

Learning & Teaching

Mathematics Teacher: Learning and Teaching PK-12, is NCTM's newest journal that reflects the current practices of mathematics education, as well as maintains a knowledge base of practice and policy in looking at the future of the field. Content is aimed at preschool to 12th grade with peer-reviewed and invited articles. *MTLT* is published monthly.

ARTICLE TITLE:

AUTHOR NAMES:

DIGITAL OBJECT IDENTIFIER:

VOLUME:

ISSUE NUMBER:

Mission Statement

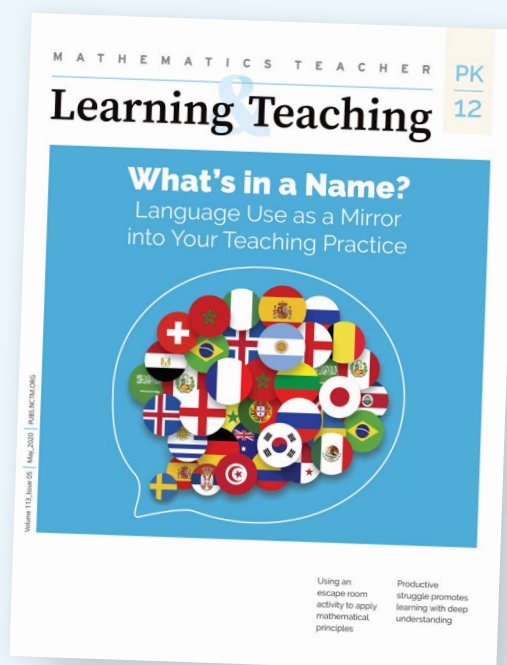
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Approved by the NCTM Board of Directors
on July 15, 2017.

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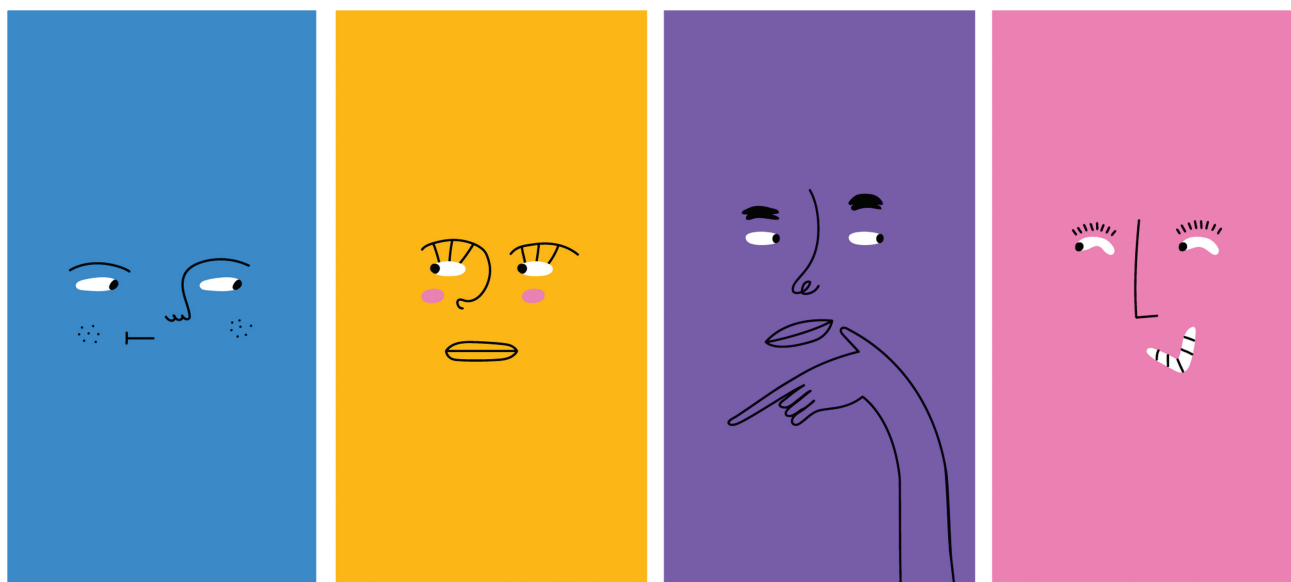


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Drawing a Positive Math Identity: Portrait of a Math Person

Activities and resources to help learners foster a positive math identity.

Liza Bondurant and Liesl McConchie

“People like me aren’t good at math!” — words spoken (or felt) by too many students. The message behind these words extends far beyond the students’ mathematical skills. It is more a statement about whether the student sees themselves as a “math person.” It is about their mathematical identity.

There are many reasons why supporting the healthy development of our students’ mathematics identity is

worth our time and effort. First, it honors the humanity of our students as capable learners. Students who believe they are not part of an elite club of “math people” are left to feel less-than or not good enough, compared with their peers who identify in ways that align with the common perception of a “math person.” This leads to greater disparities in educational and future outcomes (Knuth et al., 2016). Additionally, the

connection between a students' mathematical identity and their level of motivation, effort, and achievement is well documented (Oyserman et al., 2012).

The concept of a learner's identity in mathematics is complex and multifaceted. Based on our review of the relevant research, we believe most factors that influence one's mathematical identity fall within these four categories: (1) **past** mathematics experiences; (2) **personal** beliefs and efficacy; (3) **future** self-representation and belonging; and (4) **socio-cultural** influences. While there is some overlap, each factor plays a unique role in molding the ongoing formation of a students' mathematical identity.

In this article, we'll share a powerful classroom activity that incorporates all four elements of a students' mathematical identity, with a strong emphasis on future self-representation and belonging. The aim is to broaden students' definition of what a math person looks like. We implemented this activity with Black and Latinx middle school students, who have been historically marginalized in mathematics spaces. Middle school is a crucial period for identity development, particularly regarding mathematical confidence and interest (Lindberg et al., 2010). Confronting and expanding students' views of who does mathematics to include people they can identify with is an important first step toward students believing that they can do mathematics. To address this, our activity aims to disrupt the societal narrative of who is typically good at mathematics by expanding that picture to include people who look like them. We believe this is a critical aspect of bringing justice to mathematics education.

SOCIAL JUSTICE STANDARDS

The Social Justice Standards provide a framework for educators to integrate social justice principles into their curriculum, pedagogy, and school culture (Learning for Justice, 2022). By incorporating these standards,

educators can create classrooms and learning environments that promote empathy, respect, critical thinking, and social responsibility among students. The standards are gaining traction in the mathematics field. For example, each lesson in the recently published NCTM series *Lessons to Explore, Understand, and Respond to Social Injustice* (e.g., Lam, 2022) is aligned with the Social Justice Standards. The standards are divided into four domains: Identity, Diversity, Justice, and Action. Our activities are aligned with the Identity domain, which focuses on self-awareness and understanding one's own identities and experiences, as well as recognizing the identities and experiences of others. It encourages students to explore their own biases and to respect and appreciate the diversity of others. In Table 1, we have unpacked what the Identity Domain Standards might look like in Grades 6–8 classrooms.

PORTRAIT OF A MATH PERSON

Firmly rooted in our goal of fostering a positive mathematical identity, we explicitly and intentionally designed and implemented the Portrait of a Math Person activity. Similar to Chambers' (1983) Draw-a-Scientist activity, this activity aims to confront students' perception of what a math person looks like. Additionally, students explored how cultural and societal representations impact how they see themselves as a math person or not. We argue that the Portrait of a Math Person drawing activity can be more accessible and authentic than a writing activity for all students. Drawing can transcend language barriers, making it a more accessible activity for diverse classrooms with students from various cultural and linguistic backgrounds.

We implemented this activity twice with middle school students. During the first implementation, we worked with two after-school groups of predominantly Latinx students who had been identified as being up to two grade levels behind in mathematics. We began

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doi:10.5951/MTLT.2023.0226

by asking students to visualize what someone who is “good at math” looks like and then draw a portrait of that mental image. Students were given a chance to share their drawing with a few classmates and discuss why their portrait of a math person looked that way. Perhaps unsurprisingly, we noticed the majority of the students drew pictures that resembled Einstein (Table 2a), white female math teachers (Table 2b), or math students (Table 2c). The class discussion about the students’ initial self-portraits resembled the following exchange:

Teacher: Did you notice any patterns or similarities in the drawings you saw?

Student: They were pretty much all white men.

Student: Yeah, they look super nerdy and kinda crazy, like Einstein or something.

Student: Yup, like mad scientists (see Table 2a).

Teacher: Did anyone’s drawing stand out as unique to you?

Student: I drew a woman but she’s a math teacher (see Table 2b).

Student: I drew a math student cause we go to math class like every day (see Table 2c).

Teacher: Why do you think so many of us have a similar image in our mind of what a math person looks like? Where did we learn that?

Student: That’s all we see, like in shows and stuff.

Student: Right, on the internet too.

Next, we discussed various socio-cultural influences that may narrow our mental portraits of a math person to exclusively include white males, usually wearing glasses (Lam, 2022). Together, we explored various sources of media that contribute to this paradigm, beginning with a simple Google image search of “math person,” which produced a collection of stock photo images of white males, many of whom were wearing glasses. We discussed how a constant stream of images like this can begin to train our brains to believe the portrait of a math person is, in fact, exclusive to those demographics. We concluded the activity by drawing self-portraits and creating our own gallery of “mathematicians” or “math people” on the wall of the classroom. We affirmed students’ identities as a math person and rejected the role of the media in defining who is worthy of the title “math person.” Whole class discussion around their self-portraits resembled the following exchange:

Teacher: We are all math people. Let’s shake things up and create a collage of self-portraits. This will be our

Table 1 Identity Domain Standards and Grades 6–8 Outcomes

Identity Domain Standard	Grades 6–8 Outcome
Students will develop positive social identities based on their membership in multiple groups in society.	I know and like who I am and can comfortably talk about my family and myself and describe our various group identities.
Students will develop language and historical and cultural knowledge that affirm and accurately describe their membership in multiple identity groups.	I know about my family history and culture and how I am connected to the collective history and culture of other people in my identity groups.
Students will recognize that people’s multiple identities interact and create unique and complex individuals.	I know that overlapping identities combine to make me who I am and that none of my group identities on their own fully defines me or any other person.
Students will express pride, confidence, and healthy self-esteem without denying the value and dignity of other people.	I feel good about my many identities and know they don’t make me better than people with other identities.
Students will recognize traits of the dominant culture, their home culture and other cultures and understand how they negotiate their own identity in multiple spaces.	I know there are similarities and differences between my home culture and the other environments and cultures I encounter, and I can be myself in a diversity of settings.

Note. Reprinted from “Social Justice Standards: The Learning for Justice Anti-Bias Framework,” by Learning for Justice, 2022.

gallery of math people. Can you tell me about your drawing?

Student: I am going to be a soldier. Soldiers solve problems, just like in math (see Table 2d).

Student: It's me. See my green eyes? (see Table 2e).

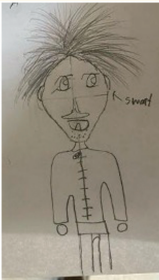
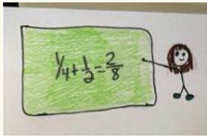




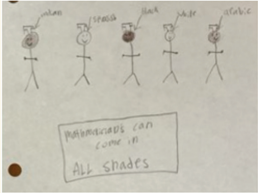

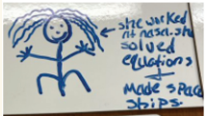
Student: Yup, that's me. Fluffy hair, glasses, and black lipstick (see Table 2f).

During the second implementation, we worked with a group of 20 Black female middle school students. Research indicates that females' attitudes toward math become more negative as they progress through middle school, with these attitudes persisting into high

school (Lindberg et al., 2010). We introduced these students to a variety of Black mathematicians and female mathematicians before engaging in the activity. We used a variety of video clips and biography cards highlighting the lives and mathematical work of several female Black mathematicians.

After these exposure activities, students engaged in the Portrait of a Math Person activity. There was a noticeable difference in these students' portraits. Students' drawings did not conform to the traditional views of a math person. For example, one student drew five people and used different shades of crayons to color their faces. This student wrote, "Mathematicians

Table 2 Portraits of a Math Person

Implementation Phase	Student Portraits		
First implementation, prompted to draw a math person	<div><p>(a)</p></div>	<div><p>(b)</p></div>	<div><p>(c)</p></div>
First implementation, prompted to draw a self-portrait, we are all math people	<div><p>(d)</p></div>	<div><p>(e)</p></div>	<div><p>(f)</p></div>
Second implementation, prompted to draw a math person after exposure to diverse mathematicians	<div><p>(g)</p></div>	<div><p>(h)</p></div>	<div><p>(i)</p></div>

can come in *ALL* shades” (see Table 2g) below their drawing. The person in another student’s drawing was smiling, wore their long hair in pigtails, was wearing an article of clothing that said “I ♥ Math,” and was holding a calculator (see Table 2h). Lastly, one student drew a smiling person with long curly hair and wrote, “She worked at NASA; she solved equations + made spaceships” (see Table 2i).

In reviewing the 20 drawings, we kept a tally of the various physical features represented in students’ portraits. Fourteen of the people in the students’ portraits had long hair or were wearing a dress. Additionally, 10 students used crayons, colored pencils, or markers to depict non-white people. Based on this data, we believe exposing students to a diverse collection of mathematicians was related to them drawing math people with more shared identity markers. It is our belief that the exposure to diverse representations of mathematicians is one way to affirm traditionally marginalized students’ belonging in mathematics and advance their mathematical identities. Through these types of activities and conversations, we can bring greater social justice to math classrooms.

Let’s return to the four categories from the introduction that we proposed that contribute to a learner’s identity. In Table 3, we will illustrate how

the Portrait of a Math Person activity connects to each category. Additionally, we will illustrate how those four categories align with the identity domain standards from the social justice standards.

Sharing biographical information of famous mathematicians from diverse backgrounds is just one way to expand representation. Below are resources, and additional activities, that can be used to affirm traditionally marginalized students belonging in mathematics:

1. **Famous Mathematicians:** Regularly introduce students to mathematicians whose race, ethnicity, gender, and/or culture matches the students you work with. There are many wonderful resources available online. We have used the following:
 - Association for Women in Mathematics EvenQuads Deck ([link online](#))
 - Mathematically Gifted and Black ([link online](#))
 - Latinxs and Hispanics in the Mathematical Sciences ([link online](#))
 - 11 Famous African American Mathematicians ([link online](#))
2. **Guest Speakers:** Invite local guest speakers to your classroom to speak about their careers involving mathematics. Focus on speakers who

Table 3 How Portrait of a Math Person Connects to Identity Domain Standards

Identity Domain Standard	Identity Categories	“Portrait of a Math Person”
Students will develop positive social identities based on their membership in multiple groups in society.	Personal Future	Students draw self-portraits.
Students will develop language and historical and cultural knowledge that affirm and accurately describe their membership in multiple identity groups.	Future	Students learn about mathematicians who they share identity markers with.
Students will recognize that people’s multiple identities interact and create unique and complex individuals.	Future	Students learn about mathematicians who have multiple identities.
Students will express pride, confidence, and healthy self-esteem without denying the value and dignity of other people.	Past Personal Socio-cultural	Students draw and display self-portraits.
Students will recognize traits of the dominant culture, their home culture and other cultures and understand how they negotiate their own identity in multiple spaces.	Past Socio-cultural	Students discuss Google search results. Students learn about mathematicians who they share identity markers with.

represent the cultures of those most marginalized in your classroom.

3. **Former Students:** At the end of the school year, have students record short 1- to 2-min videos of themselves sharing how they felt in your mathematics class and how they were able to succeed. Collect the videos and show them to your students the following year.
4. **Near Peer Mentoring:** Invite students who attended your school in the past five years and share identity markers with your current students to share a recorded or in-person testimonial about their mathematical journeys. A cascading model of near peer tutoring may also be beneficial.

CONCLUSION

Based on our use of the Portrait of a Math Person activity to capture students' views of a math person, we believe exposing students to mathematicians with shared identity markers introduces a healthy disruption of students' views of a math person. Sharing narratives of math people with common identifiers can be a powerful tool in fostering positive mathematical identities in middle school students. By encouraging students to think beyond the societal stereotypes of what a math person looks like and exploring the diverse

range of individuals who use mathematics in their everyday lives, we can help to break down barriers and create a more inclusive and just learning environment in our mathematics classrooms.

While we hope the socio-cultural influences will evolve to become more inclusive and diverse in representing all learners as highly capable in mathematics, educators can influence—and counterbalance—students' perceptions of who can be a math person. We noticed a significant difference in portraits with a simple intervention: exposing students to mathematicians from cultures who have historically been marginalized from mathematics spaces, specifically Black and Latinx mathematicians. Being introduced to mathematicians of color can help broaden students' perception of who belongs in mathematics spaces and help foster more students' mathematical identities. Talking with students about their view of mathematics was beyond the scope of this project, but discussions about students' views of mathematics would be an appropriate next step. This activity can also be easily adapted to suit different age groups, making it a versatile addition to any mathematics teacher's toolkit. By promoting positive mathematical identities, we can help our students develop the confidence and skills they need to succeed in mathematics class and beyond. —

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