NC STATE College of Education

Resources for Professional Educators:

Tips and Ideas for Teaching Secondary Grades

Contents

Dear educators,

As dean of the NC State College of Education and the wife of a current high school teacher, I know first-hand that educators have one of the toughest jobs in the world. For that reason, I have made it one of my goals to elevate the profession and provide as much support as possible to teachers in the field.

As part of this work, we have curated a series of tips and ideas based on our Ask the Expert series to assist K-12 teachers in a wide range of relevant topics. These tips are based on research and vetted practices from our College of Education faculty, many of whom spent time as classroom teachers themselves.

I hope you find these tips useful as you prepare for the upcoming school year. Please also know that all of the hard work you do is appreciated and valued by those of us here in the College of Education.

I wish you a great school year.

Sincerely,

Paola Sztajn
Dean,
NC State College of Education

Using Technology to Enhance Math Lessons

How Can Technology Improve Math Instruction?

Technology can be an important tool in mathematics classrooms both to enhance instruction and motivate students to engage with the work. The right tools can facilitate a greater and more in-depth understanding of math concepts and help students work through problems at their own pace and receive more personalized learning experiences.

→ Tips for Introducing Technology in Math Classrooms

1. Rely on free online tools:
GeoGebra offers tools for geometry, algebra, statistics and calculus while Desmos, an online graphing calculator, has embedded tools to allow students to explore graphs and allows teachers to create networked classroom activities. Desmos, GeoGebra, Web Sketchpad, and other Dynamic Geometry programs can help students visualize geometric shapes in a way that's not possible on paper. CODAP can help students create visual displays to conduct statistical analyses of data.

2. Make sure your technology aligns with lesson goals:
Teachers should take the time to get familiar with technology tools before introducing them in a lesson and must make sure each tool is the best choice for a given lesson. Different tools will be used to help students develop conceptual understanding and procedural fluency, for example.

3. Connect with peers for support:
Having peers to bounce ideas off of and communicate with while integrating new technology into the classroom can prevent the experience from becoming overwhelming. Outside school walls, social media – including the Math Twitter Blogosphere (#MTBOS) – can be a great tool to find support and resources. Additionally, the Friday Institute for Educational Innovation offers free courses through the Professional Learning and Collaboration Environment.

> "Incorporating technology with inquiry-based lessons allows students to have a more hands-on approach with gaining knowledge. They're able to investigate different scenarios, make connections between multiple representations and test conjectures and hypotheses."
>
> **Assistant Professor of Mathematics Education Ruby Ellis**

Helping Students Become Data Literate

Why Do Students Need to Understand Statistics?

Students are surrounded by data every day and often use it to inform their decisions without fully understanding where it came from or how it was compiled. Data is used to make decisions that range from a person's health and fitness to the decision to make a purchase based on online retailers' recommendations. It's important to understand the lifecycle of this data, which includes where it comes from, how and why it was collected, who collected it and how it was processed and analyzed.

> "Understanding how data is used, how it's collected and why it's collected helps you understand that you can be empowered by it or you can be manipulated by it. We want our citizens to be in a position where they're able to make sense of data that is represented to them in the media and can make the decisions that are appropriate to them or their families."

Distinguished Professor of Mathematics and Statistics Education Hollylynne Lee

Tips for Helping Students Develop Data Literacy

1. Show them how data applies to their lives:
Help students understand how they see data on a daily basis by having them analyze data from their lived experiences. For example, have students examine data from nutrition labels on different foods to see how companies can adjust measurements to change perceptions of a product. Students can discover the way a serving size might be listed much smaller or larger than what would be considered a typical portion to make a food seem like it has less sugar or more protein than it really does.

2. Bring in examples from other subjects:
Data in math lessons should have a context. Bringing in a data visualization from a news story related to science, English or social studies lessons can help students think about why the visualization was created, why specific data was collected to tell a specific story and how the story could have changed if data had been collected from a different group or visualized in a different way.

3. Provide students with the right tools:
While graphic calculators remain a staple of math classrooms, they are often not the best tool to understand data and statistics. Online tools like the Common Online Data Analysis Platform (CODAP) can offer a more authentic way to experience larger datasets with multiple variables. Students should also gain experience with data represented in text, videos, images and maps.

Using Discourse to Promote Equity in Data Science

Since activities in statistics or data science classrooms need to be grounded in context, the real-world problem teachers select for their students to explore and investigate can influence the ways in which they interact. This not only encourages students to work collaboratively, but can position students who have specific content domain expertise or interest to see that data science is relevant to them.

"We can intentionally choose topics and contexts so students see 'This is actually for me' and 'This is something that I would like to engage with. That helps the students, their motivations and their sense of belonging."
– Assistant Professor of Mathematics Education Sunghwan Byun

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Discussing Climate Change in the Classroom

How Can I Navigate the Subject?

Addressing the issue of climate change in the classroom involves sharing more than just science and data. There are two spheres of climate change information. There is the scientific side — where knowledge about how climate is created, how it has changed over time and the impact of those changes are shared — but there is also a social side.

→ ### Tips for Addressing Climate Change

1. **Engage in deliberative dialogues:**
These conversations, which allow a group to exchange and weigh ideas and opinions, enable students to explore all aspects of an issue, actions they could or could not take to address it and the ramifications of those choices. Partnership with a social studies teacher can help address social issues in these discussions as can resources like the Climate Change Deliberation Guide from the North American Association for Environmental Education.

2. **Acknowledge students' perspectives:**
Students will bring their own perspectives about climate change into the classroom based on their experiences outside of school. These perspectives, studies show, can influence how students interact with data as many often interpret it in a way that confirms a belief they already hold.

3. **Turn to online resources:**
The Climate Literacy and Energy Awareness Network (CLEAN) provides classroom materials on climate change that have been vetted for accuracy of content and classroom usability. The National Oceanic and Atmospheric Association (NOAA) also offers scientifically accurate resources that are appropriate for use by teachers.

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"I believe that explicit discussion about why there are differences in how we view climate change would do well in a classroom. Really unpacking why it's there would be very beneficial for youth"

Assistant Professor of Science Education K.C. Busch

Helping All Students Feel That They Belong

Why is a Feeling of Belonging Important?

Students who feel a sense of belonging at school are typically more energized, more likely to spend time on-task and return to activities, and more likely to choose to be in the school environment. Students who don't feel a sense of belonging often struggle to devote their full cognitive resources to tasks and experience issues with emotional wellness.

Tips for Helping Students Feel They Belong in the Classroom

1. **Build connections between home and school:** Bring in community members, artifacts or even local news stories to reinforce concepts that are covered in the curriculum. You can also give students opportunities to discuss the ways in which the content connects with their outside lives, allowing them to drive connections themselves.

2. **Incorporate students' passions into lessons:** In a school where sneaker culture was important to students, educators created a lesson that allowed students to design shoes that would be both aesthetically appealing and protective for a mission to Mars. The assignment allowed them to express their creativity and honor their culture while learning that success doesn't have to come at the expense of leaving their culture behind.

3. **Give students a voice:** Allowing students to share about their lives in class can help them feel more connected to the educational environment. One way to do this is to pass around a ball before the start of a lesson and allow students to share one good thing that has happened to them that week. Additionally, students can feel a sense of ownership in their schools if they have a say in the way things are done through roles on advisory boards or collaborations to lead initiatives within the school.

> "A sense of belonging at school means feeling a sense of acceptance, respect, inclusion and support in a learning environment."

Associate Professor of Educational Psychology and Equity DeLeon Gray

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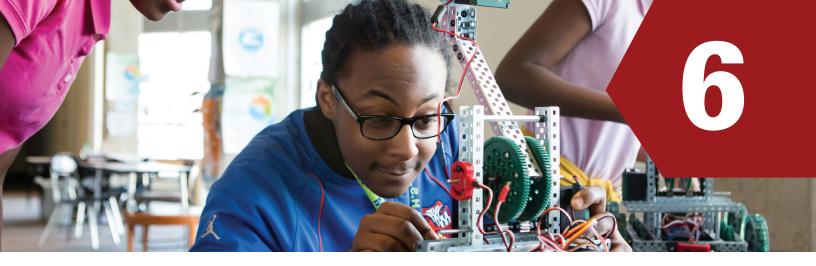# Using Students' Strengths to Teach Math

What is a Strengths-Based Perspective?

Students' thinking is often evaluated from a deficit standpoint, focusing on what they don't yet know or understand. This can be even more prominent when teaching students with disabilities. Flipping the point of view to use a strengths-based perspective means teachers focus on what students already know about a subject and then uncover their strengths and build on them through instruction.

→ **Tips for Teaching from a Strengths-Based Perspective**

1. **Understand your students' ways of thinking:** By using instruction as a way to uncover students' thought processes, teachers can use students' existing ideas, encourage active thinking through a task while providing opportunities for reflection and provide ways for students to connect their thoughts to others' ways of thinking.

2. **Get to know your students' interests and background knowledge:** By observing and speaking with students both in the classroom and in non-academic spaces, like lunch and recess, teachers can gain a better understanding of areas in which students feel competent and find ways to connect math to student interests. Use this information to create broad tasks that can expand mathematical ideas and bring forward and build upon multiple types of prior knowledge.

3. **Ensure tasks are accessible to all students:** Providing accessible tasks that allow individual students to conceptualize problems in ways that are meaningful to them and giving them opportunities to reflect upon and verbalize their reasoning can increase understanding. Allow for different ways to engage with mathematical activities, as certain physical actions, like cutting paper or manipulating objects, can be difficult for students with certain disabilities.

"Strengths-based instruction is not just embracing the notion that students think differently and allowing that in instruction, but it's also meeting that reality with accessible instruction that adapts to and responds to that difference in ways that allow students to build from their own reasoning."

Associate Professor of Mathematics Education and Special Education Jessica Hunt

Helping All Students Explore STEM Careers

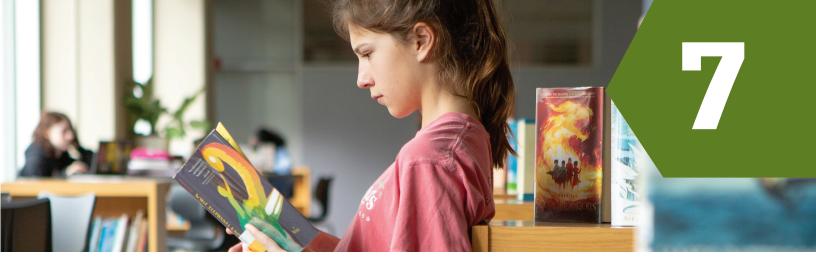## Why is STEM Education So Important?

There is a growing need for qualified graduates to fill STEM positions, as well as a need to diversify the field. Many students who are historically underrepresented, living in poverty or are first-generation college students struggle to see themselves pursuing a STEM career. Engaging these students in STEM learning and encouraging them to explore STEM careers can bring a more varied group of people to the field to generate new ideas and solutions to grand challenges in society.

Tips for Helping Students See Themselves as STEM Professionals

1. Link lessons to everyday experiences for students:
For example, a teacher in a community that relies on agriculture could ask students to solve problems related to water pollution caused by fertilizers by having them engage in small group discussions, develop and carry out investigations of solutions and share their findings.

2. Utilize project-based learning:
Hands-on activities that build competency in STEM workforce skills, tools and technology can increase students' confidence related to their STEM abilities. Lessons that set clear goals, involve choice with guidance from educators and take place in collaborative groups can better engage students.

3. Show students their options:
Helping students to understand the day-to-day duties of professionals in various STEM roles, as well as the amount of education needed to pursue a specific job, can help them understand what careers might interest them, as well as which jobs may be a bad fit. For example, a student who ruled out a career as a nurse due to a fear of blood may find that another role in the medical field might suit them.

"Just making lessons more relevant for students, giving autonomy to students and having choices for students is the best way to engage students."

Professor of Science Education Soonhye Park

Helping Bilingual Students Become Proficient Readers

What Additional Struggles Do Bilingual Readers Face?

While non-native English speakers tend to develop interpersonal communication skills quickly, academic language and literacy skills can take more than twice as long to develop. Bilingual students or English learners typically have fewer opportunities than native-speaking peers to learn academic vocabulary in everyday contexts and, as a result, may not always have the same depth of knowledge as their native-speaking classmates. English learners may also have different background knowledge than their peers, making it more difficult to make connections to texts.

➜ Tips for Supporting Bilingual Readers

1. Draw on students' ability to read in their native language:
Studies show that the knowledge bilingual students establish in their native language can be transferred to the development of literacy skills in a second language. Drawing on literacy experiences and resources in a students' native language may help them more quickly learn new literacy skills in English.

2. Build on what students already know:
Gather as much information as possible about students' prior knowledge and family and community experiences in order to link those experiences to classroom instruction and build on what they already know.

3. Provide ample discussion opportunities:
Rich and meaningful classroom experiences can help English language learners solidify their understanding of new academic vocabulary and concepts. Provide students with opportunities to engage in discussions with friends about what they have read or learned as well as opportunities to write about the topics they encounter in texts.

"An English learner's strong oral language proficiency doesn't necessarily mean that they have an equivalent level of literacy skills in English. The students need consistent exposure to a variety of texts and explicit and sustained literacy instruction in school."

Assistant Professor of Literacy Education Jackie Eunjung Relyea

Building Inclusive Classrooms

How Can I Make All Students Feel Included?

By acknowledging and leveraging different cultures, values and ways of knowing, students are able to extend their understanding of content and themselves. The goal of an inclusive classroom is to make teaching practices relevant to all students by incorporating native languages and unique background knowledge and making space for perspectives that have not traditionally been included in the curriculum.

➔ Tips for Building Inclusive Classrooms

1. Celebrate different languages and ways of writing:
While there will always be a need to teach academic writing, teachers can also offer assignments that allow students to express themselves. Allowing students to write in dialect or slang, or use their native language in writing, can enable them to see their form of expression as valid.

2. Allow books to be "mirrors and windows":
When possible, choose classroom texts that reflect the diversity of your students as well as open doors to different cultures they may not be familiar with. In making selections to fit your classroom, it can help to think about who the text was written for, what perspectives are omitted from the texts, what cultural meanings can be construed from the text and how the text is positioning the reader.

3. Consider your students and their environment:
Thinking about your school and community, as well as where your students live, what types of experiences they have outside of school and what resources are available to them, can help guide lessons that encourage students to look critically at the world around them.

> "Allow yourself to be engaged with the full humanity of your students by learning about their family, their culture, what inequities they might face within the community and how you can help address that."

Assistant Professor of English Language Arts Education Crystal Chen Lee

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Helping Students Understand Past and Current Events

Why Do Students Need a Quality Social Studies Education?

K-12 students need to be able to understand the context of the issues the world is facing in order to become informed citizens. In social studies, history and the social sciences – including economics, sociology, geography, anthropology and sociology – combine in order to provide students with the knowledge necessary to participate in a democratic society.

Tips for Teaching Social Studies

1. **Use technology to provide access:**
The Library of Congress has digitized most of their collection of primary sources, allowing teachers to bring them into classrooms in ways that were not previously available. Educators can use authentic documents to engage in historic investigations or examine geographic information systems in a way that brings social studies to life.

2. **Provide scaffolding:**
Promote understanding and navigation of any primary sources used in the classroom by providing students with engaging questions, primary source analysis sheets and high-quality projects about the topic.

3. **Help students become media literate:**
In addition to navigating historical resources, students need to also understand how to find reliable, modern-day resources online to avoid misinformation. Help students to check that all information they share is up-to-date, read multiple sources and understand the impact of bias before trusting a source.

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"Social studies is inherently relevant to students. Any job or issue they face will have a social studies connection. If you think of some of the grand challenges facing our country or interdependent world, they all have social studies connections."

Professor of Social Studies Education Meghan Manfra

Discussing Sensitive Subjects in the Classroom

How Can I Talk About Current Events or Politics?

Talking about sensitive subjects in the classroom can be tricky, but classroom discussions around contemporary issues can prepare students to be engaged citizens, teach them how to navigate productive discussions with people who may not share their point of view and keep them engaged in social studies content.

→ Tips for Facilitating Political Discussions

1. **Promote deliberation, not debate:**
It's tempting to have students engage in a debate, but this can exacerbate differences and can unintentionally encourage people to become entrenched in their views. Well-planned out and intentional deliberation, through discussion, instead encourages students to come to a common understanding.

2. **Prepare students, and yourself, in advance:**
Before hosting a discussion about a sensitive political topic or current event, help students prepare by assigning readings related to the topic, develop a structure for the discussion and prepare discussion questions for students to consider.

3. **Have students engage in a "Tug-of-War":**
In groups, have students share personal reflections about the topic with the rule that nobody can interrupt or argue with the speaker while they share. Then, have students use the "Tug-of-War" discussion strategy, which asks the group to collectively think of reasons both for and against an issue regardless of their own opinions. Lastly, students each get a turn to explain what they think about an issue.

> "When teachers engage students in open discussion about controversial issues, the students become more interested in that classroom. They love hearing each other's opinions, it makes the content more meaningful for them and they become aware that there are different and competing views."

Associate Professor of Social Studies Education Paula McAvoy

Serving Linguistically Diverse Students

What Should I Do if I Have a New Multilingual Student in My Classroom?

Over the past decade, North Carolina has seen a 160% increase in multilingual students across the state. When working with multilingual students, getting to know the child's background — such as the knowledge they possess in their native language, their journey in coming to the United States (if they are immigrant or refugee background), and their home situation — can make it easier to meet their academic needs.
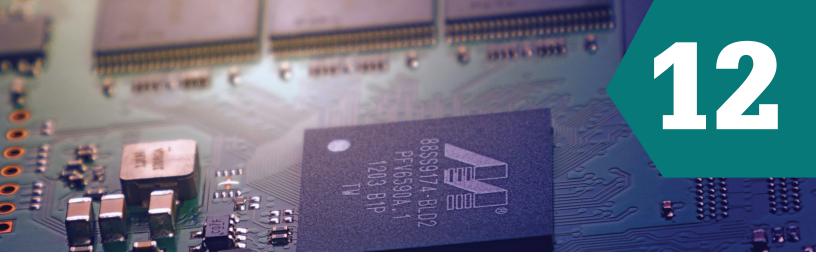
→ Tips for Working with Multilingual Learners

1. **Slow down speech:**
Although it may feel unnatural and uncomfortable to speak slowly, speaking this way will help make language comprehensible for students. Students will have time to hear the sounds and process what is being said.

2. **Avoid colloquial language:**
Using expressions that are unique to the English language, or even to a specific region in the United States, can be confusing for students who are non-native speakers. For example, if a teacher says "It's raining cats and dogs," an English language learner may not immediately understand that means it's raining hard. Remember that even common words, such as 'table', can have multiple meanings in school (table to sit at, a periodic table of elements, a table of contents). Making these differences visible or explicit to ML students is important.

3. **Introduce multilingual texts in the classroom:**
Having literature that uses multiple languages and creating a classroom where students have an opportunity to see different prints and linguistic systems not only helps children of various linguistic backgrounds feel welcome, but helps students gain a greater understanding of the world around them. It's important, too, that students see themselves and people like them represented in text and in the school environment.

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Although most of our identified Multilingual Learner (ML) students are born in the United States, "[w]e see immigrants and refugees that come from many war-torn countries around the world and those students' experiences might have been in refugee camps; they may have interrupted education for multiple years. These are issues of trauma that students could be facing, so it's not just about the language."

Goodnight Distinguished Professor in Educational Equity Maria Coady

Ethically Using Artificial Intelligence in Education

What role can artificial intelligence play in the classroom?

When used correctly, artificial intelligence technology such as revision assistant can be a valuable tool to provide accurate and timely assessments of student performance, learning and learning personalization for students.

Tips for Using AI in the Classroom

1. Protect student privacy:
AI systems can collect and analyze vast amounts of student data, including sensitive information such as demographic data and learning disabilities. Teachers need to understand how this data is collected, stored and used to ensure that student privacy is protected.

2. Ensure Fairness:
AI systems can also impact student outcomes, such as grades and college admissions. Teachers need to ensure that these systems are fair and do not discriminate against certain groups of students.

3. Foster digital citizenship:
As AI becomes more prevalent in society, it is important for teachers to teach students about the ethical considerations of AI, including bias and privacy concerns. This will help students become responsible digital citizens and make informed decisions about their use of technology.

> Although most of our "Fostering digital citizenship on AI ethics and bias is super important, as it will help to create a more responsible and equitable use of AI in education as these tools become more widely available soon."

Assistant Professor of Learning Design and Technology Shiyan Jiang

Teaching Equitably, Not Equally

What is Equity?

To meet the needs of all students, it is essential that students are treated equitably and not simply equally. Equality, which involves giving everyone the same tools and opportunities across the board, is not the same as equity. Equity acknowledges that, because of systemic oppression and historical legacies of exclusion, different groups will have different needs, and access to equal resources will not close educational gaps.

→ Tips for Becoming an Equitable Educator

1. **Focus on transformational initiatives:**
"When something happens in society," Gayles says, "we often write a response, but we don't put meaningful, authentic action behind that response. Transformational work requires doing something (e.g., changing policy and practice) that challenges the status quo. It takes a lot of risks to do this kind of work, and you have to be willing to take a stand."

2. **Examine your values, upbringing, and assumptions,** and be aware of how you perpetuate and sustain inequity in conscious and unconscious ways. Take responsibility and commit to change through reflexive praxis.

3. **Embrace mistakes and make progress:**
"In doing this work, we are all likely to make mistakes," Gayles says. "When you make a mistake, you must own it, take responsibility for it, avoid getting defensive, seek to understand, and apologize. From there, figure out how you're going to move forward differently. It helps to be in community with people who can hold you accountable, to help check yourself, to make sure that the work that you are doing doesn't cause more harm than good."

> "
> "It's more about looking at what specific people need and providing that, making sure historically marginalized people have what they need to be successful within environments."

Alumni Distinguished Graduate Professor and Senior Advisor for Advancing Diversity, Equity, and Inclusion Joy Gaston Gayles

Our Contributors

Chandra Alston is an assistant professor of English language arts education who has worked for over a decade preparing beginning middle and high school English teachers and studying the implications of educational policy reforms on literacy instruction. She worked as a high school English teacher in North Carolina for several years before earning her doctoral degree.

Meg Blanchard is a professor of science education who designs and studies teacher professional development projects, with a goal of enhancing students' STEM learning experiences and stimulating career interest. Before earning her Ph.D., she worked for several years as a middle and high school science teacher.

K.C. Busch is an assistant professor of STEM education who studies climate change education with an emphasis on improving youth activism. A secondary science teacher for more than a decade, she is currently engaged in an NSF CAREER grant-funded project to reconceptualize scientific literacy at the community level and partners with nearly three dozen informal science learning centers across the state.

Sunghwan Byun is an assistant professor of mathematics education and a former nationally board certified high school mathematics teacher who now researches discourse and social interaction in data science, mathematics, and statistics teaching and learning. He also serves as the director of educational research at the NC State Data Science Academy.

Maria Coady is the Goodnight Distinguished Professor in Educational Equity who's research focuses on English language and multilingual learners in rural settings with a particular focus on students' literacy and language development, educational practices for rural multilingual students and ways educators and schools can best engage multilingual learners and their families.

Ruby Ellis is an assistant professor of mathematics education who studies professional development aimed at supporting mathematics teachers with technology integration with a focus on teachers in high African American, low-income student populations. Prior to earning her Ph.D., she spent several years working as a mathematics teacher at the middle and high school levels.

Michelle Falter is an associate professor of English education who studies English teacher education, young adult literature and emotion in the teaching of literature and writing in secondary classrooms. A former middle and high school English teacher and instructional coach, she recently engaged in a content analysis of young adult literature to get students excited about reading through diverse, high-interest books.

Joy Gaston Gayles is an Alumni Distinguished Graduate Professor and senior advisor for advancing diversity, equity, and inclusion who studies access, equity, and success in higher education with a focus on barriers student athletes, women and people of color in STEM fields face and how barriers can be removed to help promote student success. She currently serves as the president of the Association for the Study of Higher Education.

DeLeon Gray is an associate professor of educational psychology and equity who supports educators, parents, leaders and mentors in unpacking the concept of motivation and closely studies issues related to feelings of belonging at school among historically marginalized students. He is the founder of iScholar, an after-school STEM-focused program that gives students the opportunity to collaborate on meaningful projects and speak to issues they identify within their own communities while developing a sense of belonging.

Karen Hollebrands is an associate dean for research and innovation who studies students' mathematical understandings in technological contexts and ways to prepare teachers to incorporate technology into classroom instruction. She's a former high school math teacher.

Jessica Hunt is an associate professor of mathematics education and special education and a Friday Institute faculty fellow who designs asset-based learning environments and tests interventions, including game-based curricula, to understand and support student learning, specifically for students with disabilities. Her experience as a middle school math teacher helped her develop a passion for teaching students with mathematics difficulties and learning disabilities.

Shiyan Jiang is an assistant professor of learning, design and technology who's research focuses on the integration of digital literacy in STEM learning, including empowering K-12 artificial intelligence education with narrative modeling.

Crystal Chen Lee is an assistant professor of English language arts and literacy and a Friday Institute faculty fellow who studies the intersection of literacy, communication and marginalized youth. A former high school English teacher, she now leads the Literacy and Community Initiative, which partners with community-based organizations in North Carolina to amplify youth voices through student publications, advocacy, and leadership.

Hollylynne Lee is a distinguished professor of mathematics and statistics education and a Friday Institute senior faculty fellow who has spent the past two decades improving the way mathematics and statistics education is taught and understood. A recipient of the highly prestigious Robert Foster Cherry Award for Great Teaching, she has created free online resources and professional learning courses that have reached more than 6,500 teachers in all 50 states and over 100 countries.

Meghan Manfra is a professor of social studies education who researches the integration of digital technology in social studies to improve student outcomes. A former high school history teacher, she now helps teachers engage in action research to reflect upon and improve their practice.

Paula McAvoy is an associate professor of social studies education who studies the relationship between democracies and public schools with a focus on challenges educators face when they engage students in discussion about controversial issues. A former high school social studies teacher, she is also the co-author of *The Political Classroom: Evidence and Ethics in Democratic Education.*

Soonhye Park is a professor of science education who studies teachers' pedagogical content knowledge (PCK), teacher change, and teacher professional development. A former middle school biology teacher, Park has designed several professional development programs that have helped teachers improve their pedagogical content knowledge to better engage their students.

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