood for Integrated Public Use Microdata Series, was used as the source of the datasets in finding the population data of African-Americans per decade. IPUMS USA is an online database that “collects, preserves and harmonizes U.S. census microdata and provides easy access to this data with enhanced documentation. Data includes decennial censuses from 1790 to 2010 and American Community Surveys (ACS) from 2000 to the present” (Ruggles et al., 2019). After gathering the decennial census datasets between 1910 and 1970, the data on African American population (per state and US total) was put into a spreadsheet in order to be transformed into proportions that are useful to display onto Circuit Playground Express boards. This data transformation can be completed by an instructor prior to the project, or can be completed by a student or student team as part of the unit.

Circuit Playground Express boards feature ten codable NeoPixels, which students will code to display population changes over time. The population data by state is first transformed by dividing each state’s African American population by the year’s US total number of African Americans. This yields each state’s African American population as a percentage of the US total. This step is necessary in order to control for population growth as time passes. To transform the state percentage of US total population, each state’s percentage is divided by the highest percentage within the dataset and then multiplied by ten (to create a proportion with a base of ten to reflect the ten NeoPixels present on the Circuit Playground Express boards). For the Great Migration dataset, Georgia 1910 was the highest value at 11.75%. The resulting proportions are shown below. Notably, Georgia and Mississippi start in 1910 at ten and nine units respectively, and end in 1970 with three and one units, showing a large exodus of African Americans during the Great Migration. Conversely, New York in 1910 has one unit, and increases to eight units by 1970, showing a large influx of African Americans, many of them forming communities in urban areas

## Educational implications

With immigration, migration, and forced relocation such important aspects of American history, developing tools and curricular materials that engage students in thinking about these issues is imperative for supporting youth knowledge. By working with actual data to produce a meaningful visual to explain the population shifts, students are able to explore the multiple ways in which population shifts impacts the demographics of regions across the nation.

## References

- Blow, F., Lee, P., & Shemilt, D. (2012). Time and chronology: Conjoined twins or distant cousins? *Teaching History*, 147, 26–34.
- Börner, K., & Polley, D. E. (2014). *Visual insights: A practical guide to making sense of data*. Boston, MA: MIT Press.
- Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational psychologist*, 41(2), 75-86.
- Steven Ruggles, Sarah Flood, Ronald Goeken, Josiah Grover, Erin Meyer, Jose Pacas and Matthew Sobek. IPUMS USA: Version 9.0 [dataset]. Minneapolis, MN: IPUMS, 2019. <https://doi.org/10.18128/D010.V9.0>
- Van’t Hooft, M., Swan, K., Cook, D., Stanford, T., & Vahey, P. (2012). Across-curricular approach to the development of data literacy in middle grades: The thinking with data project. *Middle Grades Research Journal*, 7(3), 19–33.
- Wills, G. (2012). *Visualizing time*. New York, NY: Springer

## Acknowledgements:

This work was supported by a National Science Foundation grant (#1758823). Any opinions, findings, and conclusions or recommendations expressed in this paper are those of the authors and do not necessarily reflect the views of the NSF.