

Newsletter

LITTLE APP RECAP

by Kate Kozak

In every StatPREP newsletter since August of 2020, there has been an article about the Little Apps. Together these articles have described activities that are written for each of the Little Apps. This article will recap the Little Apps available, the activities that are available, and then how best to use them in your classes.

All the Little Apps are free to use and are accessible through [this link](#). Each one allows you and your students to visualize different statistical concepts. The Little Apps use real datasets and large datasets. Visualizing datasets helps students understand how data can be used to answer questions. They also show sampling variation.

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UPCOMING ACTIVITIES

Be sure to check out our upcoming events and workshop plans on page 13.



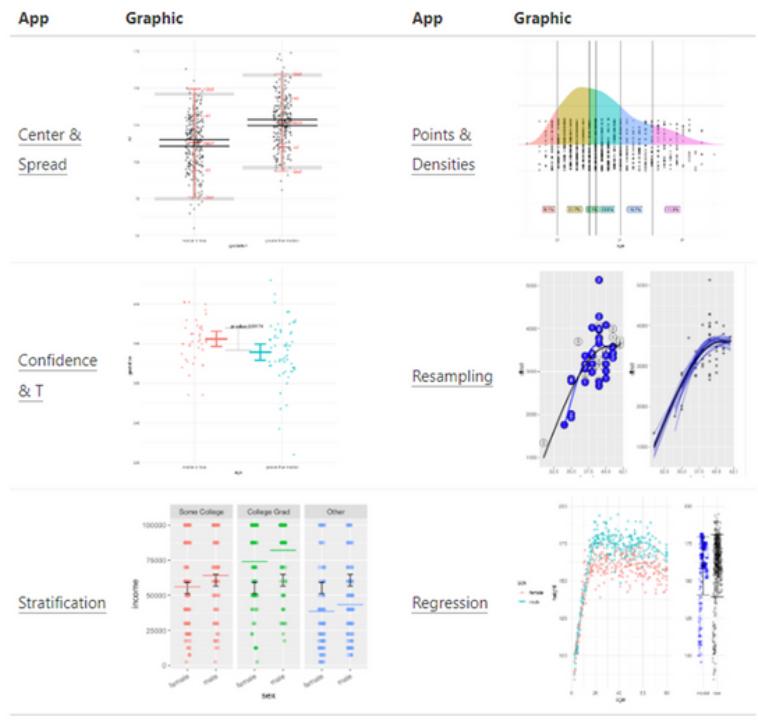
The Little Apps are

1. [Center and Spread](#) demonstrates the mean, median, standard deviation as a ruler, confidence interval, summary interval, and a violin plot, which can all be turned on and off.
2. [Points and Densities](#) displays the mean or median, and also the proportion of data that is in a range of values. It also will display the z-score, and the normal curve can be displayed with the data.
3. [Confidence and T](#) displays the mean, confidence interval with different confidence levels or sample sizes, and the t-interval that is the test statistic for a two-sample t-test. If one teaches equal variances in the 2-sample t-test, there is a way to assume equal variances.
4. [Resampling](#), demonstrates the resampling method which is a more contemporary approach to teaching statistics.
5. [Regression Modeling](#), demonstrates regression analysis and allows the introduction of a covariate and looking at linear, logistic, or different degree polynomial models.

All of the Little Apps can display graphs and statistics, and one graph can be frozen for comparison with a different graph.

Gallery of Little Apps

Each Little App is oriented around a graphical display of data with statistical annotations. Users can select the size of sample to draw at random from a "population" of the entire dataset. Every App shows each point in the sample.



The Little Apps can be used in classes to demonstrate concepts. For active learning, there are activities that utilize the Little Apps. The activities can be accessed through the Little App website, and can also be accessed directly through [this link](#). There are 12 classroom activities. Each activity has a Word and PDF version, and they are all open source. The Word version allows for modification, if desired. Please give attribution for the activities. The activities are on the next page.

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Little App Student Activities

Data and point plots
Introduces the distinction between quantitative and categorical variables through their very different appearances in a point plot.

Common and Rare
Using distributions to examine which values are common and which are rare.

Parameters of the normal distribution
Normal distributions are a "Family". The specific members of the family are identified by two parameters: the mean and the standard deviation.

Comparing two confidence intervals.
Using one sample confidence intervals on the mean to decide if there's good evidence that two means are different. Statistical experts know to use the two-sample t-test for such problems, but best to build up intuition first and then add mathematical refinements later. And, you'll be able to see for yourself whether the refinements have any practical impact.

Introducing linear regression
Discussion topics to introduce linear regression to your class.

Describing relationship patterns in words and numbers
Translating a regression line into a description in everyday terms.

Shapes of distributions
Introduces terms such as peak, bi-modal, and flat, by reference to the difference of the actual variable from a theoretical normal distribution.

Comparing two groups
Visualizing sampling variation in the difference between two groups.

What is a confidence interval?
Describes the desired behavior of a confidence interval, that is, how to know whether a procedure produces a valid confidence interval.

Response and explanatory variables
Reasons to identify one variable as the response and another as the explanatory.

Intervention and prediction
Causality as a reason to identify one variable as the response and another as the explanatory.

How much is explained?
Using R-squared to quantify how much of the variation in a response variable is accounted for by explanatory variables.



There are many ways to use these activities in classes. Groups of size three are optimal, but each instructor can determine what works best for their classroom. As an example, because of the orientation of the classroom at Coconino Community College, groups of size four work better. The best way to create the groups is through a random process. The book *Building Thinking Classrooms*, by Peter Liljedahl has very valuable suggestions for active learning in k-12 classrooms, which are also useful in higher education classrooms. It is a great resource and is highly suggested to learn more ways to create thinking in a classroom. Peter Liljedahl is the keynote speaker at the [AMATYC Annual Conference in Toronto](#), November 17-20, 2022. Come to the conference and hear from him and others about how to have more active learning in the classroom.

Please use the Little Apps in your classrooms either to demonstrate concepts or as active learning activities. I use both in my classes depending on the topic I am introducing. I know my students are benefiting from using them. I hope your students do too.

Celebrate StatPREP!

A look back on our journey



AMATYC 2017 Poster Session

2018 Summer Workshops:

Hartford, CT | Seattle, WA

Los Angeles, CA | Minneapolis, MN

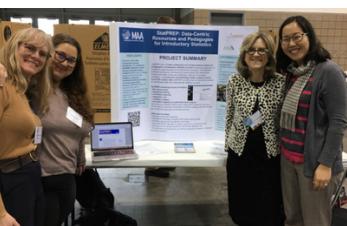


JMM 2019

DUE Poster Session

MAA MathFest 2019

Poster Session



ArizMATYC 2019 Poster Session

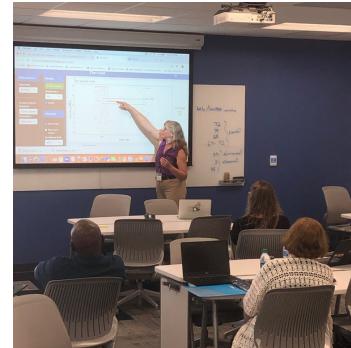
JMM 2020

DUE Poster Session

2017 Summer Workshops:
Los Angeles, CA | Minneapolis, MN

MAA MathFest 2017

JMM 2018 Poster Session



MAA MathFest 2018
Poster Session

AMATYC 2018 Poster Session

2019 Summer Workshops:

Columbia, MD | Ft. Worth, TX

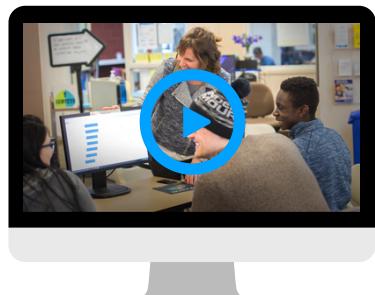
Hartford, CT | Seattle, WA



Celebrate StatPREP!

A look back on our journey

Stem For All
Video Showcase
2020



AMATYC News
October 2020 | April 2021

2021 Summer
Virtual Workshops:
Data Science | Little Apps
Intro to R | Advanced R

AMATYC 2021
Presentation

and more to come!



Join us on August 6th at 12pm ET for
a special celebration

More details to come!



THREE WAYS TO (RE)INVIGORATE YOUR TEACHING LINEAR REGRESSION

by Helen Burn

My experiences with StatPREP have reinvigorated my teaching of linear regression, a traditional topic in an introductory statistics course. Because the topic builds on students' prior knowledge of linear functions, it can be viewed as one of the easier topics in introductory stats. And I agree in part. Indeed, students tend to grasp the overall concept and can use technology to find the best-fit line, and interpret the strength of the relationship as measured by Pearson's correlation coefficient r . However, what I have learned through StatPREP has shifted my thinking about the topic and led to a webinar titled [Three Ways to \(re\)Invigorate Your Teaching of Linear Regression](#), so titled to suggest the ideas addressed in the webinar are relevant to both novice and experienced teachers of statistics.

Here are the three strategies covered in the webinar:

(re)Invigoration Strategy 1:

Focus on the response variable with the guiding question: What predicts the response variable? This is a subtle but powerful shift away from a traditional mathematical approach of asking whether there is a correlation between bivariate data. Let me demonstrate with an example. The [StatPREP Regression Modeling Little Apps](#) includes the dataset



from the [NHANES \(National Health and Nutrition Examination Survey\)](#) which contains many variables that are perfect for demonstration or deeper explorations with your students. Consider starting with the question: What predicts [Body Mass Index \(BMI\)](#)? A follow-up question would be: What real-world phenomena accounts for the relationship? Explain to students that if we were to find a predictor of BMI like getting a good night's sleep, we could design an intervention to improve sleep and that may influence BMI. With the Little App, you can explore a [multitude of different variables](#) (e.g., hours slept, income, level of education, height) and whether they predict BMI or other response variables. Overall, focusing on what predicts the response variable changes the conversation we have with students and is more authentic with how regression is used in practice.

As a side note, in the past, I have hesitated to use BMI as a grounding example to motivate linear regression for reasons including that many of my students struggle with obesity and [because of criticism of the measure](#). However, I have shifted my thinking due to learning about the history of the BMI, which was first developed by Adolphe Quetelet (1796 - 1874), an astronomer turned social scientist, who is credited with applying "averages," originally useful in astronomical measurements, to humans. Quetelet was somewhat of a celebrity during his time and became obsessed with measuring men, eventually developing the notion of L'Homme Moyenne (the average man).

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If you are a fan of using history in the teaching of your subject, check out this [podcast explaining how Quetelet became famous](#), including his development of the S-M-L sizing. It's also noteworthy that Quetelet's work preceded the work of [Galton and his polymaths around regression](#), which is essential to understanding the early underpinnings of scientific racism.

(re)Invigoration Strategy 2:

Enhance students' capacity to assess the suitability of a linear model. For me personally, most of my knowledge of regression models came from [my doctoral work in higher education](#) where we used techniques of multiple regression, including constructing, analyzing, and interpreting multiple regression models. Because of this deeper exposure, I have always been dissatisfied with my (our?) expectations for students around interpreting model coefficients and diagnostics. For example, perhaps it's just me, but I'm constantly struck by the challenge students have in transferring their knowledge of linear function to interpreting the slope of the regression model. To be sure, the intercept is rarely interpreted and the slope has units of measure that can be difficult. [The StatPREP Regression Modeling Little App](#) can enhance students' capacity to assess the suitability of a linear model. For example, it allows for resampling to see if a bivariate relationship is stable over multiple samples. Also, the Little App has a wonderfully creative visualization of Pearson's correlation coefficient along with all the typical model coefficients and diagnostics. Together, these features enable students to do more in-depth analysis.

(re)invigoration Strategy 3: Learn forward-thinking ideas from the StatPREP team

One of the StatPREP leaders, Dr. Danny Kaplan from Macalester College, has co-authored several of the [instructor resources available on the StatPREP website](#) that intertwine classroom activities with sage advice about how regression modeling (and a host of other topics) are used in practice. Several of his ideas are listed below and can be found in the [Introduction to Linear Regression instructor guide](#). Some may surprise you!

- The first idea connects to the idea I expressed about enhancing students' capacity to assess the suitability of a linear model. Dr. Kaplan advises: Don't use $y = mx + b$ except as a reminder of what a slope is, and don't worry about the intercept. Read the slope off a graph or regression report, and interpret the slope as the "effect size" of x on y . Use the guiding question: If the input changes, how much does the output change? Activities focused on this idea can be found [here](#).
- Spend more time with students distinguishing between the [response and explanatory variable](#). Dr. Kaplan provides some guidance while reminding us that most statistics textbooks are written without focusing on this distinction. Indeed, mathematicians generally talk about "bivariate relationships" regardless of the order in which you put the variables, when in fact order matters.
- Lastly, regression is often presented as a way to predict a value of y for a given value of x . According to Dr. Kaplan, this use is seriously misleading and not a proper statistical prediction. Instead, he reminds us that "the output y for a given value of x is predicted to have the form of a normal distribution with mean $a + bx$ and a standard deviation corresponding roughly to the standard deviation of the residuals of the y -values from the corresponding model value."

Together, these ideas can serve as a springboard for further exploration for both teachers and students.

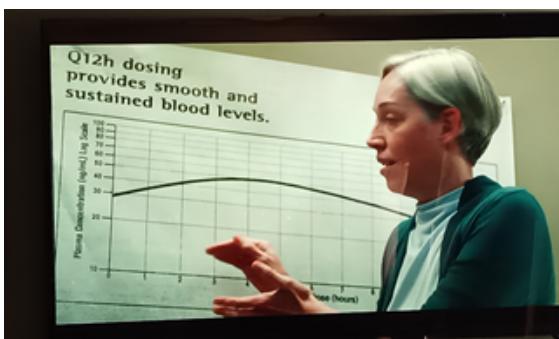


DISCUSSING...REFLECTIONS!

by Ambika Silva



For many issues of our newsletter series, there was an article about classroom discussions. These articles typically featured articles, commercials, or TV shows that incorporated statistics:



Something that I didn't highlight in the articles I wrote over the years for the StatPREP newsletter was how I also incorporate several discussion boards on topics that are relevant to how we learn. This includes topics about growth mindset, grit, and how we react to failures. Below is a list of topics I have utilized in the past several years. I have rotated some in and out, and added things over the years as I have been inspired. I like to find inspiration everywhere. I was watching a marathon of Law and Order: SVU and a Talk Stoop came on with Steve Harvey that I thought "my students should see this", and thus another discussion came about!

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I didn't include the prompts in the list below but they often include a question or two about the content so I can make sure they actually read or watched the assignment, then an open-ended question on how it relates to themselves. When leading discussions, it's important to have a question or prompt that will be open enough that others can respond to it. If the answer is "42", then no one can respond to it and interaction halts!

Title	Description
<u>Growth Mindset</u>	An article by Carol Dweck about how some people view success and failure based on innate ability (or the lack of it). Dweck describes this as a "fixed mindset." At the opposite end of the spectrum are those people who believe success is based on a growth mindset. These individuals argue that success is based on learning, persistence and hard work.
<u>Grit</u>	A TED talk that addresses Angela Duckworth's research on intangible concepts such as self-control and grit to determine how they might predict both academic and professional success.
<u>Struggle... Is it okay?</u>	An article on the work of Manu Kapur. Allowing learners to struggle will actually help them learn better according to research on "productive failure."
<u>I'm Stressed OUT!</u>	A TED talk that introduces research that suggests that stress may only be bad for you if you believe that to be the case. Psychologist Kelly McGonigal urges us to view stress as positive.
<u>Power of Introverts</u>	A TED talk about how living in a culture in which being social and outgoing are prized above all else can be difficult for introverts. Susan Cain argues that introverts bring extraordinary talents and abilities to the world and should be encouraged and celebrated.
<u>Mindful Minutes</u>	When is the last time you did absolutely nothing for 10 whole minutes? Not texting, talking or even thinking?
<u>The Surprising Science of Happiness</u>	Dan Gilbert, author of "Stumbling on Happiness," challenges the idea that we'll be miserable if we don't get what we want. Our "psychological immune system" lets us feel truly happy even when things don't go as planned.
<u>Dare to Disagree</u>	A TED talk about how most people instinctively avoid conflict. Margaret Heffernan shows us that good disagreement is central to progress. She illustrates how great research teams, relationships and businesses allow people to deeply disagree.

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Title	Description
<u>Doctors Make Mistakes</u>	Dr. Brian Goldman's TED talk about how every doctor makes mistakes. Sharing stories from his own long practice, he calls on doctors to start talking about being wrong and how we can learn from our mistakes.
<u>Stepping in Dog Mess</u>	An interview with Steve Harvey on Talk Stoop with Cat Greenleaf. Steve Harvey talks about his new book, "Act like a Success" which explains what it takes to overcome failure, and achieve success.
<u>The Broken Escalator</u>	Self-Responsibility. Has a situation in a class ever made you feel stuck? What did you do to move yourself forward when you felt that way?
<u>Born with Silver Spoon in the Mouth</u>	Lou Holtz is often put in the category of living legends of college coaching, like Joe Paterno and Bobby Bowden. Lou Holtz had somewhat of a reputation for delivering pre-game and halftime speeches that inspired his players to give their all on the field, this graduation speech is suited for athletes and non-athletes alike.

I thought it best to finish the reflection with one of my final two discussions: “What’s your Favorite”. It has the following prompt:

**We've done a lot of discussion topics. What was the discussion topic that affected you the most and why?
What will you take from this class?**

Below and on the next page are some of my student reflections at the end of the semester. You can see that they appreciate the statistics they’ve learned but also have really enjoyed the breaks from the curriculum with the discussions focused on non-cognitive behaviors that can affect learning.

My favorite discussion topic was the growth mindset video because it made me realize that sometimes we need to push forward and not give up. I have been in many situations when I have felt like I'm not good enough, but I need to trust myself and believe I can grow more and more each day. I'm going to be honest, the first week of statistics I really wanted to drop the class because I felt I wasn't capable of learning the material, but after watching the growth mindset it made me have a bit more hope. I stayed in the class and I practiced more and I changed my way of thinking. I had more of a positive mindset towards the class. I will take from this class that life is about not giving up, it is about wanting to grow and doing it. I actually enjoyed this class a lot because I feel like my brain is always wanting to know different statistics about life. I am always wondering things like: I wonder how many airplanes fly each day? I wonder how many people read books now compare to 10 years ago? Do people prefer action movies or comedy movies? This is the way I think and I finally took a class that could help me answer my own question.

I also notice statistics on ads, commercials, and more after taking this class. It is crazy to think that it's been there all along and we are just learning about it now. This should be taught at a way younger age to be able to understand life a bit better.

I really enjoyed the discussion posts where we had to watch the commercials and pay attention to the hidden statistics. Two of my favorite discussions we have done were the AdvilPM commercial one and the one on Lou Holtz's speech. I liked the commercial because it was fun and enjoyable. I liked the discussion about Lou Holtz because it was inspiring and moving. This class has surely changed my perspective on statistics. I can see the importance stats have on our lives and will be paying more close attention to them. I came into this class thinking I'd have a hard time and possibly have to retake the class, but I've learned plenty and had fun doing so! Thank you, Professor Silva! It's been a great winter session in this class.

Your mention of the Advil PM commercial reminded me how creative I thought it was, but also how, through the lessons in this class, I see commercials like those differently now. Even though I usually take the assertions of commercials like those at face value, I can now speak to why the claims can and should be questioned.

Thank you for pointing it out.

When looking back on the past discussion topics we have had, I think that Discussion 2a: Hidden Statistics (Descriptive Statistics) had the biggest impact on me. For that discussion, we discussed the hidden statistic in the commercial. It ad was deceiving through the imagery provided and how they stated some of the product's results. After writing about this topic, it made me see how common these kinds of commercials are. I do not watch TV, however, but when I do see any ads like these, I will see if the company is actually making reliable claims. Looking at the small text at the bottom of the ad is usually able to reveal a lot. Being able to look at the provided statistics and seeing if they are accurate or not will be something I take with me into my personal life and work life.



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- Create an account
- Find and join the StatPREP Community

[» Getting Started Video](#) [» Getting Started Guide](#) [» StatPREP Connect Webinar](#)

CONTINUING EDUCATION

by Donna LaLonde

In this last StatPREP newsletter, we are looking to the future, so I want to emphasize the many resources to keep us connected and to continue our education.

At the top of the list is the StatPREP community available as a part of MAA Connect. This online community keeps us connected. If you have not joined the discussion, make that a priority for the summer!

Number two on the list are the webinars provided by ASA-AMATYC Joint committee. If you have not watched these webinars, they are definitely worth your time. The recordings are available [here](#). The [AMATYC Statistics Resource page](#) will have updated information as new webinars are scheduled.

If you are not already a member consider joining the [ASA Section on Statistics and Data Science Education](#) and the [MAA SIGMA on Statistics and Data Science Education](#). Joining these communities will connect you with colleagues who share your passion for statistics and data science education.

The MAA Virtual Programming offers a variety of ways to learn and stay connected including webinars and minicourses. [Bookmark this site](#) and take advantage of this amazing resource. Also, consider participating in one of the teaching-focused workshops offered as a part of the [MAA OPEN Math](#).

The Little Apps and associated activities made a previous list and are still noteworthy. As you are planning for the 2022 – 2023 academic year be sure to check them out [here](#). The Little Apps are available via a web link so are easy to integrate into your teaching.

Data Science in a Box, a resource created by Dr. Mine Çetinkaya-Rundel, now has a very active Slack channel. Joining the Slack channel is a great way to be connected with colleagues who are using and adapting the Data Science in a Box materials. I wrote a brief overview in [this newsletter](#) and Mine talked about her work on a [StepPREP webinar](#). While you're checking out Mine's webinar, you should make a playlist of other webinars to watch.

The statistics resources are available [here](#). The textbooks are freely available in pdf format and are supported by videos, slides, and labs. As you are planning your curriculum for the upcoming academic year, check out these incredible resources.

Stay connected and continue to be a part of the community!



Save the Dates!

MAA OPEN MATH WORKSHOP: UTILIZING TECHNOLOGY TO TEACH DATA-CENTRIC STATISTICS



2022 STEM FOR ALL VIDEO SHOWCASE



MAA is proud to launch its OPEN Math Summer Workshops on building inclusive classrooms using evidence-based instructional practices from the MAA IP Guide. Join us this summer for this fully online professional development opportunity!

StatPREP's own Ambika Silva, Kathryn Kozak, and Jenna Carpenter are presenting a workshop on teaching data-centric stats on July 11-14, 11am-5pm ET.

Note: limited to 25 participants, and registration closes on April 29

[REGISTER](#)

Save the Dates! May 10th-17th

The StatPREP team is presenting in this year's 2022 STEM for All Video Showcase. Come check out our video between May 10th and 17th in this all virtual video showcase.

Missed 2020's video? View it on maa.org/statprep.

[LEARN MORE](#)



MAA MATHFEST 2022 | PHILADELPHIA, PA

Join StatPREP during August 3-6, 2022, at the Philadelphia Marriott Downtown in Philadelphia, Pennsylvania for MAA MathFest 2022!

Every summer, MAA MathFest presents the latest in mathematical research and education to diverse audiences across the nation. As the largest community of mathematicians, students, and enthusiasts, MAA is proud to bring an interactive, accessible, and informative experience to you this year.

StatPREP will be running a Minicourse at MAA MathFest; see below for more information and spread the word to your colleagues that they may find this helpful!

UTILIZING STATPREP'S FREE LITTLE APPS TO TEACH DATA-CENTRIC STATISTICS

August 4th, 9-10:50am ET & August 5th, 10-11:50am ET

Statistics courses should be data-centric! This mini-course will expose participants to free tools from StatPREP (NSF DUE-1626337) to help students learn introductory statistics concepts. There will be hands-on computer activities utilizing Little Apps along with tutorials that introduce RStudio. This is a great mini-course to attend to learn how to incorporate real data into your course.

To register for MathFest, including the StatPREP Minicourse:

[REGISTER](#)

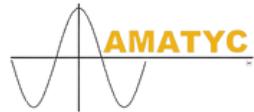
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Jenna Carpenter, Campbell University

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Ambika Silva, College of the Canyons, Santa Clarita, CA (2017-18)

Helen Burn, Highline College, Seattle, WA (2018-19)

Hwayeon Ryu, Elon University, Elon, NC (2018-19)

Carol Howald, Howard Community College, Columbia, MD (2019-2020)

Thomas Kinzeler, Tarrant County College, Fort Worth, TX (2019-2020)

Rona Axelrod, Florida SW State College, Fort Myers, FL (2020-2021)