

Maps, mobile tools, and media boards: Technologies for learning about the mathematics of pawn shops

Piloting a Mathematics Curriculum on Alternative Financial Institutions

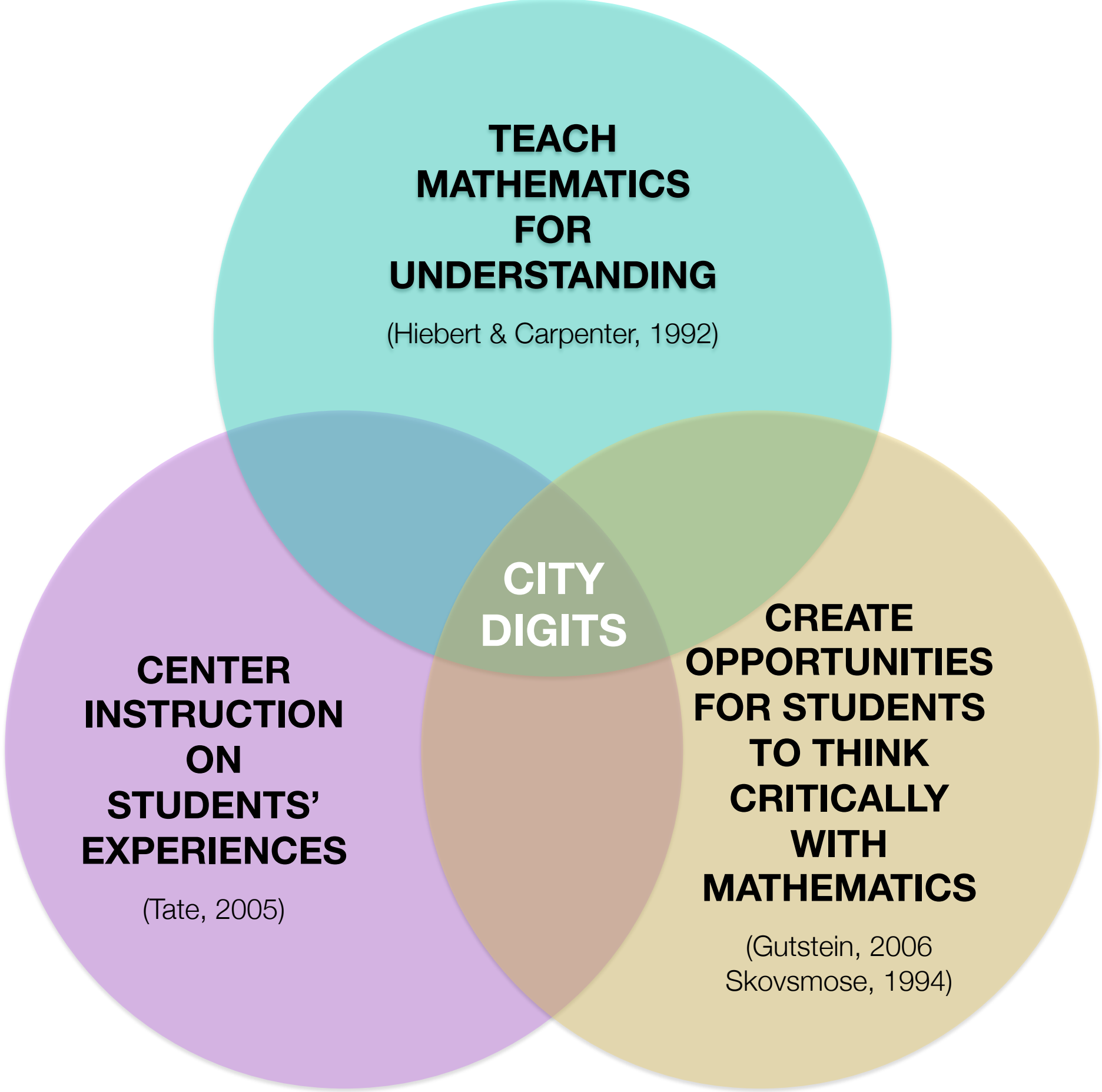
Poster is based on: Rubel, L., Lim, V., Hall-Wieckert, M., Williams, S. (2015, under review) For participation in the 11th International Conference on Computer Supported Collaborative Learning

INTRODUCTION

City Digits is a design-based research project which leverages the power of technology to bring real-world information and a critical context into mathematics education. Through the curriculum students learn to use mathematics as a way to understand local phenomena from a critical perspective. Using a combination of mapping, data, and media technologies students are enabled to explore mathematics using social and demographic information. The current iteration of the project “Cash City” is a ten day module which focuses on the location and distribution of banks and alternative financial institutions (AFIs) including: pawnshops, check cashing stores, and wire transfer services.

THEORETICAL FRAMEWORKS

CULTURALLY RELEVANT MATHEMATICS PEDAGOGY
(Ladson-Billings, 1995; Rubel & Chu, 2012)
CRITICAL PEDAGOGY OF PLACE
(Gruenewald, 2003)



DESIGN PRINCIPLES FOR INTEGRATING PLACE, CULTURE, AND MATHEMATICS

(Rubel & Lim, under review)

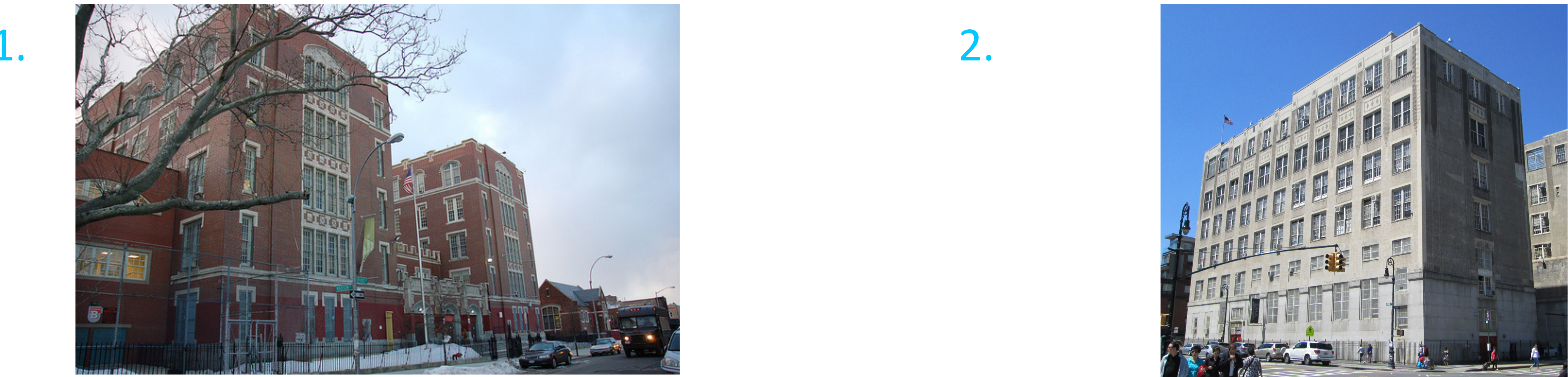
I. Mathematics as essential for understanding the phenomenon	How does it work?	Students use ratios and percentages to understand how AFI or bank loans work
II. Spatial and Quantitative Components	Where does it occur? How much or how often?	Students explore maps to determine how banks and AFIs are distributed across neighborhoods
III. Subject Dimensions	Who is involved and how do they participate?	Students draw on personal experience and interview community members/shop-keepers on banks and AFIs
IV. Social Justice Ramifications	Who is impacted and is it fair?	Students pull on their accumulated knowledge to generate evidence-based opinions about the distribution of banks and AFIs in NYC

RESEARCH QUESTION

What role can digital technologies play in a curriculum focused on integrating place, culture, and mathematics?

RESEARCH CONTEXT

The “Cash City” module was piloted in two New York City public high schools. In each case the classroom teacher led the sessions, with some support from the design team. Sessions were conducted during the school day as part of a regular class schedule.



- Neighborhood school in outer borough with a social justice theme
- Students identify as Hispanic (75%), Black (24%), and White (1%)
- (100%) of students qualify for Free Lunch
- School in city center, has an arts/humanities theme
- Students identify as Hispanic (51%), Black (32%), White (7%), and Asian (5%)
- (72%) of students qualify for Free Lunch

CURRICULUM & TECHNOLOGY: “CASH CITY”

I. THE COST OF PAWNING

The first four days of the curriculum are devoted to getting students to use mathematics to calculate the cost of obtaining a loan. Students are first provided with the terms of a pawnshop loan via skit. They learn about collateral, the fees associated with storing an item at a pawnshop, and the idea that a loan accrues interest over time. Students are then called upon to calculate interest on a pawnshop loan using a mental math (ratio table) strategy. APR is introduced as a metric for comparing interest rates between AFIs and the different banking options available to them if they need a loan.

3. Pawn Rite charges 4% interest per month in addition to a \$25 fee for a loan. The term of the loan is for 4 months.

a) Elroy needs cash, so he pawns his gold watch for \$250. How much will he owe the pawn shop when the 4 months are up? Show how you got your answer.

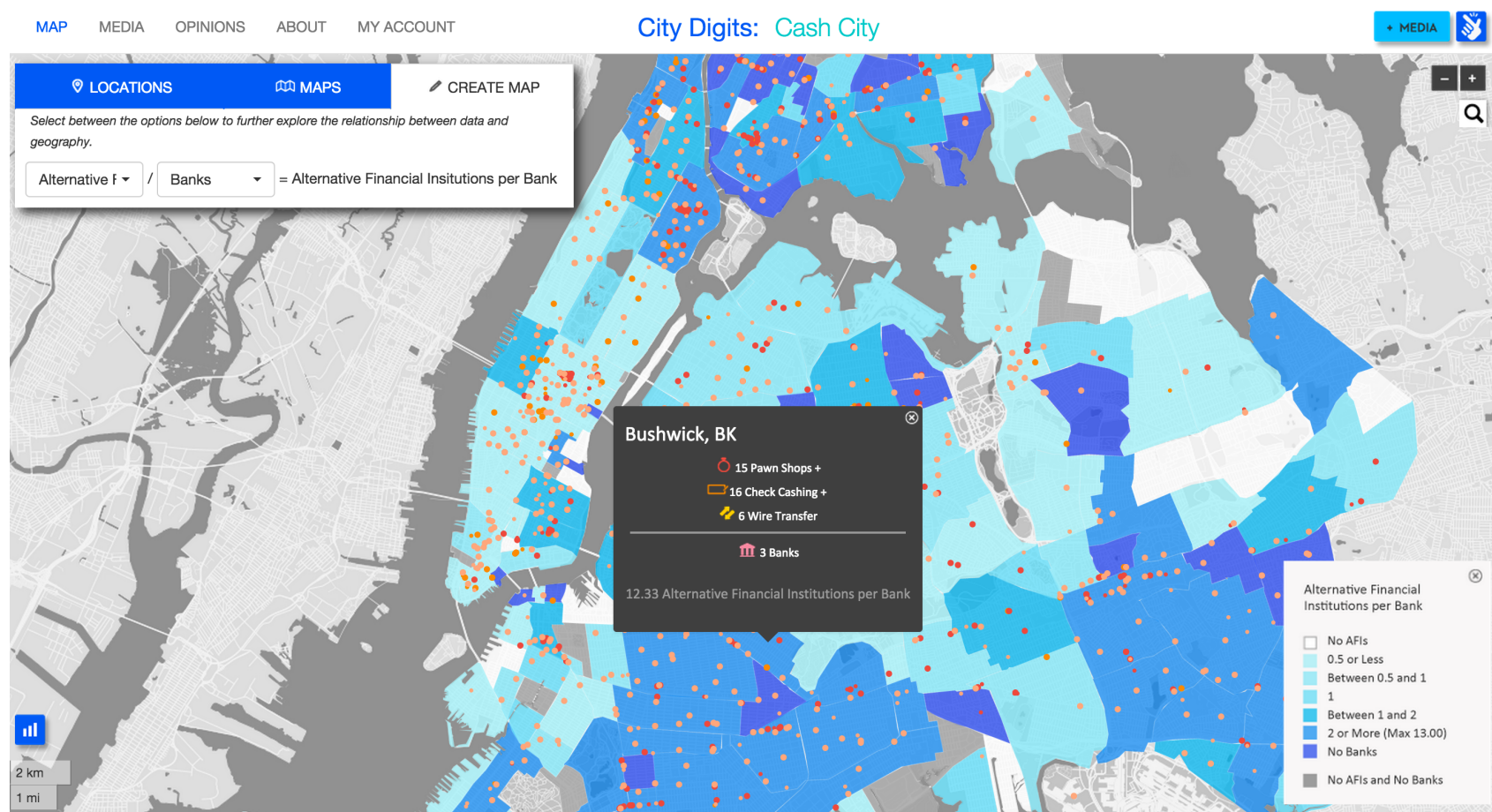
$$\begin{array}{r} \text{Paying} \quad 100 \quad 80 \quad 250 \\ \text{Interest} \quad 4 \quad 3 \quad 10 \\ \hline 104 \quad 83 \quad 260 \end{array}$$

$$250 + 10 = 260$$

Elroy will owe the pawn shop \$260 after 4 months.

II. EXPLORING MAPS

The next days in the module are spent thinking about the distribution of AFIs and banks throughout the city at multiple scales. This begins with a distribution activity centered on a walkable map of New York City and then moves into the use of digital maps layered with demographic and location information about neighborhoods, boroughs, and the city at large. The digital maps are hosted on the Cash City tool site and include tabs that direct readers to location maps, demographic maps, or ratio maps that explore frequencies of financial services relative to other variables.

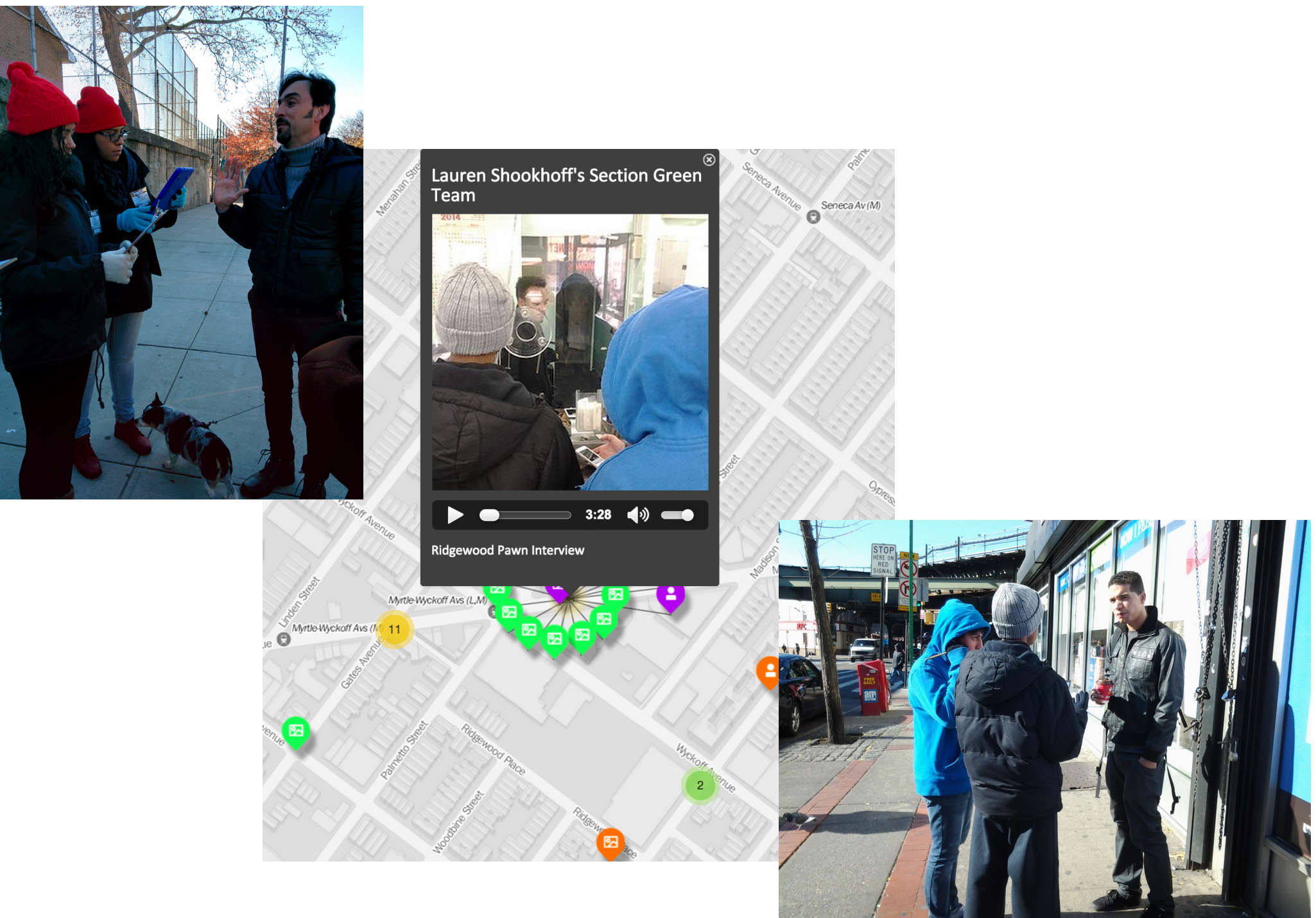


CASH CITY TOOL
City Digits utilizes a web-hosted mapping tool developed in collaboration with the Civic Data Design Lab at MIT. The Cash City tool provides students with an interactive, authorable map space which shows a variety of rich demographic map layers as well as geo-located points of interest for pawnshops, check cashing stores, wire transfer services, and banks.



III. EXPLORING THE NEIGHBORHOOD

Once students are familiar with trends in financial services distribution at multiple scales, they gather data in the neighborhood around their school. Students use mobile devices in conjunction with the web-hosted Cash City tool to collect photographs of the neighborhood and conduct interviews with both inhabitants and store owners. All media gathered using these mobile devices is then geo-located and uploaded to the site.



IV. SPEAKING BACK: STUDENT OPINIONS

Finally students author opinions on the relative distribution of financial services using data collected through map explorations as well as media gathered and uploaded to the site. Students' opinions are then published to the public tool site to encourage further discourse around the issues raised through their engagement with the curriculum.

SECTION 1
A man stating that he wanted to sell a laptop quickly, so he decided to go to a pawn shop and he only received 80 dollars for a decent functional laptop. Which he found unreasonable, but he wanted to sell the laptop, so he eventually agreed to the price the pawn shop gave to him later on.

SECTIONS 1 - 3
These accompanying screenshots are pulled directly from the Cash City tool site and showcase the work of an individual student.

SECTION 2
The map above shows that there are more Pawn shops located in the Bronx, where the population of poverty is the most highest. Which is considered very crafty or shady due to Pawn shops becoming more accessible to a location where people need money, but they don't have enough money to pay it back completely.

SECTION 3
This Sign shows that Pawn shops sells other people used items in order to Earn money for their store. These items are earned by basically putting the owner of item in a tough situation by having the APR being so high so they have to decide whether to let the store keep their item or keep borrowing money, causing your debt to become more overwhelming.

CHALLENGES

This project has developed innovative curriculum supported by cyberlearning tools for use in urban high schools. Challenges related to technology include accuracy of database of geo-located information, utilizing web-hosted software rather than a native app on mobile devices, navigating operating system changes on mobile devices, and manually geo-locating student media when location services fail in the field. Other challenges relate to making the integration of technologies and curricular materials more transparent for teachers who do not benefit from the support of the design team.

CONCLUSIONS

Digital technologies can facilitate a critical place-based approach to mathematics teaching and learning. With Cash City, students investigate an issue in place, at multiple levels of scale, from local streetscapes to neighborhood comparisons to trends across the larger city. The digital maps of the city in which students live invite them to place their own neighborhood in a broader context and extend their understanding of local phenomena to more abstract scales. The mobile tools further reinforce this connection by making it possible for students to directly upload information from their physical neighborhoods onto the digital maps. The tools bring students' learning from inside the classroom back out into the real world, as publishing students' opinions on the web makes them viewable to the public and therefore meaningful in a context that extends beyond school boundaries. In the context of a critical place-based curriculum, digital technologies mediate between students' critical understandings of mathematics and realities of their daily lives.

For more information, visit:
CITYDIGITS.ORG



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