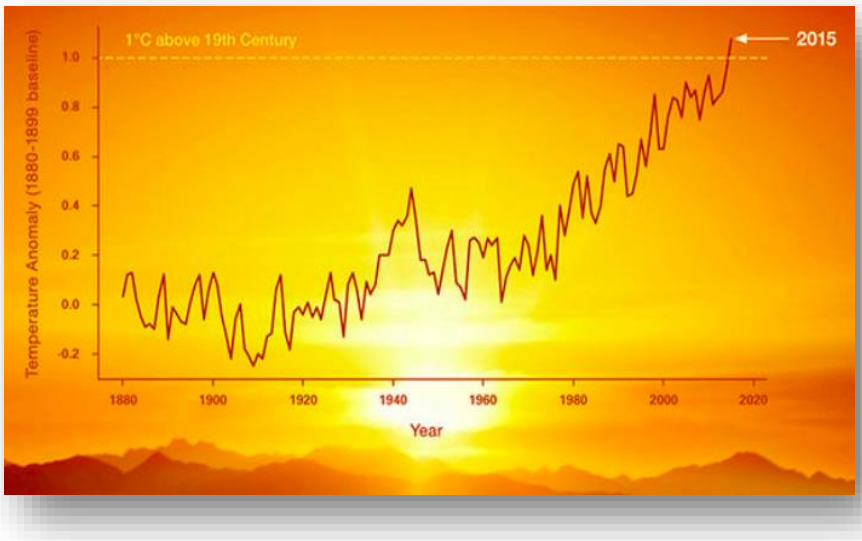
Practicum in STEM Leadership
Data- enhanced investigations of climate change in science classroom

By: Nataliya Zakharchuk
May 8, 2018

Personal development reflection:

Why do we want to use real- life data to teach scientific concepts on climate change?



My PD on *"Data- enhanced investigations of climate change in science classrooms"* took place at the American Dream School that is located in the South Bronx (address: 510 E141 St, 4th floor, Bronx, NY 10454, phone number: 718-585-3071). The PD was carried out as planned, in 8th grade PBL (project- based learning) room where all the participants were split into 4 teams based on the subject they teach or area of interest. Time that was used to complete all the assigned activities: 90 minutes (2 double- blocks). Additionally, educators had access to the computers and used the following link to complete the assigned activities:

* https://www.jpl.nasa.gov/edu/teach/activity/graphing-global-temperature-trends/ (The particular website provides an opportunity for students/ PD participants to analyze global temperature data for the past 137 years in order to create a graph for comparison of the short and long- term patterns. After completing the task, students/ PD participants should be able to determine changes of the global temperature trends due to greenhouse effect and human activity that cause global warming).

Contacts:

1. Erika Ciprian (6 PBL): 1(347)-907-4069;
2. Ahmad Inshan (Science Department Head, 8 PBL): 1(347)-216-2431;

The following educators participated in the PD:

1. Erika Jimenez Ciprian (6th grade PBL): 3 classes and approximately 30 students in each

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2. Ayal Adamit (7th grade PBL): 3 classes and approximately 30 students in each
3. Stephanie Sanchez (7th grade PBL): 3 classes and approximately 30 students in each
4. Ahmad Inshan (8th grade PBL, science department head): 3 classes
5. Lucas Hernandez (8th grade PBL): 3 classes and approximately 30 students in each
6. Glory Gomez (6th grade math, head of math department)
7. Elizabeth Sanchez (6th grade math): 3 classes and approximately 30 students in each
8. Jose Alvarez (7th grade math): 3 classes and approximately 30 students in each
9. Stephanie Ferreyra (7th grade math): 3 classes and approximately 30 students in each
10. Israel Morales (9th grade biology, physics, chemistry)
11. Niki DeGiorgio (6th grade ELA, 6th grade team leader): 3 classes, 30 students in each
12. Danniel Zaureder (6th grade ELA): 3 classes, 30 students in each
13. Susan Davila (6th grade Spanish): 3 classes, 30 students in each
14. Jordan Werwa (6th grade Spanish): 3 classes, 30 students in each
15. Yeni Martinez (8th grade Spanish): 3 classes, 30 students in each
16. Beatriz Banuelos (Assistant Principal)
17. Kim Higdon: ADS reading specialist
18. Abigail Nicolas: ADS speech therapist
19. Eddie Jimenez: Dean of students
20. Nick Gallagner: ADS administrator

General Science & Math standards that were covered by performing the activity on global temperature trend analysis:

Math:

6.SP.B.5: Summarize numerical data sets in relation to their context

6.SP.B.5.A: reporting the number of observations.

6.SP.B.5.B: Describing the nature of the attribute under investigation, including how it was measured and its units of measurements.

6.SP.B.5.C: Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviations), as well as describing any overall pattern and any striking deviations from the overall patter with reference to the context in which data was gathered.

ELA:

RHST.6-8.2: Determine the central ideas or conclusions of a text: provide an accurate summary of the text distinct from prior knowledge or opinions.

RHST.6-8.3: Follow precisely a multistep procedure when carrying out experiments taking measurements, or performing technical tasks.

RHST.6-8.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in specific scientific or technical context relevant to Grades 6-8 texts and topics.

Science:

4.2a Heat moves in predictable ways, flowing from warmer objects to cooler objects until they both reached the same temperature.

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2.1a Nearly all the atmosphere is confined to a thin shell surrounding the Earth. The atmosphere is a mixture of gases, including, nitrogen, oxygen, with small amounts of water vapor, and carbon dioxide. The atmosphere is stratified into layers each having distinct properties. Nearly all weather occurs in the lowest layer of the atmosphere.
2.2i Weather describes the conditions of the atmosphere at a given location for a short period of time.

What did I set up to do?

The PD was organized with the purpose to introduce the advantage of using real- life data to teachers of various subjects as the tool to enhance student learning. The main point was to display our PBL class as a model since we often incorporate data because such strategy takes an important instructional place in science classrooms and allows us to improve and facilitate content understanding. Students on another hand get a chance to practice how to analyze meaningful patterns of information that might be expressed in numbers, images, graphs or words. After learning how to recognize patterns and analyze information appropriately from the given sources, learners can productively apply their knowledge to solve real- life situations, make meaningful conclusions or collect reliable data on their own to share it with others.

As data driven instruction changes my class personally and allows students to take charge over learning process, same effect can be projected in other content areas as well. By using real- life data learners become responsible for pattern searching by looking for similarities, trends, disparities and relationships regarding given information either in numbers, words or on charts. It also drives them towards thinking of those trends and their meanings, which highly reinforces rigor in class and increases higher- order thinking skills among students.

Why graphing global temperature trends?

For my PD I decided to focus on the topic of climate change that is extremely relevant in recent times and teachers can talk about it in any content area including science, ELA and Spanish (in our school particularly). The purpose of the PD was introduced to participants by highlighting the importance of global warming that is constantly mentioned in science articles, educational sources and on television. Science communities consistently perform the number of studies that include data collection on average temperatures, global ice pattern reduction and possible future sea level rise to show that global warming is already taking place and causes major changes in weather patterns around the world. As we are getting used to the news that our planet is warming up, dramatic consequences come along with the process. Thus, our Earth continues to warm up and people in various corners of the world are experiencing devastating effects such as destructive tropical cyclones, intensive and severe droughts, strong rainstorms and deadly heat waves. Importantly, scientific predictions show that warmer temperatures cause Arctic regions ice to melt what might lead to an extreme sea level rise (up to 3 m). Such consequence can possibly cause destructions of the historic and precious natural environments, and take away people's homes (https://www.climaterealityproject.org/blog/why-should-you-care-about-climate-crisis).

In order to show educators how data enhances learning about climate change in PBL, I displayed the worksheets and graphs that were completed by 6th graders prior to the PD.

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Students had to follow the requirements for "Graphing global temperature trends" activity from NASA Jet Propulsion Laboratory: https://www.jpl.nasa.gov/edu/teach/activity/graphing-global-temperature-trends/ and complete the activities & questions, additionally prepared by the teachers. The main purpose of the lesson was to allow learners to investigate if global warming is taking place on our planet by analyzing actual data. All the PD participants on another hand had some time to review student work, complete same task by following the required steps and provide constructive feedback.

What activities were implemented in the PD?

Before the PD started, all the participants and educators were grouped (4-5 people in each) according to their content areas or field of interest. Each group received few copies of the completed student worksheets & temperature graphs, 2 chrome books and empty assignment sheets with data sets to perform the activity on their own. Together with their group mates, participants had to evaluate student work by completing the following questions (and discussing with one another within their table):

1. What methods of teaching differentiation were used for the particular lesson?

2. What types of activities did you find useful that you can incorporate in your classroom (or in your content area)?

3. Did you find data useful for the particular lesson? Explain:

4. Do you think that students were successful while learning about climate change from this lesson?

After the first part of the activity, all PD participants received a copy of an empty student worksheet and had 5-7 minutes to go through the reading & assigned questions prior to the actual data assignment (the worksheet can be found after the outcome- PD reflection section). The second step was to explain how the data should be plotted on the graph (each group received 10 years of data to try with). These steps were followed when the instructions were given:

1. Open your chrome book, log- in to your ADS email and follow the link from NASA Jet Propulsion Laboratory that is shared with you (https://www.jpl.nasa.gov/edu/teach/activity/graphing-global-temperature-trends/)

2. Together with your group mates determine vertical and horizontal scales to evenly space and distribute data

3. Write down the temperature averages numbers for the time period that you received and plot them on your graph (x- axis for years, y- axis for temperature averages)--→8-10 minutes

4. Let's bring all graphs together and to see & analyze what we got

5. What pattern do you see on the graph? Did the temperatures actually change as a result of global warming?

6. Look through the reflection section in the student worksheet. Try to answer questions 1 & 2.

When both previously described activities were completed, PD participants got the few minutes to share their thoughts on this personal development session and provide a feedback by stating pros& cons that they came up with. It was required for all educators to complete the following PD reflection form at the end:

PD reflection form:

Please complete this PD reflection form. We are keeping track of our performance, as we want to ensure that we do the best possible job to meet your needs.

1. Email address:
2. Name:
3. **PD title:** March 2, 2018- Data- enhanced investigations of climate change in science classroom (1:10- 2:40 pm)
4. **Facilitator:** Nataliya Melnyk
5. **The topics covered met your expectations.** *
   A. Strongly Agree
   B. Agree
   C. Disagree
   D. Strongly Disagree
   E. N/A
6. **The Power point was useful.** *
   A. Strongly Agree
   B. Agree
   C. Disagree
   D. Strongly Disagree
   E. N/A
7. **The facilitator modeled good teaching strategies.** *
   A. Strongly Agree
   B. Agree
   C. Disagree
   D. Strongly Disagree
   E. N/A
8. **I can use some of the teaching strategies I observed with my students.** *
   A. Strongly Agree
   B. Agree
   C. Disagree
   D. Strongly Disagree
   E. N/A
9. **I found this PD valuable.** *
   A. Strongly Agree
   B. Agree
   C. Disagree

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D. Strongly Disagree
E. N/A

10. **The facilitator presented the material in a clear and understandable manner.** *
A. Strongly Agree
B. Agree
F. Disagree
G. Strongly Disagree
H. N/A

11. **The facilitator was prepared to teach this PD.** *
A. Strongly Agree
B. Agree
C. Disagree
D. Strongly Disagree
E. N/A

12. **What did you learn from this PD?**

13. **What will you do differently as a result of this PD?**

14. **How and when will you have an opportunity to put these practices into place?**

15. **What supports will you need to implement these changes?**

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* Reflection section:

What was the outcome of the PD?

According to "From Good Teachers to Great Teaching" article by Fulton (2011), teachers nowadays have the complex set of responsibilities to develop the skills and knowledge that are required in order to prepare students to our quickly- changing societies. As educators also have to adapt to this rapidly- changing world filled with innovative technologies, it becomes a necessity to acquire the skills to differentiate the instruction while delivering the content to students with the various learning needs (Jenkins & Yoshimura, 2010). Thus, it is mainly important to incorporate different interactive activities based on real- life data so our learners can easily understand the purpose of studying the particular information. From my perspective of view, my PD was successful since it allowed all the participants to complete the interactive, higher- order thinking activity and in addition showed to the advantage of using data. Students (that completed the activity prior to PD) at the same time were actively engaged and claimed that this graphing task dragged their attention to climate change topic. They were excited to learn more about global warming in the nearest future. Additionally, I received a lot of positive comments on the content and pedagogy from the teachers and our admin team. Lastly, the head of science department asked me to repeat this PD or come up with the similar one in order to train the upcoming science teachers. I am satisfied with the work that I did and definitely looking forward to develop more organizational skills in order to share engaging learning practices & knowledge with the others.

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- **Worksheet sample: this worksheet was used during the PD** (it also includes all content questions on climate change that teachers and PD participants were focusing on)**:**

Aim: How do we recognize global temperature trends changing due to global warming?

Do now: Answer the following questions:

1. What is the difference between climate and weather? What are main factors that determine weather on Earth?

_____
_____
_____
_____

2. What is the greenhouse effect? Does the greenhouse effect have a positive or negative effect in our planet? Explain

_____
_____
_____
_____
_____

Weather and climate are two frequently confused terms that refer to events with broadly different spatial and time scales. **Weather refers to atmospheric conditions that occur locally over short periods of time – from minutes to hours or days.** Familiar examples include rain, snow, clouds, winds, floods or thunderstorms. Remember, weather is local and short-term. **Climate, on the other hand, refers to the long-term regional or even global average of temperature, humidity and rainfall patterns over seasons, years or decades.** Climate is regional or global and long-term; weather is local and short-term. Erratic weather in your neighborhood – whether rain or drought – may or may not be a symptom of global climate change. To know, we must monitor weather patterns over many years.

What is global warming?

Global warming refers to the upward temperature trend across the entire Earth since the early 20th century – and most notably since the late 1970s – due to the increase in fossil-fuel emissions since the beginning of the Industrial Revolution. Though there are many different greenhouse gases, carbon dioxide, or CO2, is the one that has been on the rise during the last

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century. Since the beginning of the Industrial Revolution, the concentration of CO2 in the atmosphere has increased by 39 percent. Increasing the concentration of greenhouse gases causes the Earth greenhouse to overheat. Worldwide since 1880, the average Earth surface temperature has gone up by about 1.4 degrees Fahrenheit (0.8 degrees Celsius) relative to the mid-20th-century baseline (measured between 1951 and 1980).

Together let's watch and discuss the following video:

https://www.youtube.com/watch?list=PL9TFrgFq75552g7qVa-iTOeuo7Fy11o5f&time_continue=3&v=nAuv1R34BHA (Name of Vid)

What did you learn from the video? Write & share your thoughts with your partner:

Climate change refers to a broad range of global phenomena created predominantly by burning fossil fuels, which add heat-trapping gases to Earth's atmosphere. These phenomena include the increased temperature trends described by global warming, but also encompass changes such as sea-level rise; ice-mass loss in Greenland, Antarctica, the Arctic and mountain glaciers worldwide; shifts in flower and plant blooming; and extreme weather events.

Climate change is driven by an increase in global temperature. But how do we know global temperatures are on the rise? We analyze temperature data, including daily temperature readings and monthly or annual average temperatures.

https://climate.nasa.gov/vital-signs/global-temperature/

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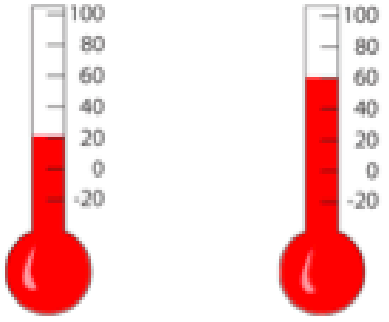
Graphing global temperatures:



For the following activity you will get a chance to use global temperature data to create models and compare short- term trends and long- term trends. With your group mates you will then determine whether global temperature is rising based on data:

1. On your desk your group received a table data set.

2. The data file for this activity contains 137 years of average global annual temperature measurements. Your group will be assigned to use 17 years portion of the previously mentioned data set.

Years assigned to my group: _____

3. You have a graph paper on the next page where with your group mates you will have to determine appropriate vertical and horizontal scales:

- *Tips for vertical/ horizontal scale determination:* determine the range of data by subtracting the maximum and minimum temperature values (e.g. 14.87- 13.54 = 1.33) + follow demonstration on the board.

4. Plot the data and make sure that your group is using the consistent scale. A consistent scale allows data to be combined seamlessly and accurately.

5. After plotting the data, your group will combine your sheet with the other groups and will complete class puzzle together to display and analyze data for the period 1880-2016. You will then determine trends and patterns & will identify if temperature increased in recent times.

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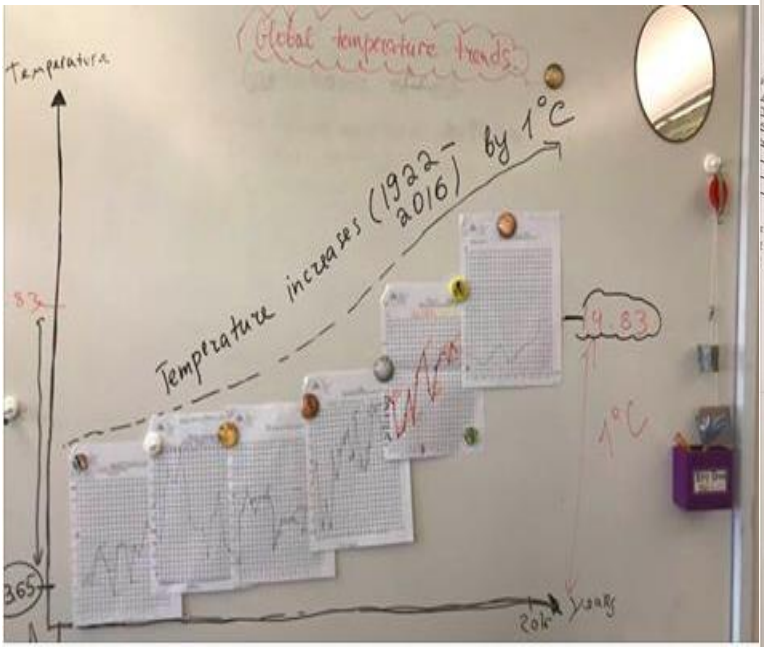
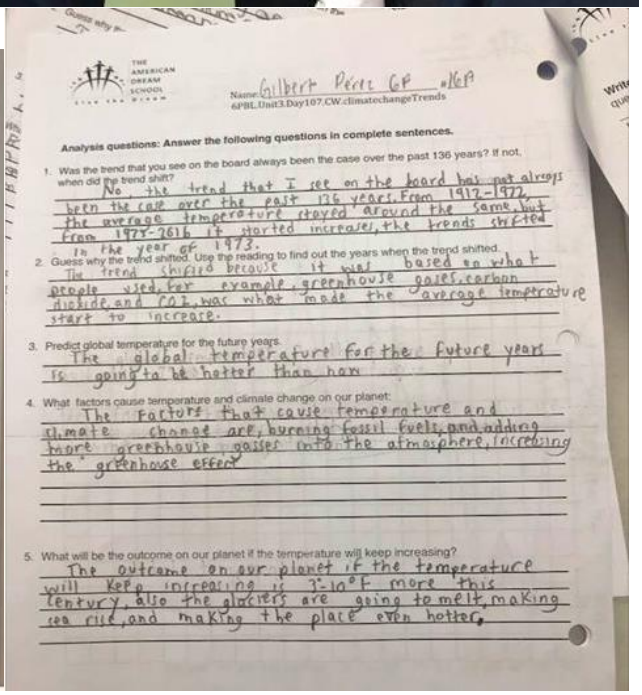
Some of the pictures from graphing activity and PD:





Name: Gilbert Perez GP #6?
6PBL_Unit3.Day107.CW.climatechangeTrends

Analysis questions: Answer the following questions in complete sentences.

1. Was the trend that you see on the board always been the case over the past 136 years? If not, when did the trend shift?
No the trend that I see on the board has not always been the case over the past 136 years. From 1922-1972, the average temperature stayed around the same, but from 1973-2016 it started increase, the trends shifted in the year of 1973.
2. Guess why the trend shifted. Use the reading to find out the years when the trend shifted.
The trend shifted because it was based on what people used, for example, greenhouse gases, carbon dioxide, and CO2, was what made the average temperature start to increase.
3. Predict global temperature for the future years.
The global temperature for the future years is going to be hotter than now.
4. What factors cause temperature and climate change on our planet:
The factors that cause temperature and climate change are, burning fossil fuels, and adding more greenhouse gasses into the atmosphere, increasing the greenhouse effect.
5. What will be the outcome on our planet if the temperature will keep increasing?
The outcome on our planet if the temperature will keep increasing is 3-10°F more this century, also the glaciers are going to melt, making sea rise, and making the place even hotter.

-→ Our science department enjoying the activity (everyone looks super- funny since we had a superhero day on the day of the PD and did dress up for the kids ☺)

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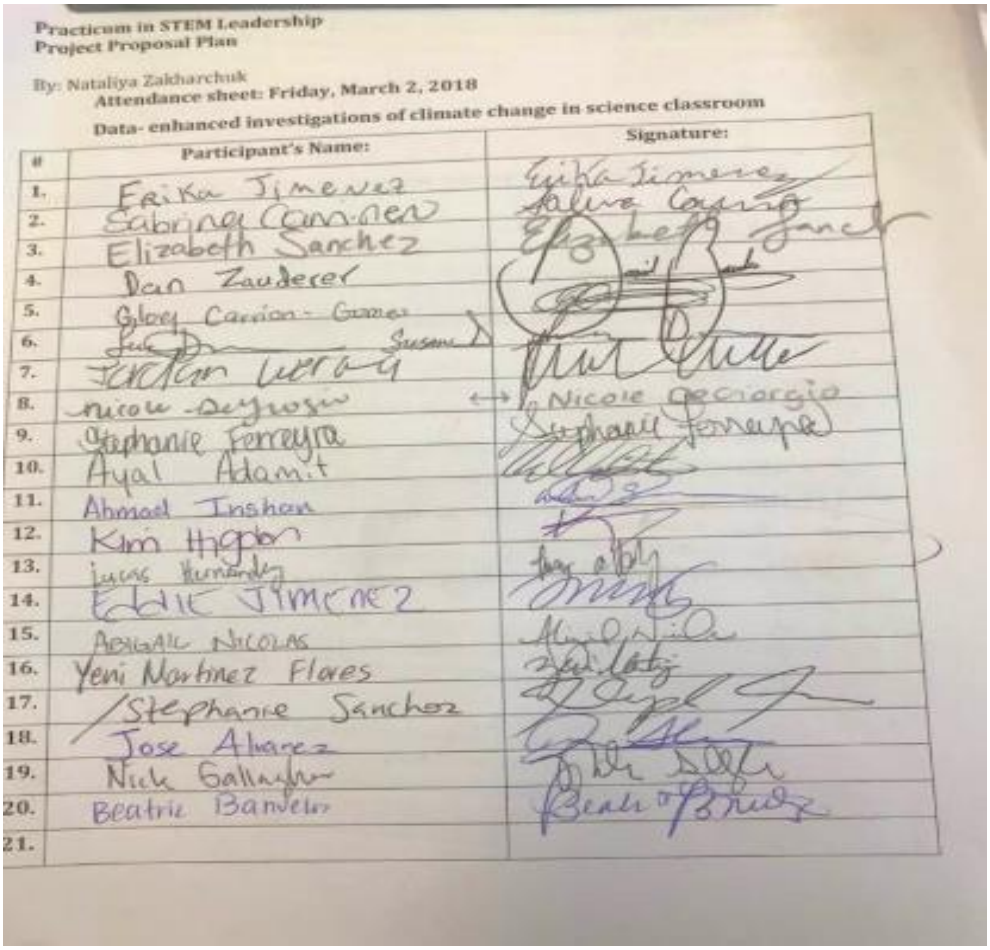

Practicum in STEM Leadership
Project Proposal Plan

By: Nataliya Zakharchuk
Attendance sheet: Friday, March 2, 2018
Data- enhanced investigations of climate change in science classroom

#	Participant's Name:	Signature:
1.	Erika Jimenez	Erika Jimenez
2.	Sabrina Cannon	Sabrina Cannon
3.	Elizabeth Sanchez	Elizabeth Sanchez
4.	Dan Zauderer	[illegible]
5.	Gloria Carrion-Gomez	[illegible]
6.	[illegible] Susana D	[illegible]
7.	Jordan Lerma	[illegible]
8.	Nicole Deyrosier	Nicole Deciorgio
9.	Stephanie Ferreyra	Stephanie Ferreyra
10.	Ayal Adamit	[illegible]
11.	Ahmad Inshan	[illegible]
12.	Kim Higgins	[illegible]
13.	Lucas Hernandez	[illegible]
14.	Eddie Jimenez	[illegible]
15.	Abigail Nicolas	[illegible]
16.	Yeni Martinez Flores	[illegible]
17.	Stephanie Sanchez	[illegible]
18.	Jose Alvarez	[illegible]
19.	Nick Gallagher	[illegible]
20.	Beatriz Banuelos	[illegible]
21.		

---→ Attendance sheet

References:

1. Fulton, K. & Briton, T. (2011). STEM Teachers in Professional Learning Committees: From Good Teachers to Great Teaching
2. Jenkins, A.A. & Yoshimura, J. (2010). Teaching Exceptional Children, 42(5), 36-43