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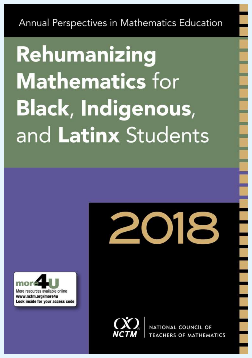


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CHAPTER 8

# Centering Students' Mathematical Agency at Northwest Indian College

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This chapter discusses the ongoing transformation in assessment, course content, and pedagogy in the mathematics courses at Northwest Indian College (NWIC), a Tribal College chartered by the Lummi Nation. Its authors are a group of Native and Non-Native educators who have been working at NWIC for over seven years. The transformation began in 2010, when the authors took advantage of a high-quality, research-based professional development opportunity and initiated a process of rehumanizing mathematics in NWIC classrooms. Student tutors, all of whom are Native and some of whom are Lummi Tribal members, continue to shape and improve the implementation of this new pedagogy, while making the faculty more aware of the importance of the students' cultural context. While future improvement is expected, NWIC mathematics classrooms are currently spaces in which students' identities are embraced, all students' mathematical abilities are valued, and there is enough flexibility for students to attend to cultural and familial responsibilities while still being provided with meaningful opportunities to learn mathematics.

## Place

Northwest Indian College (NWIC) is a Tribal college chartered by the Lummi Nation. The college mission statement is: "Through education, Northwest Indian College promotes Indigenous self-determination and knowledge." The historical context for NWIC's existence is explained below, excerpted from the 2017 NWIC Self-Evaluation Report to the Northwest Commission on Colleges and Universities (Northwest Indian College 2017):

> [The] Tribal college movement has been based on the belief that an effective education for American Indian students was not occurring when they attended exclusively mainstream institutions. The history of Indian education has been forever changed by the acculturation and assimilation of Tribal people through "effective" mainstream education. The intention was to dramatically change—or even eliminate—the language, cultural and religious practices, and social/familial structures that identified Tribes as distinct nations. NWIC is part of [a] resilient movement to reclaim both governance of education and control of its content within . . . Tribal communities.

> The origins of NWIC can be traced back to the founding of the Lummi Indian School of Aquaculture in 1973. . . . From its beginning, NWIC grew from the vision of generations of Lummi people who wanted to educate their own children and grandchildren about resources vital to their way of life, such as the salmon, and not abandon traditional ways and Tribal responsibilities. In 1983, the Lummi Nation . . . established [what would later be renamed] Northwest Indian College and welcomed surrounding tribes by expanding its service area to include Tribal communities throughout the Pacific Northwest, while still retaining its identity as a Lummi Nation chartered institution.

NWIC has physical locations in six Native Nations in the Northwest United States. On average, about 80 percent of its students are enrolled in federally recognized tribes, mostly from Washington State, but also from Alaska, the southwestern U.S., and Canada. The main campus, where the authors are based, is located in the Lummi Nation, in northwestern Washington State. Over the course of the past five years, the average number of students enrolled in classes at the Lummi campus each quarter has been around 300. Roughly 70 percent of NWIC students are female.

Over 70 percent of students place into precollege mathematics when they enroll. The mathematical background of many students is similar to that described by Stigler, Givvin, and Thompson (2010), namely that students both "rely on flawed procedural habits," many of which have been developed over the course of years in earlier grades, and that "when students are able to provide conceptual explanations, they . . . produce correct answers." Likewise, students at NWIC share a background with those described by Urbina-Lilback (2016) who "face life responsibilities that reduce their ability to dedicate time to their education."

All our college-level mathematics classes have a prerequisite of Intermediate Algebra to fulfill transfer agreements with other universities, and the majority of students take Elementary and Intermediate Algebra. Most of our experience with changing our curriculum has taken place primarily in those courses, which span linear and quadratic expressions and equations (among other things), with a new emphasis on multiple representations of algebraic objects. Since 2015, we have arranged the schedule so that the classes meet for an average of 350 minutes a week over five days, longer than the standard 250 minutes.

## People

My name is **Matteo Tamburini**. I was born and raised in Tuscany, Italy. My father's family, going back four generations, has been from the same region. My mother's family was mainly Irish immigrants to the United States. Before working at NWIC, I would have never imagined that sharing this aspect of my identity would become a regular part of what I do in the classroom each quarter.

Both of my parents were college educated. I attended Italian public schools from elementary through high school. After graduation, I moved to the United States and earned a BS in mathematics at the University of Washington. Inspired by naive idealism, I taught through Teach for America in Newark, New Jersey, for three years. After earning an MS in mathematics, I began to work at NWIC in 2009.

Up to that point, I had experienced mostly lecture-based classrooms and had very little experience in collaborative curriculum development. I had no meaningful information about the history of the Lummi or Coast Salish people. As a result, when I started working at NWIC, the best I could do to make the material "culturally relevant" was to alter some of the surface features of exercises taken from mainstream curricula while keeping the broader structures the same. I



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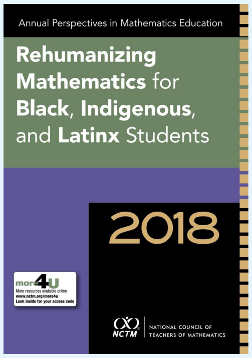


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finally gained insight about teaching and learning mathematics from the Mathematics Education Collaborative (MEC), and I am slowly learning about connecting mathematics to aspects of my students' lived experiences.

My name is **Cassandra Cook**. My father immigrated to the United States from England when I was born. My mother's family migrated to the United States several generations back and has roots in England, Ireland, and Germany. The way I see the world, and the knowledge I do and do not have, comes directly from my ancestors and community, as well as my experience going through the colonial school system. Throughout my life, including college, I thought of mathematics as something universal, and I therefore imagined that everyone would learn mathematics roughly the same way. After graduating with my BS in physics from Western Washington University, I began to teach at NWIC and confronted, for the first time, the unexamined assumptions I had about the teaching and learning of mathematics, as well as my own identity. I learned that the content was not neutral in terms of student access. I was naïve at first, but I now believe that I cannot effectively teach mathematics to any student, especially students from a different culture than my own, simply by explaining the way I understand and interpret a mathematical concept. Although colonialism continues to impact the content and pedagogy of our classrooms, I believe I should strive to challenge the dominant narratives while looking at my own long-held assumptions about mathematics, learning, and teaching.

My name is **Zachariah Bunton**. I am an enrolled member of the Lummi Nation. I was born to Qe'solie, my mother, who descended from an Upper Skagit woman and a Diegueno man; I was also born to T'towinook, my father, who descended from a Musqueam woman and a Lummi man. I've spent my entire life living in the Whatcom County area, and I have experienced both public and tribal schooling. Mathematically, both atmospheres were similar to each other: lectures followed by numerous examples and exercises that highlighted the concepts for the day, and then on to the next topic the next day. While I was able to understand and reproduce the sequences well enough, my peers were not having as much success. They began to seek me out for mathematics help, and I would oblige. This eventually led to the side job of a tutoring position while I was taking classes at NWIC in 2008; I found it a natural capability to "help" others at mathematics. In hindsight, I see that I was not genuinely helping my peers to learn mathematics or even to think about mathematics. In 2011, after working with educators at a MEC workshop, I discovered that I had been undermining their abilities as I was "helping" them when they came to me for tutoring. Providing a series of procedures to follow implies that the learner is incapable of critical thinking and problem solving. I realized there was a definite difference between thinking about mathematics and memorizing mathematics. My work continued as a tutor up until the fall of 2015, when I was asked to fill a role as instructor for an elementary algebra course. This was also the time I began my work as the Site STEM Coordinator for NWIC, where my main role has been to support the mathematics faculty at the NWIC extended sites. While I continue to do this work with faculty, I remain engaged with the students at NWIC both through teaching part-time and working in the tutoring center.

## Our Journey

Our experience has shown that every educational situation is unique. No single method will work in all possible contexts and, therefore, the story is important. Equally important to the story are these underlying questions that guided the changes we made and that we continue to investigate:



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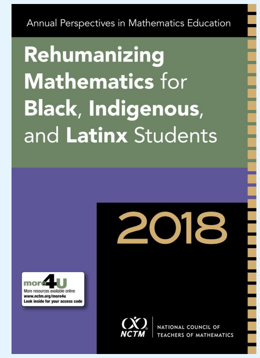


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- Who am I?
- What do I know?
- What don't I know?
- How do the relationships among the students and between the students and the instructor impact the classroom environment?
- What does it mean to *learn* mathematics?
- What is the purpose of learning any particular piece of mathematics in supporting specific students' goals?

Previously, all of us, instructors and tutors, had attended predominantly lecture-based mathematics classes. We are now learning to teach differently than the way we were taught ourselves. It is a challenge, and we credit our growth to each other's support and our openness to ongoing discussions, classroom observations, and guidance from the Mathematics Education Collaborative (a nonprofit organization that provided us with high-quality professional development workshops and ongoing support), as well as to the experiences of other faculty grappling with the teaching and learning of mathematics in different contexts. Our small group became a teacher network with similar characteristics to those described by Niesz (2007). She argues that such groups of teachers, and in our case, tutors, "organized for purposes related to teacher learning, inquiry [or] support" are "*poised to be* a powerful source of teacher learning and school improvement." In our case, that potential has become actualized.

In the 2010–2011 school year, an observer of our classrooms would have encountered a very conventional, lecture-based environment. In our Elementary and Intermediate Algebra classes, we still relied heavily on using a typical textbook. Our best attempts at helping the students learn were not dissimilar from the pedagogy used by the Khan Academy (Khan 2011).

In the fall of 2010, we received the Rethinking Pre-College Mathematics (RPM) grant, which first sparked our efforts at faculty collaboration and led us to ask questions about the content, pedagogy, and assessment of our courses. However, our practice has changed primarily because we used the grant funds to attend a two-week professional development course offered by MEC. The authors' experience at the MEC workshop helped to transform our views about the teaching and learning of mathematics, but it did not provide us with mathematical tasks that were particularly connected to the lived experiences of most of our students. The work of our Native student tutors shaped the pedagogy along those lines. For example, one of the tutors soon produced a task about knitting, and, after a long afternoon conversation among faculty and tutors, a disembodied task about geometric shapes morphed into one about decorations on moccasins. The relationships built at that summer workshop became the foundation for the ongoing process of revision of the pedagogy and the content.

The material that we encountered in the MEC workshops was more directly tied to the content of our Elementary and Intermediate Algebra classes. The first attempt at using the MEC materials and process was made in Intermediate Algebra in 2012. Over the course of five years, we gradually expanded to revise our Statistics, Precalculus, and Calculus classes. We made many missteps and learned important lessons along the way.

Our current definition of what it means to rehumanize mathematics emerges from our journey and from our current practice. To rehumanize mathematics means first to make academic mathematics accessible to students from varying mathematical backgrounds. In order to truly do this, it is necessary to foster an environment in which the following principles are followed:

1. Each individual's perspective is respected and brings value to the learning community.
2. Each individual feels welcomed to bring their whole identity—including their cultural background and their personal experiences.
3. All the people involved (teachers, students, and tutors) form genuine relationships that are not limited to the way in which conventional teacher-centric settings dictate classroom interactions.

This definition is consistent with NWIC's mission statement: By making room for individual students to be their whole selves, we are implicitly challenging the process of acculturation and assimilation, thus making room for indigenous self-determination and knowledge. We consider this to be a stepping-stone to a broader rehumanization that includes challenging the meaning of the word *mathematics* itself—for example, by emphasizing the inherent mathematical knowledge and skills that individuals have as a result of their lived experiences and their cultural and historical practices.

## Content

In NWIC mathematics classes, students work on tasks that revolve around geometric or numerical patterns. The patterns and the tasks chosen have several essential characteristics:

1. Students with various mathematical backgrounds should be able to access the embedded mathematics; in particular, students who are not confident in their academic mathematical skills should still find a point of access.
2. The mathematics itself should lead to deep investigations with many connections for those who are ready.
3. Some tasks should include algebraic patterns embedded with geometrical concepts such as area, perimeter, volume, and measurement to re-establish the essential connections between algebra and geometry that are often neglected in students' previous education.

To rehumanize mathematics, we also include patterns that are relevant to aspects of most students' lives (e.g., beading, number of ancestors, natural resources). This combats the notion that only topics that have emerged from a colonialist society are inherently mathematical or worthy of inclusion in a mathematics classroom. In our Statistics class, we include data about quantities that are more familiar and relevant to our students, such as the yearly size of salmon runs and local weather (including historical trends related to climate change). Most of our classes also include a final project for which students have the option to create or describe their own mathematical patterns. Students have created patterns related to beading, basket weaving, and quilting. With the students' consent, those patterns become part of the permanent curriculum for future quarters.



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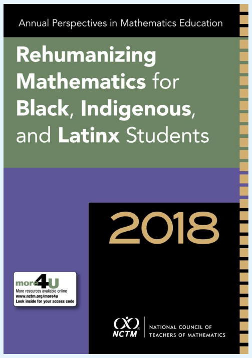


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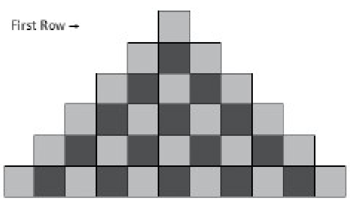
One example of a student-generated pattern is included below (fig. 8.1). Others are available on this book's page on NCTM's More4U website.

**Sheila's Beads**




How many beads are there in the 5th row? In the 3rd row?

How many beads would be necessary for the 10th row?

What about any row?

Challenge: Can you visualize the pattern in a different way?

Developed at NWIC by Sheila Cooper, Nooksack, in Math 99, Winter 2015

Fig. 8.1. A student-generated pattern

We use this pattern in Elementary Algebra, and we expect a student who is proficient to be able to describe the pattern in words, translate their description into an algebraic formula that generalizes the number of beads in the $n$th row, and construct a graph of the row number vs. the number of beads in that row. Sheila's prompt to visualize the pattern in a different way reflects our common practice of eliciting different ways of seeing from the class. Some of the descriptions that the students have given us include ones such as "The number of gray beads is the same as the row number, and the number of blue beads is one less than the row number" (which might lead a student to the formula $n + (n - 1)$ for the number of beads in the $n$th row) and "There is one bead in the first row, and two more beads in each row after that" (which might lead to the formula $1 + 2(n - 1)$. We include some sample student work on a different pattern, along with a version of the rubric that we use to give feedback to students, later in this chapter in the section titled "Assessment of Student Learning."

We hope to be able to create more opportunities for students to reflect on the wealth of algebraic structures that are present in their cultures by including tasks drawn from their experiences that they might not have previously associated with mathematics.

## Method

Our attempts to rehumanize mathematics for the students at NWIC are not as culturally immersive as the examples set out by Dora Andrew-Ihrke (Yup'ik) (Andrew-Ihrke 2013). She draws on her background growing up steeped in the Yup'ik culture and on her extensive work with Yup'ik children in Dillingham, Alaska, weaving the Yup'ik language and specific teachings from elders in her community directly into the mathematics. Our work cannot be as immersive for two main reasons: The students at NWIC come from many different tribal cultures, and the full-time mathematics faculty are not Indigenous to North America and have had very different life experiences than those of NWIC students. In addition, the staff in the Coast Salish Institute (CSI), the college's



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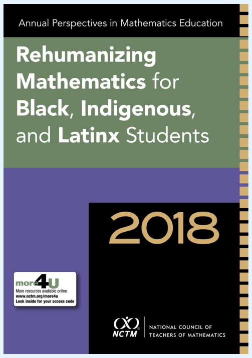


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department that oversees Native Studies programming and is supervised by the Dean of Indigenous Education, has explicitly guided the faculty that we should not teach about what we don't know (e.g., the culture of the many tribes to which NWIC students are affiliated), as suggested by Aveling (2013). Rather, CSI has encouraged the faculty to focus on teaching mathematics.

Aveling discusses what it means for her (a non-Indigenous person) to engage in research with and in Indigenous communities. Her attempts to change her practice relate closely to our own efforts to rehumanize mathematics at NWIC. Aveling conducts research with Indigenous values in mind, endeavoring to establish a human-to-human connection, rather than entering into interactions between researcher and object. In the classroom, we have removed ourselves to a great degree from the conventional role of the mathematics teacher as "keeper" of mathematical knowledge that our students have often encountered in their previous formal mathematics experiences. Instead, we attempt to establish a much more human interpersonal relationship, crucial to the process of rehumanizing mathematics, by focusing classroom time on deepening understanding of mathematical relationships. Students and instructors continuously share an exchange of intimate moments that include genuine inquisitiveness as well as cognitive dissonance from the uncomfortable and confusing state of comparing a new intuition with a previous, contradictory understanding. As teachers we intentionally try to create opportunities for students to reach such a state because this is when they are most challenged to engage in sense making. In our rehumanizing approach, with its emphasis on genuine relationships, it is not the role of the teacher to rescue the student from confusion. We have also learned to seek out cognitive dissonance for ourselves as we genuinely seek to understand what the students are thinking. Questions flow back and forth from student to teacher, teacher to student and, at its best, from student to student; each question is part of a search for a deeper understanding of the mathematical relationship.

Although *Indigenous* is used as a term that groups the majority of our students together, our students remain vastly different in cultural practices and thus have vastly different inherent mathematical knowledge. Our materials and presentation should not give students the impression that we (the teachers) are "experts" in *their* Indigenous knowledge. Avoiding this is necessary not only to honor the identities of our students but also to maintain a human relationship supported by trust and respect. The exception is when a student and an instructor or tutor share a cultural background, in which case the connections are made naturally and propel the discussion of the mathematics. Currently, faculty members have adopted an approach that explores mathematical relationships within contexts familiar to the students without pretending to know their cultural or historical significance. On the other hand, exploring such relationships opens the door for students to be recognized for their knowledge and perspective and to help define what is valuable in a mathematics classroom.

Typically, an eleven-week quarter is divided into three or four units of study. Most class time is spent with students investigating the underlying relationships in a set of visual, geometric patterns described above, referred to as a *menu.* A menu for a two- or three-week period contains roughly five to ten different tasks. Students explore the relationships in whichever order they decide. We demonstrate our rehumanizing approach when we value and respect each student's mathematical perspective by not telling them how to interpret mathematical relationships in any given pattern. Instead, it is our role to encourage students to articulate their own perspective and support them in creating a clear written record of their thinking. Structuring a unit of study in this way, over two or three weeks, allows for the flexibility required to meet most students' needs. For example, if a student has an important family or cultural obligation, or a health-related emergency, they are not unduly penalized because they had to miss a few days of class. The class comes together regularly to process specific tasks. Processing is a time for students to engage with



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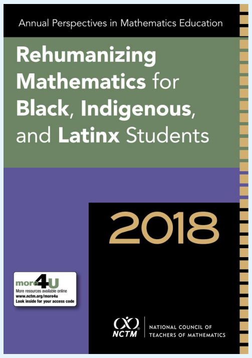


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each other, self-selecting to share their work, and to practice articulating *their own* mathematical ideas. The role of the instructor during this time is to sit unobtrusively in the back of the class and to encourage students to share their thinking and ask probing questions, being careful not to share his or her own thinking because the students may interpret it as the "right" way.

In the classroom, we have attempted to make way for our students' own mathematical explorations. Similarly, in our department we have created a space for the leadership of Indigenous instructors who can help both students and other instructors relate class material to contexts that are relevant to students' experiences. It is our aspiration that in the future the people teaching the majority of the classes will be indigenous to the place in which they teach.

## Environment

Our current pursuit to rehumanize our classrooms is to make academic mathematics genuinely accessible to everyone. Each individual is unique in his or her own history, culture, identity, and learning style. What learners have often experienced in past mathematics classrooms were lectures, multiple-choice quizzes, and memorization of algorithms. This colonial method ignored each learner's identity and unique capabilities. The method acted as a filter: Those who were able to memorize and regurgitate correctly (or "mock-learn," as we refer to it) were those who had the most success. Those who could not mock-learn were left behind. Certain values underpinned the method: To be good at mathematics, you have to be quick at mathematics; you have to get the correct answer; the teacher holds all the knowledge. As Stigler, Givvin, and Thompston (2010) have shown, for many students this method is not beneficial. Our new approach enlists a different set of values that nurture and encourage each learner's identity. Instead of lectures, class discussions emerge from simple, yet deep, prompting questions. Rather than extensive sets of exercises that focus on recipes of steps, learners spend time on a handful of mathematically deep tasks designed so that they can discuss and share their own method with one another and with the instructor. Sometimes the richest conversations emerge when students share vastly different, or even mutually inconsistent, ways of seeing or interpreting a task. These differences typically invoke cognitive dissonance. It is our role, then, to facilitate conversations in which the focus is making mathematically convincing arguments, and everyone's contribution is treated as enriching the group's understanding. This method often contradicts students' assumptions and previous experiences with mathematics.

The environment of the classroom is a key component of this pedagogy. Throughout the quarter, learners repeatedly engage in tasks that invoke cognitive dissonance. In conventional classrooms, when a student is struggling with a specific task, the instructor is the savior who bears answers, and learners quickly move on. By contrast, part of our role as instructors is to state explicitly and demonstrate that we trust students' ability to arrive at a conclusion supported by evidence. This means that the learners' environment must be one in which they feel safe to openly share thoughts and ideas. This also means that instructors are no longer the bearers of answers; they are the guardians of the mathematics environment.

What happens on the first day of the quarter is a good indicator of the overall shift from our previous practice. The seating is arranged so that the students and instructor sit in a circle facing one another so they may introduce themselves at the beginning of class. This arrangement begins to break some students' expectations of what it means to be in a mathematics class. Giving learners time to properly introduce themselves shows everyone the clear intent to respect and value their identity. Some people may speak their native language and provide their lineage from both their parents, a common introduction in Indigenous communities. The instructor's participation in these introductions shows the students that the instructor is an equal member of the learning community.



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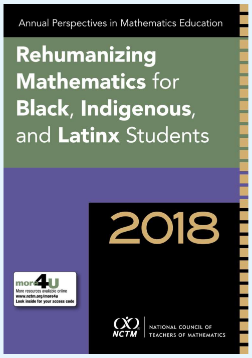


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We then engage the students in a group exercise in which we invite them to share with the class how they count the dots in the pattern in figure 8.2. Dwayne Donald (Papaschase Cree) and colleagues (Donald, Glanfield, and Sterenberg 2011) describe their use of a very similar exercise in their work with the Eagle Flight First Nation. They emphasize that the purpose of this activity is to invite the students into a reciprocal relationship, one in which the teacher is not assessing the correctness of the students' answers but rather is attempting to better understand the students' thinking. We learned of the power of this activity through MEC and the work on number talks of Humphreys and Parker (2015). All of the authors have found that this exercise makes evident each student's mathematical power and the value of a classroom in which the interpersonal relationships allow everyone to participate fully.

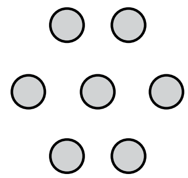

Fig. 8.2. Dot pattern for group exercise

Equally important to the exercise itself is the brief commentary on the activity in which we highlight the following points. First, we emphasize that everyone comes with their own mathematical knowledge. And second, we stress that we can all learn from each other, thus chipping away at the idea that learning is an individual enterprise and re-emphasizing the collective nature of education.

While we do not always make this explicit, we also are challenging the idea that mathematical knowledge is only held by the instructor and more broadly from the colonial institution of school. This is consistent with the remarks made by Daniel Wildcat (Muscogee Nation of Oklahoma) (2014), in which he rejects the idea that there is only one acceptable way to arrive at knowledge, emphasizing the fact that there is natural variability in cultures and customs. He suggests that our classrooms should embrace this variability.

## Assessment of Student Learning

The process of assessment evolved in tandem with our pedagogy. In 2010, course grades across our mathematics classes were determined with the common technique of attaching point values to assigned work. This practice focuses student attention on the "point-game" of accumulating sufficient points for the desired grade, thereby obfuscating the real goal of taking the course, which is to learn. The point-game challenges the development of genuine relationships between student and instructor, as it sets up an adversarial dynamic between them. A poor score on an exam also unnecessarily penalizes a student for not having learned a concept that they might learn given more time and reinforcement. The point-game was in profound conflict with the instructional methods we used when we began to restructure the environment of our classrooms and our roles in them. We needed a new system. The initial inspiration for change came when a colleague in the RPM project pointed us to the work of Lipnevich and Smith (2009), who found that giving writ-



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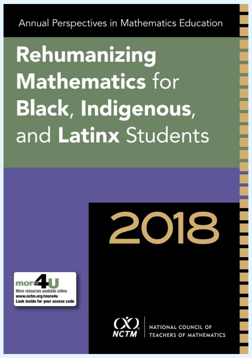


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ten feedback without a numerical grade produced the best student learning outcomes. However, this shift turned out to be only a small first step in the evolution of our assessment process. We found the following reflective questions to be of great value:

- What specifically do we want students to have learned by the time they leave our courses?
- How do we know they have reached a certain level of proficiency?
- Are there other ways, aside from exams, in which we can know that the students have learned?

We began by collaboratively rewriting the outcomes for each course and creating rubrics with definitions of various levels of proficiency. The rubrics have continued to evolve over time as we learn more about their effectiveness. We look for evidence of students' understanding of the course outcomes in a variety of sources, such as a portfolio of student work containing their exploration of geometric patterns, one-on-one interactions between student and instructor and among students, and conventional exams. All of the tasks that the students complete are scored using rubrics, and we provide only written feedback with no numerical grades. Examples of student work with some representative comments and a rubric are shown in figures 8.3a–c.

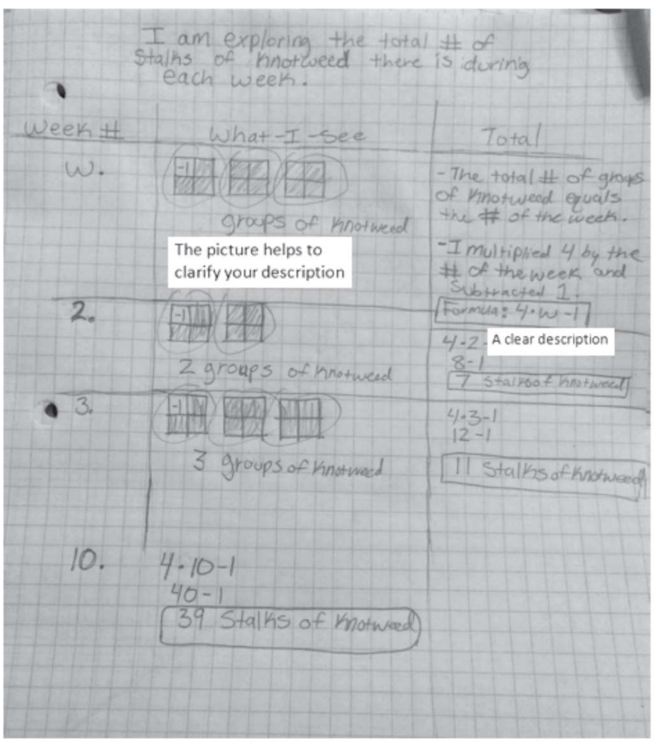


Fig. 8.3a. Typical feedback on the first draft of a student assignment



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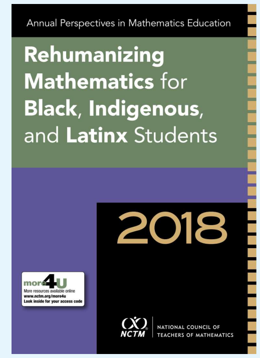

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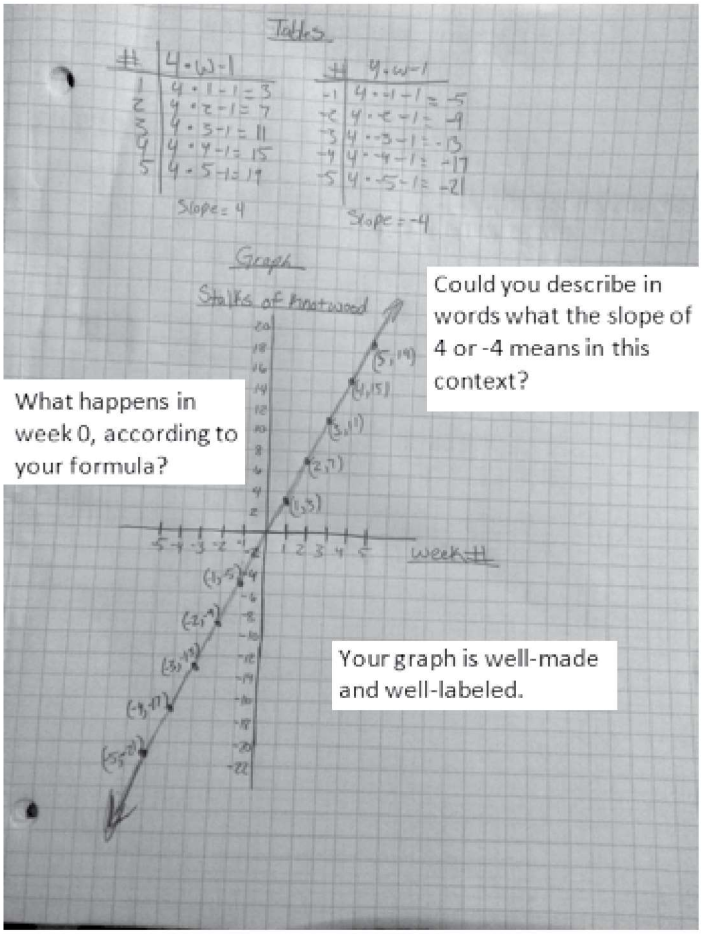


Fig. 8.3b. Typical feedback on the first draft of a student assignment



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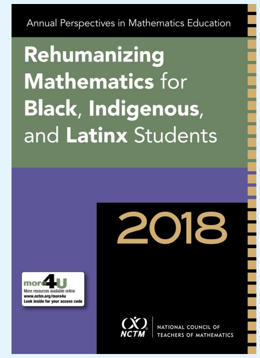


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| NWIC Algebra task proficiency rubric | Mathematical Content | Communication | Accuracy (checking and defending) |
|---|---|---|---|
| Fluent | The translation of the task into mathematical concepts is thorough [...] | Graph, pictures, models, diagrams, symbols, and words are used in harmony and presented in a logical way. | The work shows that the some of the conclusions made are supported by more than one argument. [...] |
| Proficient | The translation of the task into mathematical concepts is completed (contains a graph that shows the slope and extends into negative x-values, a formula, a sentence describing the relationship and a geometric explanation). | Graph, pictures, models, diagrams, symbols, and words are used appropriately. (The graph includes enough points to be able to identify the slope; the axes and variables are labeled) | All conclusions made are supported by the work shown. |
| Emerging | The translation of the major concepts of the task is partially completed (at a minimum, the work clearly shows a way of seeing ). | Graph, pictures, models, diagrams, symbols, and words are inconsistent with each other or unclear. | Some conclusions made are inconsistent with each other and/or with the work shown. |
| Incomplete | | | |
| Comments | *Nice work! What does a slope of 4 mean in this context? explain it in terms of weeks and stalks of knotweed.* | *Your "What-I-See" table is very clear. From your graph, what happens in week #0 is a bit unclear.* | *What does it mean that the slope is both 4 and -4?* |

Fig. 8.3c. Rubric for evaluating student assignments

Periodically, students receive updates of their understanding of the course outcomes, and their final grades are determined primarily by their demonstrated understanding by the end of the quarter. Our approach is consistent with the assessment proposals made by Quattromani and Austin-Manygoats (Navajo) (2002). Our current practice and their proposals both include using a portfolio of student work as an assessment tool, measuring proficiency using a rubric that is shared with the students during one-on-one conferences, and emphasizing the growth of students' understanding over time.

## Student Voices

The comments that we share below reflect the positive engagement and reactions to our work that we have seen from most students. Even so, we do not mean to suggest that all students have evaluated our classroom work in uniformly positive ways:

> [The instructor] made us think in all different ways of getting an answer instead of just the one way in western style schools [and] made us see many ways to get the answer without writing it down on paper in the mindless one way I have learned growing up. (Student evaluation, Introduction to Quantitative Numeracy, Spring 2017)
>
> I appreciated how [the instructor] provided [materials] that related to Native Americans to help gain my interest in math. (Student evaluation, Survey of Mathematics, Spring 2017)



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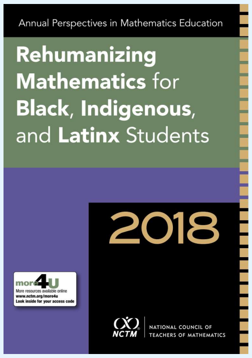


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> [The instructor] helped me see that there are multiple ways of seeing things and that you should ask how others see things because it could help broaden your mind. (Student evaluation, Intermediate Algebra, Winter 2017)

> When students are allowed to have hands-on activities with their learning they will not only learn but remember. . . . For instance when I was trying to comprehend college algebra, my math instructor related to sewing; by showing me that I could use my sewing ruler in fractions [the instructor] demonstrated through the way I knew. (Student paper on Place-Based Learning, prepared for a Native Environmental Science Course, Spring 2017)

> In [Elementary Algebra], patience was emphasized for me. I learned new perspectives from my peers that broadened my understanding of whatever math concepts we were working on at the time. Because it was promoted to integrate culture into math, I felt more engaged in the learning, I soon found myself having fun and getting satisfaction from solving menus and completing final projects. It was the first time I was able to complete a final math project which not only included math, but also, sacred colors, symbols, and even a poem to go along with the patterns that I created. This is when math started to become meaningful for me and I now enjoy it. (Personal communication from student who has now completed the first quarter of Calculus)

## Conclusion

It is our hope that sharing this portion of our journey toward rehumanizing mathematics for our students may be useful, perhaps even inspirational, to others who may be interested in a similar pursuit. If we were to start back at the beginning, we would tell ourselves to take the pen out of our own hands more often. If we want to see what our students have to contribute and the unique ways in which they each think mathematically, we need to create an environment in which they do not have to leave who they are and what they already know at the door. We need to let go of the idea that there is only one correct way of thinking and embrace diverse approaches to mathematics. We would tell ourselves to model listening and asking questions to better understand each other's perspective, as opposed to imposing a list of steps to be memorized. As part of our practice of rehumanization, we remind ourselves that each person in the classroom, students as well as teachers, are human beings beyond their institutional classroom roles, and true learning can only happen with trust and respect. Our transition continues as we challenge and broaden the definition of what counts as mathematics.

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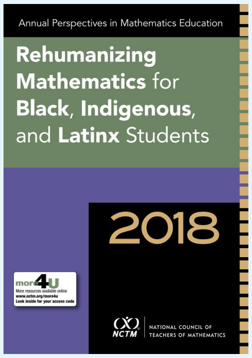


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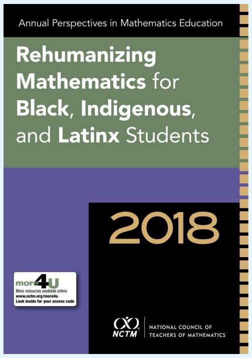


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