

# **The Model Career Challenge: Math at Work**

## **Final Report**

### **Executive Summary**

The Career Challenge: Math at Work program was designed to support middle school math and/or CTE teachers in creating their own career-integrated, math-centered units using real-world, problem centered, collaborative activities that integrate math concepts, applications, and career connections within existing 5th-8th grade common core mathematical practices. A series of short webinars over five months provided a sample career challenge project, suggested connections to math and career information and lesson templates for teachers to construct their own career explorations with students in their math classes. This effort was funded through a partnership with the Illinois State Board of Education.

A total of 20 educators from across the state of Illinois participated in the Model Career Challenge (see Appendix A for list of teachers and school districts). These educators modeled the Career Challenge with over 1500 students in their classrooms. Measurable student gains were made in both attitudinal, career awareness and math content standards. Educators also expressed additional confidence in both using problem centered scenarios into their curriculum and integrating math and career awareness into their teaching.

Educators who participated in this project were able to receive:

- A model Career Challenge curriculum to use with their students that integrates mathematics with career exploration related to city planning and severe weather preparedness.
- Over six hours of online, after-school professional development on how to use the model Career Challenge and how to create their own.
- Four hours of online professional development during Aviation Day.
- Up to five Challenger Center e-missions related to mathematics and space exploration for each of their participating classes.
- Classroom technology (including a camera, microphones, and headset) to improve the ability to deliver lessons to students learning remotely.

It should be noted that this entire project was done remotely due to the COVID 19 global pandemic. All teacher professional development and much of the student instruction was completed on-line during a time in which educators were stretched to deliver all of their instruction in an ever-changing environment. This uniquely challenging situation may have had some impact on the outcomes of this project.

### **Introduction**

Middle school is a natural time for students to learn about careers and develop skills such as

problem solving, critical thinking and teamwork through career exploration activities. Research has identified middle school as a time when students can benefit the most from career exploration, a process of building self-awareness, learning about potential careers, and developing a plan for reaching future goals. Career exploration engages middle school students at a time when they are at a higher risk for disengaging from learning due to challenges in forming identity, coping with puberty and navigating new environments. CTE capitalizes on their developing abilities to think abstractly, their preferences for teamwork and active learning through relevant real-life scenarios.

([https://www.acteonline.org/wp-content/uploads/2018/02/ACTE\\_CC\\_Paper\\_FINAL.pdf](https://www.acteonline.org/wp-content/uploads/2018/02/ACTE_CC_Paper_FINAL.pdf))

This problem-centered learning experience was created to integrate career awareness along with middle school mathematics practice. Educators were invited from across Illinois and 20 teachers from 16 schools agreed to work through the activities that were provided and then create two challenges of their own. Recruitment for the program began with an outreach to schools with a low (below 70%) funding adequacy that served a high percentage of families with low income. As that outreach effort only filled half of the available slots, the remaining slots were opened to all applicants from Illinois schools serving grades 5-8.

### **Math at Work Career Challenge: Activity Development**

A series of problem-based mathematics and career activities were developed in the fall of 2020 appropriate for use in remote settings as well as in-person mathematics classrooms. The activities in this unit were designed for 1-2 weeks of classroom implementation. All materials were shared from a Google Folder.

#### **The project scenario**

In the near future, the small town of Aztlan, Illinois (population 50,000) is facing a refugee crisis. An unprecedented series of hurricanes has brought such devastation to the Atlantic and Gulf Coasts, that government agencies can no longer insure housing or support reconstruction in many coastal communities. Citizens are being encouraged to relocate to safer regions and many are headed to small midwestern cities like Aztlan. City planners expect 50,000 American refugees to settle in and around Aztlan in the next five-to-ten years, effectively doubling the population. Compounding the crises is the fact

that severe weather in the Midwest has also become more frequent. All new construction must take this reality into account.

The **City Modeling Activity** is a hands-on design activity in which each student creates a map showing one possible layout of the newly expanded city. Students examine commercial and industrial areas, public buildings, open spaces and housing patterns by housing type and residential area. They plan for a doubling of the population over the next 10 years. Teachers were provided with foam core sheets and large city maps for this activity.

Working in **Sector Teams**, students assume the roles of city planners, engineers, scientists, technicians and managers to respond to the growing population and to potential severe weather events. Students employ typical data and projections from each sector, to learn about the occupations involved and the mathematics required to find solutions. Each team is responsible for the response of a different organizational sector of the city. Those sectors are:

- Water and Waste
- Transportation
- Health and Human Services
- Government
- Food and Energy
- City Planning and Housing



The teams' work can be interrupted by the instructor with **three severe weather scenarios**. The "story" is narrated to students by a series of slide shows that model local

TV news broadcasts. The student teams are asked to determine warnings and responses to typical severe weather events (tornado, flash flood and snowstorm) in the Midwest.

**Occupational Research Assignment** allows students to explore several occupations related to their sector of city management.

A **Sample Rubric** was provided for teachers to evaluate student performance during the implementation of the model challenge.

### Connections to Mathematics Standards

The following middle school mathematics concepts were highlighted in the model challenge project.

- CC.6.RP.1 and CC.6.RP.3 Understand ratio concepts and use ratio reasoning to solve problems.
- CC.6.RP.3b Solve unit rate problems including those involving unit pricing and constant speed.
- CC.6.RP.3c Find a percent of a quantity as a rate per 100; solve problems involving finding the whole given a part and the percent.
- CC.6.NS.1 Apply and extend previous understandings of multiplication and division to divide fractions by fractions.
- CC.6.NS.2 Compute fluently with multi-digit numbers and find common factors and multiples. Fluently divide multi-digit numbers using the standard algorithm.
- CC.6.EE.2c Evaluate expressions at specific values for their variables. Include expressions that arise from formulas in real-world problems.
- CC.6.EE.7 Reason about and solve one-variable equations and inequalities.
- CC.6.G.1 Solve real-world and mathematical problems involving area, surface area, and volume.
- CC.6.SP.2 Develop understanding of statistical variability. Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.
- CC.6.SP.4 and CC.6.SP.5 Summarize and describe distributions. Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

Career Challenge: Putting Math to Work  
Project Assessment Rubric

|                                   | 4<br>Exceeds Expectations  | 3<br>Meets Expectations  | 2<br>Minimally Meets Expectations  | 1<br>Does Not Meet Expectations   | 0<br>No attempt to complete                                    |
|-----------------------------------|--|--|--|---|--|
| Completion                        | All assignments were complete  | Most of the assigned work were complete  | Less than half of the assigned work was complete   | Most of the work assigned was not complete  | Student did not turn in any assigned work                      |
| Timeliness                        | Homework was received on the due date.   | Homework was 1 day late.   | Homework was 2 days late.  | Homework was 3 or more days late  | Student did not turn in the assignments.                       |
| Mathematical Solutions            | Student provides correct solutions and strategies.   | Student provides mostly correct solutions and strategies with minor errors.  | Student demonstrates some correct thinking about solutions and strategies.   | Student shows some evidence of mathematical thinking but shows little understanding.                    | No evidence of attempting the tasks.                           |
| Application of mathematical ideas | Student demonstrates mastery of the mathematical ideas in the project and can apply the ideas to new situations. | Student demonstrates mastery of the mathematical ideas in the project and can apply the ideas in limited ways to new situations. | Student demonstrates partial understanding of the mathematical ideas or understands but cannot apply them in new situations. | Student demonstrates minimal understanding of the mathematical ideas.                                   | No evidence of understanding the mathematical ideas presented. |
| Solutions and critical thinking   | Student provides well justified solutions and thoroughly explains the thinking behind them.                      | Student provides solutions and justifies the thinking behind them.   | Student explains the thinking behind the solutions but the thinking may be hard to follow.                                   | Students offers little explanation of thinking behind solutions or what is offered does not make sense. | No evidence of developing solutions.                           |
| Collaboration                     | Exceptional work with other students to accomplish all team assignments.   | Work with the team is good but at least one team assignment was not completed.   | Work with the team is good but many team assignments were not completed.   | Work with the team is poor with many team assignments incomplete.                                       | Work with the team was not acceptable.                         |
| Total Points                      |  |  |  |   |  |

Project Total out of 24 points \_\_\_\_\_

- CC.7.RP.1, CC.7.RP.2, CC.7.RP.3 Analyze proportional relationships and use them to solve real-world and mathematical problems.
- CC.7.RP.2b Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
- CC.7.EE.4, CC.7.G.4 and CC.7.G.6 Solve real-life and mathematical problems using numerical and algebraic expressions and equations.
- CC.7.G.1 and CC.7.G.2 Draw, construct, and describe geometrical figures and describe the relationships between them.
- CC.8.EE.4 Work with radicals and integer exponents.
- CC.8.G.2 Understand congruence and similarity using physical models, transparencies, or geometry software.
- CC.8.G.7 Understand and apply the Pythagorean Theorem.
- CC.8.SP.2 Investigate patterns of association in bivariate data.

### **Educator Professional Development**

A series of short webinars over five months provided information about the model career challenge project, suggested connections to math and career information and lesson templates for teachers to construct their own career explorations with students in their math classes.

Project teachers were asked to:

- Participate in all online professional development activities.
- Use the model Career Challenge with a group of their students in the 20/21 school year.
- Conduct a brief pre-test and post-test of student knowledge on targeted mathematics standards and career awareness and report results by June 14, 2021.
- Create two career challenges of their own and deliver them by June 14, 2021 to the project managers.

In order to encourage the participants to think about the timing of their implementation of the model challenge activities, teachers were asked a series of planning questions.

1. Consider how much time would your students need to complete the various assignments of the challenge.
2. Which activities will you do and which will you have to skip due to time constraints?
3. Which activities will be done in the classroom and which at home?
4. What modifications will you make to the activities to ensure successful learning in your classes?
5. How will you assess student learning?
6. On what date will you begin the Model Career Challenge?

90% of the participants completed the survey and indicated that they planned to spend an average of 9 hours of student time on the assignments to implement the model challenge. The time varied widely depending on whether the students were remote or in-class. Educators

suggested modifications that they would need to employ for this project. Several requested materials in Spanish (which were completed and supplied to them), having students do some of the activities as homework, and reviewing mathematics skills that the students need to have in order to be successful in the project. One of the teachers also stated that she “will introduce more opportunities for students to ask questions about their scenarios and determine some assumptions that they are making as a team; relatedly, I am interested in adding more opportunities for graphing data if possible. I will also modify the news announcements to provide some space for students to react/make connections before moving into or back into sector teams. I will have students participate in a socratic seminar discussion or feedback forum on the final day where each sector will share their findings and hear feedback and connections from other groups”.

### **Professional Development Webinar Timeline**

Introduction Webinar: December 14, 2020, 4:00 to 5:00 pm

- Background, timeline, responsibilities and benefits to teachers, model career challenge components

Career Model Challenge Session 1: January 11, 2021, 4:00 to 4:30 pm

- Overview of project, educator responsibilities, project timeline

Career Model Challenge Session 2: January 12, 2021, 4:00 to 4:30 pm

- Educator and Student Surveys

Career Model Challenge Session 3: January 13, 2021, 4:00 to 4:30 pm

- Suggested guide for the model challenge activities including occupational assignment, city planning and team sector assignments

Career Model Challenge Session 4: January 14, 2021, 4:00 to 4:30 pm

- Severe weather scenarios, project assignment rubric, planning questions

Math and Careers Webinar 1: January 25, 2021, 4:00 to 4:30 pm

- Review of terminology (job, occupation, career), mathematical practices and engineering occupations

Math and Careers Webinar 2: February 22, 2021, 4:00 to 4:30 pm

- Resources for everyday math, careers that use math, career challenge development

Math and Careers Webinar 3: March 15, 2021, 4:00 to 4:30 pm

- Midwest climate overview (why Illinois is a potential place for climate refugees), math at work: using math on the job

Aviation Day: Virtual event March 26, 2021, 9:00 am to 2:45 pm (program below)

Math and Careers Webinar 4: April 19, 2021, 4:00 to 5:00 pm

- Open mic session to answer questions from participants

Math and Careers Webinar 5: May 10, 2021, 4:00 to 5:00 pm

- Review of assignments (classroom work, student post-survey, educator post-survey) and eMission certification/scheduling

**Virtual Aviation Day 2021 for Educators**, held on March 26, 2021, 9:00 am to 2:45 pm, was an opportunity for 67 K-12 teachers and school counselors to learn about aviation, discover

STEM connections and apply STEM skills related to aviation, be introduced to various aviation related careers, engage with professionals from various aviation related organizations and acquire aviation curricula and outreach resources and implement them across the curriculum. Zoom sessions were recorded and posted to the conference portal for a limited time. Registrants could attend any session live or watch a recorded presentation at a time convenient for them. Educators attending live sessions were eligible to acquire 1 CPDU per session (5 CPDUs maximum).

#### Highlights:

- Keynote by Lt Col Kenyatta Ruffin, Commander of the 71st Operations Support Squadron at Vance Air Force Base in Oklahoma. Lt Col Ruffin is a 1999 graduate of the Illinois Mathematics and Science Academy (IMSA) in Aurora, IL and a 2003 graduate of the United States Air Force Academy in aeronautical engineering.
- Presentations from NASA's Susan Kohler about using NASA resources to implement STEAM and discovery learning.
- National Weather Service representative Jon Carney described aviation weather forecasting services.
- STEM careers related to the U.S Air Force by a panel of experts from several careers pathways in the Air Force.
- Presentations on Binary Math and its use in cybersecurity from Kelly Remijan (IMSA), Jason Scott (Cybersecurity Engineer and Cyber Warfare Operator for the United States Air Force) and Mike Bryan (CyberUp).
- Panel of men and women from Tuskegee Airmen, EAA, Wings of Hope and Women with Wings to discuss their organizations, suggestions for educators on building relationships for outreach, and an activity/information that educators can share with students.
- Drones in teaching STEM concepts and using geographic tools by Rich Schultz (IMSA).
- How the Illinois State Police utilizes drones in crash reconstruction and how to integrate drones into 5-12th grade math curriculum from Sgt Brad Brachear, Trooper Ray Sutton and Kelly Remijan (IMSA)
- Career paths available in aviation (military aviation, corporate aviation and airlines) by Keith Mueller and Matt Harter from Southwestern Illinois College.
- Force and motion in flight by Dr. Stepen Beltand and Dr. Srikanth Gururajan (Saint Louis University)
- Project Management Tools for Spaceflight missions and aerospace programs by Patrick Young (IMSA)
- How aircraft mechanics and air traffic controllers keep aircraft safe using STEM by Angel Green (Association for Women in Aviation Maintenance) Lindsay Tow (FAA) and Paul Apel (FAA)

Full program at: <https://www.imsa.edu/centers/educator-development/available-courses/virtual-aviation-day-for-k-12-educators/>

#### **Implementation of the Model Career Challenge**

Teachers implemented the model challenge activities with online and in-person classes from

February through April, depending on the flow of their curriculum. There were multiple ways that the activities were employed depending on curricular needs of each classroom. Many teachers indicated that trying to do this with remote students was difficult. However, overall the teachers' comments were positive.

- "This project gave me more ideas of ways to add scenarios to what I am already doing."
- "I am trying to incorporate more real-world, career based scenarios with my students. This project has really sparked my interest in exposing my middle schoolers to a variety of careers."
- "My students really enjoyed this project. We ran out of time when we got to the maps, so I didn't have them accurately measure the foam cut-outs. They still enjoyed the process and got pretty creative with the additions to their city. I heard several positive remarks throughout the project. "This is really cool", "I feel like I'm really doing something", "This is my favorite assignment", etc. The students really enjoyed the occupational research assignment. Several have continued doing more research on a career they found interesting. I had a female student trying to plan her high school classes so she could take the fast track to become a nurse. Overall, this was a wonderful learning opportunity for my students. Thank you for all of the hard work and planning that was put into this."

Comments from students:

- "I thought the product was very informative on how issues such as hurricanes and famines can affect cities and how functional they are. When we got to observe how to manage water for populations of millions that continued to increase, it really educated me on how hard of a job it may be for local government officials and mayors because tending to the needs of all people is difficult & risky (I say this because an unexpected natural disaster can devastate an entire city before officials are able to prepare their people for it)."
- "Overall, I thought it was fun to use the interactive sites and test out how good our group's calculation skills are (with finding sums and averages)."
- "This is so fun, I like the city modeling activity best."
- "I really enjoyed the job research assignment. I had no idea those existed."





- “I liked the foam cutouts. It was cool to move them around and see what fit the city.”
- “I Liked working in teams and solving real world math problems .”
- “I was surprised by the numbers (gallons of water per day)”

### **Teacher-developed Career Challenges**

Educators were provided with sample templates to design two career challenges that would be appropriate for their students incorporating career and mathematics content. It was requested that one of the challenges be focused on aspects of aviation that they might have learned about during the Aviation Day inservice. Teachers were asked to share their challenges with the project managers by June 14, 2021 in order to receive eMission opportunities. 22 lessons were submitted along with 10 aviation-related activities. These included:

- A series about the economic feasibility of electric vehicles and whether they can lower the carbon footprint of the country.
- Water Purity Career Challenge.
- A series of activities about the pros and cons of owning a vehicle.
- A revised model career challenge series using the Great Migration a large shift of people, particularly African Americans from the South to Northern and Western states at the beginning of the twentieth century.
- Design a sneaker for an athlete in a particular sport.
- An addition to the model career challenge in which the students design teen spaces and activities.
- A crime investigation through a series of tasks to find a missing teacher.
- An addition to the model career challenge in which the students develop temporary housing from shipping containers.
- A series about animal habitat requirements and designing a space at a zoo to protect a threatened species.
- Research and build a kite by investigating different shapes and sizes while employing geometric terms.
- Applying binary mathematics to cybersecurity.
- An aviation recruitment challenge to meet the future needs of air travelers.
- A design challenge for a rotary winged model.
- Drone deliveries - a coordinate plane and graphing project.

### **Challenger Learning Center eMissions**

Educators who successfully completed the professional development webinars and submitted their design of 2 new challenges were provided with up to 5 paid Virtual eMissions from the Challenger Learning Center. These are 60-90 minute class experiences highlighting careers and application of math concepts led by remote “flight directors” at the Wheeling Challenger Center. Pre and post event activities provide curricular connections with math and science. 3 potential event choices that focus on math and science content and are appropriate for middle school students. Teachers will have the option to schedule these events in the 2021-2022 school year.



## Evaluation Methodology and Results

Three different survey tools were used in evaluation of this project: an Educator Participant Pre-Post survey, an Aviation Day Evaluation, and a Student Participant Pre-Post Assessment. All of these tools were delivered on-line through the use of a Google Form for data collection.

### *Pre-Post Educator survey*

The Educator Participant Survey consisted of seven questions regarding experience and comfort with both integrating math and career exploration, and using real-world scenarios as an instructional strategy. Participants responded on a 7-point Likert scale. There was also one free response question on the potential/actual barriers to implementing this project remotely during a pandemic and a final opportunity for participants to add anything additional.

Twenty-two educators completed the Pre-Survey in January and eleven educators completed the Post-Survey in May and June. Ten educators completed both the pre and post survey. With this small of an  $n$ , an informal comparative was completed using the responses of the ten educators who completed both surveys. Gains were noted on five of the questions with the greatest gain being in the area of experience integrating math and career exploration. On the Pre-Survey, participants reported a mean score of 2.5/7.0 which grew to a mean of 4.6/7.0 on the Post-Survey. Educator comments for this question included, “I have a better idea now of how I can integrate more.” and, “I occasionally showed students brief videos regarding careers connected to the math lessons, but the career exploration was not strategically integrated with the math before we piloted the Career Challenge.”. Other areas of growth were in the responses to items on using real-world scenarios as an instructional tool. As a final response, one teacher stated, “Completing the Model Challenge and working to create my own helped develop my confidence that I can integrate more career exploration into my math instruction in the future.”

| Question (measured on 7 pt Likert scale) | Mean - Pre | Mean - Post | Change |
|--|------------|-------------|--------|
|--|------------|-------------|--------|

|  |     |     |      |
|--|-----|-----|------|
| What experience do you have using real-world scenarios with students?  | 4.3 | 5.3 | +1.0 |
| What experience do you have using real-world scenarios in an online environment with students?                           | 3.1 | 4.6 | +1.5 |
| What experience do you have integrating mathematics with career exploration?   | 2.5 | 4.6 | +2.1 |
| What experience do you have using actual or simulated "real-world" scenarios for large group problem solving activities? | 3.0 | 4.6 | +1.6 |
| What is your level of confidence integrating career explorations into your mathematics or CTE classes?                   | 4.1 | 5.4 | +1.3 |
| The use of real-world mathematics scenarios increases mathematical understanding in my students                          | 6.4 | 6.4 | 0    |
| The use of real-world mathematics scenarios increases student understanding of potential careers                         | 6.4 | 6.3 | -0.1 |

*Aviation Day Evaluation*

Aviation Day was a one day professional development event focused on aviation career integration into different STEM areas. Sixteen unique sessions were offered in addition to the keynote speaker. Participants were asked to complete an evaluation at the end of each session. A total of 147 evaluations were completed throughout the day. Each evaluation consisted of five questions reported on a five-point Likert scale asking the following: 1) The professional learning experience was well-crafted; 2) I was able to achieve the learning objectives specified by the facilitator; 3) I intend to use what I learned in my practice; 4) I plan to share what I learned with my colleagues, school district and/or professional network; 5) My knowledge and skills increased as a result of this learning experience. The evaluation also asked participants to estimate the number of students who would be impacted by this professional development and allowed a space for additional comments.

On all five of the Likert scale questions, the mean response was greater than 4.6 indicating an “agree” or “strongly agree” response was average for all questions.

| Question (measured on a 5-point Likert scale) | Mean response |
|---|---------------|
|---|---------------|

|  |      |
|--|------|
| The professional learning experience was well-crafted  | 4.72 |
| I was able to achieve the learning objectives specified by the facilitator                     | 4.74 |
| I intend to use what I learned in my practice  | 4.57 |
| I plan to share what I learned with my colleagues, school district and/or professional network | 4.56 |
| My knowledge and skills increased as a result of this learning experience                      | 4.69 |

Educators indicated that this professional development of Aviation Day would impact over 22,500 total students.

*Pre-Post Student Participant Assessment*

Students participated in the Career Challenge program as a result of being enrolled into the participating teachers’ courses. They did not volunteer to participate nor was there an ability to opt-out of participation. Students completed a 20 question pre-assessment and repeated the same 19 questions as the post-assessment (Appendix B). The Pre-Assessments were given prior to introducing the Model Career Challenge and the Post-Assessments were given at the conclusion of the Unit. The time between pre and post assessment ranged from two weeks to 9 weeks depending on the implementation model used by the educator. Questions 2-10 were attitudinal in nature as measured by a 7-point Likert scale. Questions 11-20 were forced response and focused on specific math concept standards. The attitudinal questions were developed internally by the IMSA team and the math concept questions were obtained through a vetted online resource for validity and reliability. Students represented thirteen unique schools for a total of 1,447 student responses. There were 763 pre-assessment responses and 684 post-assessment responses. There was statistically significant growth in 15/19 questions as determined using a Two-Sample T-test.

| <b>Question</b>               | <b>Pre-Assessment<br/>(mean score on<br/>5pt Likert)</b> | <b>Post-Assessment<br/>(mean score on<br/>5pt Likert)</b> | <b>Change</b> |
|-------------------------------|--|---|---------------|
| I know what an engineer does. | 4.7  | 5.2   | +0.5          |

|   |  |   |                                      |
|---|--|---|--------------------------------------|
| I think that having a career that uses mathematics would be interesting.  | 3.9  | 4.3   | +0.4                                 |
| I think that having a career that uses science would be interesting.  | 4.4  | 4.7   | +0.3                                 |
| I will be able to do well in many careers if I have a good background in mathematics.   | 5.2  | 5.5   | +0.3                                 |
| I like working in a team to complete projects.  | 4.7  | 4.8   | +0.1*                                |
| Mathematics is useful in many careers.  | 5.6  | 5.7   | +0.1*                                |
| I would like to have a job that helps solve problems.   | 4.9  | 5.1   | +0.2                                 |
| I like thinking about how to do things better   | 5.6  | 5.7   | +0.1*                                |
| Mathematics can help to make people's lives better  | 4.8  | 5.0   | +0.2                                 |
| <b>Question</b>   | <b>Pre-Assessment<br/>(indicated as %<br/>correct)</b> | <b>Post-Assessment<br/>(indicated as %<br/>correct)</b> | <b>Change<br/>(% point<br/>gain)</b> |
| The following graph shows how much of the electricity generated in Texas came from different sources. Which of the following sources provided the most electricity? | 96.2%  | 95.9%   | -0.3*                                |
| If Texas generated a total of 200 units of electricity in 2018, how much of that electricity came from wind?  | 38.7%  | 49.9%   | +11.2                                |
| The following graph shows the popularity of various social media platforms. Which was the most popular with teens in the fall of 2015?                              | 49.3%  | 61.5%   | +11.2                                |
| If there were 20 million teens using social media in the fall of 2017, how many of them preferred Snapchat  | 54.3%  | 60.8%   | +6.5                                 |
| What is the area of this shape?   | 16.8%  | 32.2%   | +15.4                                |

|   |       |       |       |
|---|-------|-------|-------|
| Imagine that you drink two cans of orange soda each week. How much orange soda do you drink in a year?  | 59.1% | 66.0% | +6.9  |
| Assume that people typically eat about four slices of pizza each month. How many slices of pizza are eaten by a community of 1,000 people each year?  | 55.2% | 61.6% | +13.6 |
| You are planning a community vegetable garden. It will be shaped as shown below. You want to protect your garden from animals by installing a fence around the perimeter. How much fencing will you need? | 29.9% | 42.5% | +12.6 |
| You will need to spread fertilizer over the entire area to help the plants grow. How much fertilizer will you need?   | 26.9% | 37.3% | +10.4 |
| An experiment compared plant growth with fertilizer with plants that did not get fertilizer. The results can be seen in the data table below. What was the height for the fertilized plant on Day 4?      | 76.9% | 82.8% | +5.9  |
| MEAN SCORE FOR CONTENT QUESTIONS  | 50.3% | 59.0% | +8.7  |
| *not statistically significant  |       |       |       |

APPENDIX A - PARTICIPATING TEACHERS AND SCHOOL DISTRICTS

| Teacher Name                                    | School District            | School county | *District EBF Adequacy* | *District Low-income %* | *District URP (Black+Hispanic students) |
|---|----------------------------|---------------|-------------------------|-------------------------|---|
| Amy Kissing & Josh Lemons                       | Herrin District 4          | Williamson    | 62%                     | 59%                     | 8%                                      |
| Angela Courtright                               | Rome District 2            | Peoria        | 58%                     | 43%                     | 3%                                      |
| Barb Baker                                      | Galesburg District 205     | Knox          | 35%                     | 64%                     | 28%                                     |
| Brittany Yunker                                 | Plainfield District 202    | Will/Kendall  | 66%                     | 28%                     | 35%                                     |
| Caressa Postin                                  | Lewistown District 97      | Fulton        | 68%                     | 49%                     | 1%                                      |
| David Wollenzien                                | West Chicago District 33   | DuPage        | 63%                     | 51%                     | 83%                                     |
| Erica Abangan & Louisa Shannon & Salenia Cooper | Chicago Public Schools 299 | Cook          | 66%                     | 79%                     | 83%                                     |
| Esther Olivio & Preston Chmura                  | Lyons District 103         | Cook          | 62%                     | 76%                     | 78%                                     |
| Grace Finn                                      | Forest Park District 91    | Cook          | 152%                    | 46%                     | 59%                                     |
| Heather Melton                                  | Carbondale District 95     | Jackson       | 73%                     | 43%                     | 59%                                     |
| Jill Bielski                                    | Wheeling District 21       | Lake          | 85%                     | 46%                     | 55%                                     |
| Julie Arentsen                                  | Berkeley District 87       | Cook          | 63%                     | 54%                     | 92%                                     |
| Justin Broderick                                | Brookwood                  | Cook          | 64%                     | 56%                     | 94%                                     |

|                    |  |           |      |     |     |
|--------------------|--|-----------|------|-----|-----|
|                    | District 167                           |           |      |     |     |
| Kate Carter        | Univ. Chicago<br>Charter -<br>Woodlawn | Cook      | 66%  | 79% | 98% |
| Margaret Calabrese | GlenEllyn<br>District 41               | DuPage    | 106% | 22% | 17% |
| Marti Minott       | Taylorville<br>District 3              | Christian | 69%  | 46% | 3%  |



## APPENDIX B - STUDENT PRE/POST ASSESSMENT