About the WP (Working Paper) series on the Math Stagnation Nations (& what MMU1 can do about this quickly)
By Dongchan Lee

This paper is a part of the WP (Working Paper) series by Dongchan Lee about the math stagnations in the OECD, all the developed English-speaking or the majority of the Latin American countries.

In the WP series on the math stagnation nation series, for the USA, we observed and analyzed the following in part 1-5 in the USA series:

1) the math stagnations of the OECD countries, including the USA internationally (from the PISA 2000-2015, TIMSS 1995-2015);
2) the math stagnations of the 50 USA states;
3) the math stagnations of at least 85-90% of the big cities (or school districts) that have participated in the TUDA program of NAEP;
4) the math stagnations vs. the Common Core math for the NAEP math dips in 2015. Regardless of the Common Core math, the math stagnations are here to stay.
5) They key summaries of this series and beyond.

NOTE: throughout the math stagnation nations series, we use the yellow arrows for the MMU1 impacts to easy visual comparisons to the traditional quasi-flat growth over 10-20 years.

To boost the math poverty (math poorest 25 percentile) to the math prosperity (math richest 25 percentile)

Math saturations of all English-speaking countries

Lee’s online repository to get updates about the WP series on “Math Stagnation Nations”
http://uslgoglobal.com/wp-math-stagnation/
WP series: Mathematics Stagnation Nation series for the USA (Part 3)
The collective Math stagnations of the grades 4th and 8th in the big cities (or the School Districts based on TUDA of NAEP) of the USA over the 1 decade: their confirmations, time lags, math poverty shares, and the roles of the Common Core math

By Dongchan Lee (Date: February 7, 2017. Version 1.2)

Abstract

In this short paper whose charts were directly borrowed from the NAEP website on the National Report Cards, I noticed some very striking features about the national and state math stagnations in the USA, especially for 2005-2015 during which most of the citywide math stagnations seemed to have taken place. We examined the NAEP math data from 2003 to 2015 for the math grades 4 and 8 from 21 big cities (or districts). Although there are some variations with the time lags of perhaps 2-4 years (Los Angeles or Chicago) or even 6 years (for the case of District of Columbia), there were strikingly consistent, emerging patterns about the math stagnations. The overall math stagnations took their roots around 2005 for the math grade 4 and this was observed for the math grade 8 in about 4 years later and this was very consistent in almost all TUDA participating cities and districts. Thus the main outline for the stagnations were 2005-2009. The conclusion after examining the 21 cities is that 18 of them have confirmed the hypothesis of the math stagnations already by 2015. So the confirmation of the hypothesis of the math stagnations in all these cities is at least 86% and most likely 90-100% will be by 2017-2019 most likely. The math stagnations are here across the USA even in the city and district levels and very unlikely to go away. We discussed the implications of about 4 year time lags impacting the math stagnations to grade 8 with the implications of the Common Core math standards of the USA 2011-2015.

Critical Note: Throughout in this observational report with timelines from the NAEP math scores, all the data were gathered from NAEP’s The National Report Card data. As such, all the data 1990-1996 had “Accommodations Not Permitted” while the data from 2000 on, I used the data with the Accommodations Permitted.

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Key words: Math stagnations, math crisis, USL, MMU1, math education innovation. Education reforms, math crisis in the United States

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Introduction

Districts gains and losses of NAEP math between 2013 and 2015 from the 21 cities or districts data for the TUDA.

Please note first of all that in 2013-2015 for the chart below, there was absolutely no city whose math grew for both grade 4 and 8. For the math grade 4, about half of them are stagnating and the other half are getting worse while only 3 cities are increasing still (although negligibly and most likely as a brief gains and not much more). For the math grade 8, they are all stagnating while 2 cities are getting worse and only 1 increasing still (although negligibly). What do these mean?
As I have demonstrated immediately after this section, the time lag between the math grade 4 and math grade 8 is estimated to be about 4 years. Due to the math grade 4 pattern of half of them stagnating and the other half getting worse, we will see more tangible declines in the math grade 8, starting in 2017 and then to 2019 NAEP math results because the roughly even distributions of math stagnations vs. the math declining in the math grade 4 will spill over to the math grade 8 in 2 to 4 years obviously because this pattern has been confirmed in almost all 22 cities that have participated in NAEP’s TUDA program.

Furthermore, few cities that happened to gain a bit from 2013-2015 time zone are very likely stagnate and start declining at least according to the overall overwhelming patterns of the past a decade as I present here.

Sources:

1) For the NAEP math grade 4:

2) For the NAEP math grade 8:
4th grade math (2003-2015), but pay attention to primarily to 2005-2015 because that is where the quasi-plateaus of the math growth stagnations are prominent in most of the participating districts and cities.

NOTE: the cities or districts are listed in the alphabetical order.

My presentation format for the 21 cities or districts of the USA for TUDA here:

For each participating city (or districts), each page consists of 3 rows: on the top row, we put the timelines of the math growths of the 4th grade math. On the second row, we put the timelines of the math 8th grade. On the bottom 3rd row, we put the math percentile distribution growths: for the 4th grade to the left and for the 8th grade to the right.

As the NAEP measures the math growths of the grades 4 and 8, I expected some 4 years of math stagnations’ time delays for the 8th grade math compared to the grade 4 math and this has been 86-95% confirmed in this observation paper.

A very critical note about the 2 types of the 4 year time lags: Since there are 4 years of gaps between the grade 4 and the grade 8, we found interesting pattern: 1) overall, the math growth saturations of the math average scores started around 2005-2007 for the grade 4. The math saturation for the grade 8 in each city seemed to kick in with about 4 years of time lag. You should carefully observe this pattern; 2) the math poverty 25 percentile closely mimics the 4 year time lags for about 90% of the time.

This is a more concrete indication that the math stagnations in the city or district levels are real, not just for the state or national level. So for the grade 4, the nationwide math stagnations kick in around 2005-2007 and subsequently the math stagnations of the grade 8 kicks in about 4 years later around 2009-2011 although there are variations of course.
USA national NAEP math average stagnations with about 4 years of time lag between the grade 4 and the grade 8:

We can see clearly the stagnations kicks for the grade 4 by around 2005-2007 and for the grade 8 by around 2009-2011 about 4 years after the stagnation kicked in for the grade 4.¹

¹ We decided not to use a concrete definition for the math stagnations as it is obvious for anyone to see visually in the timeline charts that the stagnations are present without a doubt.
For the nationwide large city average, math Grade 4 timeline, the saturation may have arrived around 2013-2015; so the 4 year time lag cannot be observed yet in 2015.\(^2\)

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\(^2\) As mentioned for the format of the presentation of this paper, from here on, the first row is for the math grade 4 and the second row is for the math grade 8.
20 big cities (or districts) of the USA to participate in TUDA of the NAEP: their math average stagnations for the grade 4 vs. grade 8 (confirmed 90-100% already by 2015) Albuquerque (confirming math saturation hypothesis; actually getting worse)

Albuquerque joined in 2011 and already have declined past 4 years as you can see clearly here.
Atlanta (confirming math saturation hypothesis), expecting decline in math grade 8 in 2017

Trend in fourth-grade NAEP mathematics achievement-level results for public school students in Atlanta

<table>
<thead>
<tr>
<th>Year</th>
<th>Basic</th>
<th>Proficient</th>
<th>Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>56</td>
<td>39</td>
<td>21</td>
</tr>
<tr>
<td>2012</td>
<td>54</td>
<td>41</td>
<td>22</td>
</tr>
<tr>
<td>2011</td>
<td>54</td>
<td>41</td>
<td>22</td>
</tr>
<tr>
<td>2009</td>
<td>57</td>
<td>42</td>
<td>23</td>
</tr>
<tr>
<td>2007</td>
<td>39</td>
<td>41</td>
<td>22</td>
</tr>
<tr>
<td>2005</td>
<td>43*</td>
<td>40</td>
<td>23*</td>
</tr>
<tr>
<td>2003</td>
<td>50*</td>
<td>37</td>
<td>24*</td>
</tr>
</tbody>
</table>

Trend in eighth-grade NAEP mathematics achievement-level results for public school students in Atlanta

Percentage at or above basic

<table>
<thead>
<tr>
<th>Year</th>
<th>Basic</th>
<th>Proficient</th>
<th>Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>45</td>
<td>31</td>
<td>19</td>
</tr>
<tr>
<td>2013</td>
<td>46</td>
<td>32*</td>
<td>14</td>
</tr>
<tr>
<td>2011</td>
<td>46</td>
<td>32*</td>
<td>14</td>
</tr>
<tr>
<td>2009</td>
<td>54</td>
<td>34</td>
<td>12*</td>
</tr>
<tr>
<td>2007</td>
<td>53*</td>
<td>26*</td>
<td>15*</td>
</tr>
<tr>
<td>2005</td>
<td>69*</td>
<td>26*</td>
<td>15*</td>
</tr>
<tr>
<td>2003</td>
<td>72*</td>
<td>24*</td>
<td>14*</td>
</tr>
</tbody>
</table>
Austin (confirming math saturation hypothesis)

Austin’s math grade 4 has been flat earlier since 2003 already and the grade 8 declining for 6 years already.
Baltimore City has been declining for both math grade 4 and 8 since 2011 already (confirming math saturation hypothesis), time lag (missing as both of the grade 4 and 8 are declining together).
**Boston** (confirming math saturation hypothesis), time lag (confirmed): the grade 4 saturation around 09 and the grade 8 saturation around 11-13.

![Graph showing trend in average scores for eighth-grade public school students in NAEP mathematics, by jurisdiction.](image)

*Significantly different (p < .05) from 2013.*

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**Trend in fourth-grade NAEP mathematics achievement level results for public school students in Boston**

<table>
<thead>
<tr>
<th>Year</th>
<th>Basic</th>
<th>Proficient</th>
<th>Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>22</td>
<td>33</td>
<td>20</td>
</tr>
<tr>
<td>2011</td>
<td>18</td>
<td>35</td>
<td>15</td>
</tr>
<tr>
<td>2012</td>
<td>10</td>
<td>35</td>
<td>15</td>
</tr>
<tr>
<td>2013</td>
<td>21</td>
<td>50*</td>
<td>20*</td>
</tr>
<tr>
<td>2014</td>
<td>21</td>
<td>50*</td>
<td>20*</td>
</tr>
</tbody>
</table>

**Percentage of above basic**

| 2010 | 78   |
| 2011 | 81   |
| 2012 | 81   |
| 2013 | 72** |
| 2014 | 50** |

---

**Trend in eighth-grade NAEP mathematics achievement level results for public school students in Boston**

<table>
<thead>
<tr>
<th>Year</th>
<th>Basic</th>
<th>Proficient</th>
<th>Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>33</td>
<td>33</td>
<td>23</td>
</tr>
<tr>
<td>2011</td>
<td>31</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>2012</td>
<td>32</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>2013</td>
<td>35</td>
<td>35</td>
<td>25</td>
</tr>
<tr>
<td>2014</td>
<td>55</td>
<td>35</td>
<td>25</td>
</tr>
</tbody>
</table>

**Percentage at or above basic**

| 2010 | 67   |
| 2011 | 67   |
| 2012 | 67   |
| 2013 | 67   |
| 2014 | 67   |

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*Significantly different (p < .05) from 2013.*
Charlotte (confirming math saturation hypothesis), 4 year time lag (confirmed): grade 4 saturation 09-11 and the grade 8 saturation 13-15.

NOTE: for Charlotte, the math stagnation kicked in earlier by 2003 for Gr 4 and by 2007 for Gr 8.
Chicago (not confirming yet as the math saturation hypothesis with a notable delay), for 4 year time lag, we may see the saturations of math grade 8 around 17-19 as the math grade 4 saturation seemed to start around 2015. NOTE: the math stagnations are kicking in several years later than the national average, starting about 2011-2013 instead of 2005-2009.

Chicago • Illinois • Large City • Nation (Public)

* Significantly different (p<.05) from 2015.
Cleveland (confirming math saturation hypothesis), 4 year time lag: grade 4 saturation by 07 and the grade 8 saturation 09-11.

Trend in average scores for eighth-grade public school students in NAEP mathematics, by jurisdiction.

* Significantly different ($p < .05$) from 2015.

**Percentage at or above proficient level**

<table>
<thead>
<tr>
<th>Year</th>
<th>Below Basic</th>
<th>Basic</th>
<th>Proficient</th>
<th>Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>40</td>
<td>43</td>
<td>53</td>
<td>1</td>
</tr>
<tr>
<td>2016</td>
<td>41</td>
<td>43</td>
<td>53</td>
<td>1</td>
</tr>
<tr>
<td>2017</td>
<td>42</td>
<td>43</td>
<td>53</td>
<td>1</td>
</tr>
<tr>
<td>2018</td>
<td>43</td>
<td>43</td>
<td>53</td>
<td>1</td>
</tr>
<tr>
<td>2019</td>
<td>44</td>
<td>43</td>
<td>53</td>
<td>1</td>
</tr>
<tr>
<td>2020</td>
<td>45</td>
<td>43</td>
<td>53</td>
<td>1</td>
</tr>
<tr>
<td>2021</td>
<td>46</td>
<td>43</td>
<td>53</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Below Basic</th>
<th>Basic</th>
<th>Proficient</th>
<th>Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>40</td>
<td>43</td>
<td>53</td>
<td>1</td>
</tr>
<tr>
<td>2016</td>
<td>41</td>
<td>43</td>
<td>53</td>
<td>1</td>
</tr>
<tr>
<td>2017</td>
<td>42</td>
<td>43</td>
<td>53</td>
<td>1</td>
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<tr>
<td>2018</td>
<td>43</td>
<td>43</td>
<td>53</td>
<td>1</td>
</tr>
<tr>
<td>2019</td>
<td>44</td>
<td>43</td>
<td>53</td>
<td>1</td>
</tr>
<tr>
<td>2020</td>
<td>45</td>
<td>43</td>
<td>53</td>
<td>1</td>
</tr>
<tr>
<td>2021</td>
<td>46</td>
<td>43</td>
<td>53</td>
<td>1</td>
</tr>
</tbody>
</table>
Dallas (not quite confirming math saturation hypothesis), 4 year time lag: for the grade 4, the 2015 had a bit of growth, but for the Below Basic, both grades 4 and 8 have reached the saturations.

Dallas joined in 2011 and by 2011 the math stagnation had taken place already.
Detroit (confirming math saturation hypothesis), time lag: for the grade 4, the saturation around 11 started and for the grade 8, there have been fluctuations since 2009 with the seeming simultaneously without time delays. Note: Detroit joined a bit later in 2009 and by 2009-2011, their math stagnation seemed to have taken place.
District of Columbia (DCPS) (NOT EXACTLY confirming) math saturation hypothesis, but by 2013-2015, it has significantly slowed down its math growth, but the grade 8 had a dip actually earlier than the grade 4; as the grade 4 had been growing still till 2015, we cannot deal with the 4 year time lag yet.
Duval (cannot either confirm or deny the math saturation hypothesis because it joined in 2015) 
Note: Duval average is basically aligned with Florida average, which had been stagnating for a decade or so. So the chances are that it had been stagnating similar to the Florida average.
Fresno (confirming math saturation hypothesis), time lag is hard to confirm as the saturation had been in pace in 2009 when it joined.

Note: Fresno joined in 2009, but by then its math stagnations had taken place already.
Hillsborough (FL) (confirming math saturation hypothesis by the year 2011 it joined), 4 year time lag (irrelevant as the grade 8 dipped in 2015 before the dip of the grade 4).
Houston (confirming math saturation hypothesis), 4 year time lag (confirmed as the grade 4 saturation starting 09-11 and the grade 8 had 13-15 saturation and even the dip in 2015).

Note: by 2005-2007, the math saturation became real.
Jefferson country (confirming math saturation hypothesis) when Jefferson county (KY) joined a bit later in 2009 and by then the math stagnations had taken place already, time lag (irrelevant as both grades 4 and 8 had been saturation by 2009).
Los Angeles (confirming math saturation hypothesis with about 4 years of time delay), the math stagnations seem to have taken place by 2007-2011 for the grade 4, and for the grade 2-4 years by 2013.
Miami-Dade (confirming math saturation hypothesis), by the time Miami-Dade joined in 2009, the math stagnation had taken root without the need for the 4 year time lag issue.
New York City (confirming math saturation hypothesis), 4 year time lag was confirmed to, following the typical 2005-2009 route as the grade 4 saturation around 2007-2009 and the grade 8 in 2009-11.
Philadelphia (confirming math saturation hypothesis), 4 year time lag is here tricky because the 4th grade started declining in 2013 and this may be reflected in the grade 8 declining in 2017 later. Philadelphia joined in 2009 and by then the math stagnations had taken place and declining noticeably past 4 years, not just stagnating.
San Diego (confirming math saturation hypothesis), the time lag for the grade 8 saturation may come around 2017-2019 as the saturation for the grade 8 seemed 2013-2015.

Trend in average scores for eighth-grade public school students in NAEP mathematics, by jurisdiction

Trend in fourth grade NAEP mathematics achievement level results for public school students in San Diego

Trend in eighth grade NAEP mathematics achievement level results for public school students in San Diego

* Significantly different (p < .05) from 2015.
Table for the confirmations or denials of the Math stagnations and about 4 year time lags

Math stagnations typically starting around 2005 in the grade 4 and 2009 for the grade 8

<table>
<thead>
<tr>
<th>Concrete Confirmations from 16 cities with the stagnations or even declines</th>
<th>Alphabetical order for the cities that have participated since 2003</th>
<th>the math saturation of the grade 8 with the 4 year time lag after the grade 4 (excluding the irrelevance of those that joined 2009 on)</th>
<th>Cities that joined TUDA later</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete Confirmations from 16 cities with the stagnations or even declines</td>
<td>Albuquerque, Atlanta, Austin, Boston, Charlotte, Cleveland, Dallas, Detroit, Hillsborough (FL), Houston, Jefferson country (KY), Miami-Dade, New York City, Philadelphia, San Diego</td>
<td>Austin, Boston, Charlotte, Cleveland, Houston, Los Angeles, New York City.</td>
<td>(those joined later and saturations already: Albuquerque, Baltimore City, Jefferson Country, Miami-Dade)</td>
</tr>
<tr>
<td>2 Partial confirmations with several years of delays</td>
<td>Chicago (since around 2011), Los Angeles (with 4 years delay than usual)</td>
<td>Atlanta, San Diego</td>
<td></td>
</tr>
<tr>
<td>Expecting the 8 grade saturations or declines 2017-2019</td>
<td>Chicago, Dallas, District of Columbia, Fresno, Hillsborough, Philadelphia</td>
<td>Chicago, Dallas, District of Columbia, Fresno, Hillsborough, Philadelphia</td>
<td>Duval (joined in 2015; so cannot decide), Dallas and Hillsborough joined in 2011, Philadelphia joined in 2009</td>
</tr>
<tr>
<td>Twilight zones</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Denials (but the signs are up)</td>
<td>District of Columbia (DCPS),</td>
<td>Detroit</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: For some cities where the math stagnations kicked in earlier, e.g. Charlotte, the timeline was 2003-2007. For a few cities that had the math stagnations later by 2-4-6 years were those that had been in near the math bottom of the USA, e.g. DC, Los Angeles, and Chicago. This was because they had more time to have math growths till they have reached their saturation levels.

Implications:
What do all these mean?

1) Out of 21 cities in analysis, 18 cities have confirmed the math growth saturations and the 3 unconfirmed may well be other way for the confirmations as these 3 have slowed down their growths in the final 2013-2015 time frame.

2) 4 years of the time lag of saturations between the grade 4 and 8 of math at the big city levels seemed to have 6 in twilight zone still for the observations, 2 cities to expect to confirm in a few years, and only Detroit alone seems to be against this pattern concretely. As of now, the rule of thumb confirmation of the 4 year delay rule seems about 60-70% by 2015 while there are some pending ones.
3) If the 4 year time lag of saturations between the math grade 4 and 8 becomes real, what does this mean? This means that mathematics as a cumulative subject, the math growths of the earlier years (e.g. grade 4) will really add up to the later grades quasi-inevitably. This also means that the math poverty of the earlier grades will haunt the rest of the upper grades. This means that the education policymakers should assure that the math poverty reductions take place as early as possible without delays because the math poverty add up like snowballs as year go by.

4) By 2015, the majority of these cities have experimented with the Common Core standards earlier, but 90-100% of them slowing down with nothing fundamentally gaining means that the Common Core standards at least by mid-2015 had miserably failed.

5) The overall math stagnations between the math averages vs. the math 25 percentiles have had very tightly mimicking growth patterns, which is similar to the patterns observed in PISA math. This means all put together that to radically reduce the math poverty should be prioritized.

Conclusion
We have shown that the math stagnations in the 21 TUDA participating cities (or districts) have been at least 86% confirmed already and may be 95-100% confirmation by 2017-2019 most likely. As such the math education policymakers should take some radically new approaches to overcome the current math stagnations of their nations (although the author focused only on the USA math stagnations in this paper) because the traditional approaches simply fail to overcome the juggernauts of the math stagnation nation phenomenon. Furthermore, the 4 year time lag implies that the math is a cumulative subject and earlier grade math materials should be mastered because the lack of the mastery earlier will have the snowball effects to impact the later grades’ math growths as evidenced by the 4 year time lag rule of thumb for the NAEP math grade 8 scores.

References

National or state or city or district level math assessment timelines


3) For the NAEP math grade 4 (accessed on January 5th, 2017):
4) For the NAEP math grade 8 (accessed on January 5th, 2017):

International level math assessment timelines


1) Lee, Dongchan. 2017 February. WP series of “Mathematics Stagnation Nations” for the USA, Australia, New Zealand, UK, and Ireland and most Latin American countries (Part 1). “Math stagnation nations of all 5 developed, English-speaking countries according to PISA and TIMSS for the past 15-20 years of the math growth history: what this means for education and economy”


3) Lee, Dongchan. 2017 February. WP series of “Mathematics Stagnation Nations” for the USA (Part 3). The collective Math stagnations of the grades 4th and 8th in the big cities (or the School Districts based on TUDA of NAEP) of the USA over the 1 decade: their confirmations, time lags, math poverty shares, and the roles of the Common Core math (http://vixra.org/abs/1702.0101)

4) Lee, Dongchan. 2017 February. WP series of “Mathematics Stagnation Nations” for the USA (Part 4). Math Education Stagnations in the USA played more roles than the Common Core Math Standards impacts for the stagnations on the NAEP math 2015, but the Math dipping were most likely due to CCSS Math (http://vixra.org/abs/1702.0097)

5) Lee, Dongchan. 2017 February. WP series of “Mathematics Stagnation Nations” for the USA (Part 5). The quasi-universal math stagnations in almost all developed countries are real and won’t go away. How to transcend them with MMU1 or at least 1/3 of its full version in just 2-4 years


4) Lee, Dongchan. 2017 February. 8 point executive summary: math stagnations and the Economic impacts of MMU1: To end the math poverty multiple times faster with MMU1 than without it (then to
achieve the POST-2015 goals of the UN multiple time faster than without MMU1)
(http://rxiv.org/abs/1702.0056)

economic impacts” (http://vixra.org/abs/1701.0485)

Some Youtube versions by Dongchan Lee

1) Lee, Dongchan. 2017. “Math edu crisis in most of the USA states and what MMU1 can do”
https://www.youtube.com/watch?v=qizW2GnNLXQ
2) Lee, Dongchan. 2017. “Math EDU crisis in most of the USA states Part 2 and what MMU1 can
do” https://www.youtube.com/watch?v=vB7LcMLVWs4

Lee’s online repository to get updates about the WP series on “Math Stagnation Nations”
http://uslgoglobal.com/wp-math-stagnation/