**Tales from the Chihuahuan Desert:**

**Borderlands Narratives about Identity and Binationalism**

National Endowment for the Humanities and The University of Texas at El Paso

2017 Summer Institute for Secondary School Teachers (Grades 6th–12th)

**Lesson Plan: Graphing Immigration Stories**

**An Analysis of How Graphs/Data can (de)Construct Narratives**

**Prepared by**

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Dina Mahmood is a current project based learning educator of mathematics at Samueli Academy, where she also advises a Model UN program. She is interested in ways that education can allow students to think critically about themselves and their community. She believes that by making math personally relevant and meaningful, students can more greatly appreciate the importance of mathematics.

Dina is also currently pursuing a PhD in Education Studies as she continues her own journey to understand the world around her. In her free time, Dina enjoys cooking, yoga, and travelling the world.

**Subject Area:** Algebra I/ Integrated Math 1

**Key Word**: Graphing, Functions, Immigration, Stories, Data

**Grade Level**: 8th / 9th Grade

**Time Required**: 3-5 days (can be embedded within larger Linear Functions Unit)

**Common Core Standards:**

#### Interpret functions that arise in applications in terms of the context.

[CCSS.MATH.CONTENT.HSF.IF.B.4](http://www.corestandards.org/Math/Content/HSF/IF/B/4/)

For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity*.\*

[CCSS.MATH.CONTENT.8.F.B.5](http://www.corestandards.org/Math/Content/8/F/B/5/)

Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

#### Analyze functions using different representations.

[CCSS.MATH.CONTENT.HSF.IF.C.7](http://www.corestandards.org/Math/Content/HSF/IF/C/7/)

Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.\*

[Modeling in Mathematics](http://www.corestandards.org/Math/Content/HSM/)

The basic modeling cycle involves (1) identifying variables in the situation and selecting those that represent essential features, (2) formulating a model by creating and selecting geometric, graphical, tabular, algebraic, or statistical representations that describe relationships between the variables, (3) analyzing and performing operations on these relationships to draw conclusions, (4) interpreting the results of the mathematics in terms of the original situation, (5) validating the conclusions by comparing them with the situation, and then either improving the model or, if it is acceptable, (6) reporting on the conclusions and the reasoning behind them.

**Instructional Objectives and Student Learning**

Students will think critically about how graphs are created - specifically graphs that show the relationship between two variables (i.e. time and population growth). Students will understand the impact of decisions like scaling, axes, variables, data selection have on the story that is told in the graph. Students will learn to interpret graphs. Students will apply their understanding by creating their own graphs that tell a story that counters the dominant narrative of immigration currently portrayed in mainstream media. Students will demonstrate the following learning outcomes: oral communication, written communication, collaboration, agency, and knowledge and thinking. These learning outcomes will be evaluated through the process of creating their culminating product (graphed story). Activities will include a lecture on how to interpret key features of a graph, data collection, and creating/interpreting their own graphs. Students are invited to deconstruct and recreate an existing graph in order to tell a different story related to immigration or interview a community member and represent their story using graph(s). Students will reflect on the ways that graphs can represent and misrepresent stories and the importance of thinking critically about the ways that data is collected and portrayed.

**Guiding Questions**

How can we capture immigration experience using functions/graphs/mathematics models?

How can data collected be used to represent or misrepresent our story?

Who’s story is represented and how is it misrepresented as it relates to data?

How can we affirm truth using data?

How can we as mathematicians, use key features of a graph such as scale, axis, variables, to represent data in such as way that it accurately tells our story?

Why do we use functions/graphs to display data?

**Materials and Resources**

What will teachers and students need in terms of materials and artifacts, or previous materials, to complete this lesson? Provide readings and resources with fair use.

<http://www.pewhispanic.org/2015/11/19/more-mexicans-leaving-than-coming-to-the-u-s/ph_2015-11-19_mexican-immigration-08/>

<http://www.pewhispanic.org/interactives/unauthorized-trends/>

Gallery Walk/Dissecting a Graph Organizer

Organizer for Final Product - Graphed Story

Interview Worksheet

<https://www.thinglink.com/>

**Introduction**

“If I had my powerpoint, I’d be able to show you the graphs. Once the wall went up, the number of people entering illegally just dropped!”, said the border patrol officer on our border tour attempting to justify the construction of the border wall.

The immigration debate in the US is a hotly contested subject where even word choice can be debated - undocumented or illegal? fence or wall? Media choice of rhetoric and images as well as increased coverage can shift the national consensus (Bustamante 31). Mathematics is a powerful tool that can be used to read, write, and shape the world around us. Those who wish to oppress and dominate use mathematics as a tool to justify particular policies and agendas. To subvert such an agenda, it’s vital to interrogate so-called “objective” graphs, charts, and statistics: to tell the untold story, identify strategic pieces of misinformation and contradiction them, make absences visible, ask questions, be an agent, and personalize the story (Morales).

Data visualization is regularly promoted for its ability to reveal stories within data, yet these "data stories" differ in important ways from traditional forms of storytelling. Storytellers, especially online journalists, have increasingly been integrating visualizations into their narratives, in some cases allowing the visualization to function in place of a written story. (Segel and Heer).

Mathematics in the high school classroom can often be a impersonal, trivial chore in crunching numbers. Students, particularly students of marginalized and disenfranchised communities, need to take ownership of their learning.

Stories can be told in a variety of media, graphs included. Yet as we are reminded to question the inherent bias and perspective in written stories, we need to also consider the decision making in creating graphs that might influence the way the story is represented.

I hope to expose students to the inherent bias and misrepresentations that can exists in graphical representations of stories. Furthermore, I hope to develop agency in students as they begin to generate and create their own graphed stories that can counter the narratives on immigration.

Ideally the following lessons would be part of an integrated unit with English and History centered on the theme of narratives, immigration, and perspectives in storytelling. I hope that other educators are able to see how mathematics can be integrated with humanities in a thoughtful and personal way.

**Instructional and Lesson Activities (ENGAGE, EXPLORE, EXPLAIN)**

**Lesson 1**: Interpreting Key Features of a Function that is represented Graphically (60-90 mins)

 Objective: Students will learn to interpret a graph by analyze the key features of the graph: rate of change, variables, key points, and shape. Students will use line of best fit to interpret the average rate of change and linear relationship between two variables.

 Math Content: Interpreting Graphs, Linear Approximation

 Connection to Driving Question: Graphs will be related to the immigration and will help students understand how mathematics is used to construct a narrative about immigration.

 Materials: [Graphs + Guiding Questions](https://docs.google.com/document/d/1YKMe1Mi3zf_RpfdX3j9oZVdNHlAUbWg2-2HucPq5_6M/edit) (“Graphs to Story” Attachment)

 Questions:

1. What key words/vocabulary did you have to look up? Define them (at least 2).
2. What does the graph say? (pay attention to the axis labels, scale, and other key information).
3. What does the graph mean? (Tell the story: First...then..finally). Who’s story is being told?
4. Why does the graph matter? If you had to make a prediction based on the graph - what would you predict. Use tools such as linear approximation.

**Lesson 2**: Misleading Graphs Reading / Activity (30 - 60 mins)

 Objective: Students learn about how without looking closely, readers can reach false conclusions about the story communicated in a graph.

 Connection to Driving Question:

 Materials: [“How to Mislead Using Graphs”](https://docs.google.com/document/d/1XFeLwPJNn3Y5b9l4zZRzuqS9u6fwVgbRkudOon9nUA4/edit) (Attachment Reading)

 Questions:

1. Create a misleading graph of your own. This requires that you make two graphs: an original graph and a misleading graph.
2. Describe the impact you were trying to create in Question 1. Explain how your graph is misleading.
3. Find/print or Cut out a graph from a newspaper or magazine and write about why you think it is fair or why you think it may be misleading. This graph should be related to immigration.

**EXTEND/ELABORATE: Additional Learning**

Find a graph that may have been misleading in media and contact local media representative about particular data that was represented and argue about how that graph/ data may have been misleading.

Use data from <http://apps.npr.org/borderland/#_/stats> to generate graphs/tables that tell the story of border crossing and immigration using data.

Students can create their own poster or website page that includes graphs they created, written description of the graphs, and reflection of what they’ve learned.

**EVALUATE: Assessment**

Students will interview a member of the community and collect data/information about their immigration story. Students will then graph elements of their story (such as miles travelled per day, money spent, income level, education level over time language ability over time, connection to homeland over time, etc.) [Example here](https://docs.google.com/presentation/d/187D8OGhrP1FJcyzrDGYZadkuH663V4svOYPBlhJhUco/edit) based on narrative in [*Devil’s Highway*](https://drive.google.com/drive/u/0/folders/0B3cRLO6WtfxIY0hsN19xTXVVUGM)

Using the graphed interview and work from Lessons 1 and 2, students should respond to the following prompt in a written essay:

What are the key features of a graph and how can they be used to tell a story? Use the following academic language: independent/dependent variables, function, scale, axis, data, linear approximation, rate of change, and any other mathematical terms you feel relate.

Scoring should be based on:

* ability to communicate effectively using written and visual elements accurately
* correct use of mathematical conventions when graphing
* strength of analysis when interpreting features of the graph

**Accommodations and Modifications**

State how you adjust instruction and activities for individual students as needed.

Sentence Starters

Graphic Organizer

Allow students to work with peer / partner

Focus students on particular data to collect when conducting the interview

**Additional Resources**

<http://www.ci.santa-ana.ca.us/library/teens/icma/documents/oral_history_presentation.pdf>

<http://apps.npr.org/borderland/#_/stats>

 <http://vis.stanford.edu/papers/narrative>

 <http://inationmedia.com/>

**References (or Works Cited)**

González de Bustamante, Celeste, [“Politics, Media and the U.S.-Mexico Border,](http://borderlandsnarratives.utep.edu/images/Readings/Reading1_GonzalezdeBustamante_VoicesofMexico10208.pdf)” Voices of Mexico 102 (2017) 29-32.

Morales, Aurora Levins. “The Historian as Curandera.” JSRI Working Paper #40. The Julian Samora Research Institute, Michigan State University, East Lansing, Michigan, 1997.

“Narrative Visualization” <http://vis.stanford.edu/files/2010-Narrative-InfoVis.pdf>

Devil’s Highway by Luis Alberto Urrea

**Reflection**

This lesson represents my attempt to humanize the study of mathematics. Oftentimes, mathematics is used only as a tool to explore financial or scientific matters. Yet, throughout my learning in the Chihuahan Desert Borderlands Seminar, data was often cited as evidence to persuade the audience on a certain narrative. I hope that students, through this mini-lesson series, take more ownership and think more critically about the data that is being used to describe and shape the world around them.

I believe this lesson should take place early in the year as way to encourage students to think critically about the world around them. Beyond a tool to count money, mathematics can be a tool to give voice to the voiceless. I hope that students begin to think about who is collecting the data, why they are collecting the data, and what narrative the data collectors are attempt to perpetuate or dismantle when they display their data. Every graph tells a story and every story has perspective and bias. Mathematics is not always objective or clear cut.

Attempting to graph the journey described in *Devil’s Highway* was a challenge. There is the skills challenge of creating a table of data constructed from a narrative. I further recognized that reducing an entire story, especially a traumatic story as the one presented in *Devil’s Highway*, provided a superficial representation. It reminded me how data visualization can reduce personal, traumatic human stories to lines and numbers.