Opening the COMMON CORE

HOW TO BRING ALL STUDENTS TO COLLEGE AND CAREER READINESS

CAROL CORBETT BURRIS • DELIA T. GARRITY
Equity—The $E$ in ACES

GIVING ALL STUDENTS THE OPPORTUNITY TO LEARN

Ensuring that all of our students have the opportunity to learn is what equitable schooling is all about. The term *Opportunity to Learn* (OTL) was first introduced by John B. Carroll in 1963 (Burstein, 1993). Its importance as a determinant of student achievement was recognized by the *First International Mathematics Survey*, which took place during the same era. *Opportunity to Learn* (OTL) represents a simple yet powerful concept—students cannot be expected to master what they have not been taught (Burstein, 1993; Lucas, 1999). Those who support OTL identify *curriculum* as a primary determinant of students' learning. In Linda Darling-Hammond's (2010) recent book on equity, she notes that decades of research show that student "access to curriculum opportunities is a more powerful determinant of achievement than initial achievement levels" (p. 54). Our own research confirms this as well (Burris & Garrity, 2009; Burris, Heubert, & Levin, 2006).

If the Common Core remains true to the spirit of *Opportunity to Learn*, and its focus is on standards that influence curriculum, we predict that it will be a great success and more students will indeed become college and career ready. If, however, the Core becomes the foundation for new testing that punishes students, teachers, and schools if scores do not increase, it will not bring equity, but rather greater inequities. We write this chapter and this book with a cautious optimism that giving all students access to enriched curriculum will be the primary focus of the Core's implementation.

Although the term, *Opportunity to Learn* was first used in 1963, equitable access to challenging curriculum is still very uneven. The latest data from the Civil Rights Data Collection survey of 2009–10 show disparities
in OTL that are breathtaking despite decades of federal reforms. There are thousands of high schools that do not offer a mathematics class more challenging than Algebra I. Twenty percent of white students in Boston are enrolled in Advanced Placement courses, but the percentage drops to 8 percent for black and Latino students in the same city (Khadaroo, 2011).

Despite studies that clearly link challenging curriculum to successful college completion (Adelman, 1999), many students do not have access to the courses that they need for postsecondary success. The inequities among schools and the inequitable access to excellence within schools are two reasons why the Opportunity to Learn is out of reach for so many of our students.

**Barriers to Equitable Schooling**

As noted above, American schools are far from equal when it comes to providing excellent opportunities for learning. For example, the opportunity gap between white and Asian American students vs. black and Latino students persists as documented by the civil rights survey discussed above. The gap in opportunity is due to two critical barriers to equitable schooling—racial isolation and tracking.

**Racially Isolated Schooling**

Even though nearly sixty years have come and gone since *Brown v. the Board of Education* (1954), America’s schools are becoming more, not less, segregated (Orfield & Lee, 2006). The harmfulness of racial segregation was widely understood in the 1970s, but the nation has shifted its focus to an “educate where they are” philosophy grounded in the notion that we can feign colorblindness and do just fine. We cannot. Separate but equal was not fine prior to *Brown v. the Board of Education* and it is not fine now. The disparities between urban schools with high concentrations of students from low socioeconomic (SES) households and suburban schools that serve upper middle class homes are well known. The fact that schools which have a higher proportion of minority or low SES students are less likely to offer challenging curriculum, such as AP courses, is but one example (Handerwork, Tognatta, Coley, & Gittomer, 2008). Policymakers must muster the courage to confront this most difficult issue of equity.

**Tracking and Ability Grouping**

Although a meaningful discussion of policies to reduce racial isolation in schooling is beyond the scope of this book (as well as beyond the control of individual schools), the second barrier to universal access to opportunity
to learn is not. In the majority of America’s middle and high schools, access to excellent learning opportunities is gated by tracking systems or ability grouping. Since the turn of the 20th century, schools have practiced tracking, or the differentiation of instruction, by placing students in different classes based on perceived ability (Kliebard, 1995; Oakes, 2005). Unfortunately, such grouping practices continue despite years of research that demonstrates the harm that tracking causes. We know from researcher Jeannie Oakes (2005) and others that tracking depresses student achievement and causes racial and socioeconomic stratification in schools (Braddock & Dawkins, 1993; Welner, 2001). There is also an extensive body of research which shows that even in schools that are racially integrated, the practice of tracking, or ability grouping, resegregates students within those schools (George, 1992; Oakes, 2005). Minority students are overrepresented in low-track classes and underrepresented in high-track classes, even after taking students’ prior achievements into account (Mickelson, 2001; Slavin & Braddock, 1993; Welner, 2001). We also know that track assignment is influenced by factors unrelated to student achievement, giving advantage to the children of college educated parents (Useem, 1992).

If students are to meet the Common Core State Standards (CCSS), they need to learn the enriched, high-track curriculum generally reserved for high achievers. From both research and practice, we know that providing all students challenging learning experiences in heterogeneously grouped classes is the most effective and equitable way to bring all students to higher achievement (Burris & Garrity, 2009). The following section explains why heterogeneous, detracked classes are so important.

HOW DETRACKING PROMOTES BOTH EQUITY AND EXCELLENCE

Every classroom has a culture. If all students are to become college and career ready, they must work together in an environment that is challenging and enriched and where high expectations are held for all. Students learn from each other as well as from their teacher. If they are to participate in discussions that are rich in critical thinking, then students must be exposed to classmates who are intellectual risk takers and willing participants in high level discussions. Our Standard English learners (SEls) and English language learners (ELLs) must hear academic vocabulary used as part of classroom discourse if they are to develop the academic vocabulary that they need (Calderon & Minaya-Rowe, 2011; Zweirs, 2008). Likewise, students from upper middle class homes must hear the point of view of students who live with far fewer resources and have different life stories
in order to develop an understanding of social justice and to appreciate literature that reflects a culture different from their own. Special education students must develop confidence and identity as learners outside of the sheltered environment of self-contained classrooms. All of the above happens best when the classroom reflects the diversity, in both achievement and culture, of a school.

Some argue that the struggling student is overwhelmed in such an environment, but that they can be leaders in a low-track class. They believe that the solution is to provide the same curriculum but to teach it at a slower pace. That is an interesting theory, but it is not borne out by research. Attempts to reform low-track classes have not met with success—in school after school, such classes are characterized by disproportionate numbers of minority students and students from low SES households, low expectations, behavior management issues, and the least qualified teachers (Oakes, 2005). In schools, the squeaky wheels get the best teachers, and the squeakiest wheels of all are the parents of high achievers.

For those who have only taught tracked classes, the transition can seem formidable and difficult to imagine. Certainly, meeting the needs of special education students, English language learners, and the most proficient learners all in the same classroom is a challenge. However, it can be accomplished with great success (Burris & Garrity, 2008; Garrity, 2004: Garrity & Burris, 2007). For more information on how to successfully detrack, we recommend our book, Detracking for Excellence and Equity (Burris & Garrity, 2008). In this chapter we will explain strategies and share effective lessons and ideas that can be implemented or adapted and refined for our readers’ practice.

Despite our passion for equitable classrooms, we realize that although teachers can be advocates for detracking, ultimately such decisions are made at the district, not teacher level. Although the strategies that follow are designed for heterogeneous classes, they can be used in any class—after all, all classrooms are filled with students who are unique, and therefore to some extent, heterogeneous. Whether you teach in a heterogeneously grouped classroom (and we hope that you do) or one that is tracked, the strategies and lessons that we share in this chapter can foster equitable access to a challenging curriculum for students.

**ACTIVELY ENGAGING ALL STUDENTS IN LEARNING**

When we talk about how to allow all students access to high level learning, we always begin with the basics. The first basic principle is that learning
occurs in the mind of the learner. As we discussed in Chapter 2, learners actively seek to make connections with prior experiences as they negotiate what they are learning with what they have learned before. All learners need time to retrieve information, to process new learning, to make meaning and connections that make new knowledge both useful and memorable, and to practice that learning to promote retention. What differs from learner to learner are the instructional conditions that they need to make learning happen. Our job as teachers is to provide access by creating lessons that are student-centered with ample opportunity for students to demonstrate understanding.

This is what effective differentiation is all about. Unlike those who believe in tracking, we stand firm in our belief that all students deserve to be taught the same excellent curriculum. What differs is how you teach it. Differentiation occurs in the methods we use to help different students learn the curriculum, not in the standards that we hold for them.

For example, students with learning disabilities in reading or who are emerging English language learners might require an audio and a written version of text. Students who have a limited academic vocabulary may need additional vocabulary supports during or outside of class. We may need to differentiate the difficulty level of the materials we use to deliver content. Well-organized chalk boards, with posted aim questions for the lesson, help students with attention deficit disorder (ADD) or organizational challenges to follow the lesson and record notes with minimal confusion.

Not every student must do every problem on a math practice sheet—different problems can be assigned to different students depending on their facility with the topic. Challenging problems that require students to extend what they know can be given to high achievers. Prepared cue cards with formulas or procedural models can be quietly passed to students who are struggling with their math problems. The next chapter on support, the S in ACES, will elaborate on strategies that can be used to provide access to high level learning for students within the classroom and in small classes, such as resource rooms, which are designed to provide mainstream support.

DIFFERENTIATED LESSONS

We have never met a student, no matter what her gifts or struggles, who did not enjoy thinking deeply about interesting ideas. As administrators, we have been in awe as we watched brilliant teachers engage children who are generally silent, passive learners. We listened as children who were generally
disengaged or shy contributed deep, thoughtful insights to class discussions. Whenever that magic occurs, it is always because the teacher designed the lesson in a way that allows all learners to enter the classroom dialogue.

Wise teachers compensate for the deficits that impede learning. As Jeff Zweirs (2008) reminds us in Building Academic Language, “when ideas are transformed into speech, transmitted, and then turned back into ideas, some things are lost in translation” (p. 12). Often, a lack of academic language gets in the way. Students feel out of the game and passivity takes over. That is why it is imperative that we bring them into a rich, heterogeneous class where high level thinking is occurring and academic language is spoken. The following lesson, designed for a heterogeneous tenth-grade English class, is designed to do just that.

A Model Lesson: A Differentiated English Language Arts Lesson for High School Students

Analyze multiple interpretations of a story, drama, or poem (e.g., recorded or live production of a play or recorded novel or poetry), evaluating how each version interprets the source text.

National Governors Association, CCSS Curriculum: Reading Standards for Literacy, p. 38

In college, students are required to think and analyze ideas across texts (Conley, 2003). In order to help students develop that ability, high school teachers will often ask their students to read two works of literature, recognize a controlling idea shared by both, and then write an essay or commentary using both works. For example, a novel or short story may be paired with a poem or with an essay that shares a common theme.

The differentiated lesson below is designed to precede the study of William Golding’s Lord of the Flies, a novel often taught in high school. Lord of the Flies allows students to explore themes common to great literature such as the struggle between good and evil within the individual, the nature of man apart from society, and how man reacts when his survival is threatened. In Chapter 6, we will return to this lesson and show how it can be integrated into a wider unit of study.

The text that will be used in this lesson is a poem by W. D. Snodgrass (1987) entitled “After Experience Taught Me . . . .” Poetry offers a wonderful opportunity to teach our students how to closely read and analyze text. It also presents a unique opportunity for students to understand
how form conveys meaning (Clark & Fifer, 1999). Because poems are by nature shorter than most works of literature, they can seem more accessible to SELs and ELLs. Poetry is a perfect vehicle for a differentiated lesson that promotes higher level thinking. Because it is meant to be heard as well as read, poetry offers an excellent opportunity to practice the CCSS above.

**Background**

The students in this heterogeneous tenth-grade class represent a wide range of student achievement. Three students have learning disabilities that restrict their ability to read, and two students are English language learners. There are also students who have extraordinarily strong academic vocabularies and reading skills while others struggle with below grade-level texts.

For this lesson, the teacher chose the poem, “After Experience Taught Me . . .” by W. D. Snodgrass. She chose it for several reasons. First, she could use the poem to introduce the theme of the tension between good and evil when survival is at stake. That is a theme she would develop with the class when reading *Lord of the Flies*. Second, although the poem would require higher level thinking skills for analysis, the vocabulary in the poem was accessible to students—sophisticated enough to help build academic vocabulary, but not so difficult as to serve as a barrier for her SEL and ELL students. Third, because she was cognizant of the CCSS, she knew that when students heard an audio version of the poem read by the author, they would understand how both the written text form and the recited form contributed to a deep understanding of the poem. Finally, she knew that her students would read *Beloved* by Toni Morrison in Grade 11. This poem would introduce the students to the use of multiple narrators. The eleventh-grade teacher could refer back to the poem to help accelerate student learning through transfer.

Rather than teach a whole class, teacher-directed lesson, she decided that she would create a differentiated lesson that would allow all students to engage in high level thinking and contribute to the analysis of the poem. She wrote this objective in her plan:

*Students will analyze the poem “After Experience Taught Me . . .” and write a reflection on how listening to a poem while observing its structure can deepen a reader’s understanding.*

(Continued)
Because this was a constructivist lesson that would ask students to uncover the objective through their analysis, she did not write the objective on the board. Instead, she posted a simple aim question:

What can we learn about the role of structure by reading the poem, “After Experience Taught Me...” by W. D. Snodgrass?

The teacher thought about all of the learners in her class and how she could best use their gifts and talents so that they could be active participants. Her first concern was to make sure that her students for whom reading might be a barrier could actively contribute to the class. She decided that her English language learners and her students with reading disabilities could listen to the poem and focus their analysis on the poem’s recitation. She searched for an expert recitation of the poem and found one online. The Poetry Foundation (www.poetryfoundation.org) had a podcast recitation of the poem by the author. She would borrow the school’s iPads and headphones for the five students who would analyze the recitation. She made sure that the special education and ELL teachers had a copy of her plan and the poem ahead of time.

It was also important that her highest achievers be challenged by the lesson. She knew that they could read and interpret the poem independently, and therefore they could spend their time in deeper analysis. Finally, she recognized that the majority of the students in the class needed an assignment with more scaffolded support. The teacher decided that she would integrate academic vocabulary building in their assignment as well. The plan for the lesson was for students to work independently with tailored assignments. Students would then work in heterogeneous, cooperative groups of four, with each member making a unique contribution.

The tenth-grade English teacher and the ELL and special education teachers created the following chart for assigning work and group membership for the lesson:

While the class was copying the aim, the teachers (subject area and special education) put the chart (Figure 4.1) on the overhead projector and arranged materials in four piles, by letter, on a table. Students retrieved their materials and began working. Students independently worked on the task that corresponded with the letter that identified the row in which their name appeared. Students in Row A had iPads with the recording as well as a written version of the poem. Students in Row B...
were given half of the poem’s stanzas and the final stanza, while Row C
students were given the other half and the final stanza. Although students
were not told, these two halves represented two distinct narrators of
the poem. Students in Row D were given the written version of the
poem only.

Tasks were assigned, in a handout, as follows:

**Group A:**

Read the poem silently. Now listen to the poem’s author read the
poem as you read along silently.

Notice how the poet changes the tone of his voice.

Circle the words when a change begins.

Listen for a second time. Is there a pattern to the change?

Why do you think the author’s voice changes?

What do you notice about the way he reads the final stanza?

**Group B:**

Read the poem silently twice. After the second reading:

Describe the mood of the poem.

Speculate who the speaker might be and what we know about
him.

(Continued)
What are the meanings of the following words in the poem (you may give a synonym or phrase that could be substituted)?

vain
excepting
priority
endeavor

Does the final stanza startle you? If so, why?

Group C:
Read the poem silently twice. After the second reading:
Describe the mood of the poem.
Speculate who the speaker might be and what we know about him.
What are the meanings of the following words or expressions in the poem (you may give a synonym or phrase that could be substituted)?

facial mask
dawdling
remorseless

Did the poem startle you? If so, why? How does the final stanza connect with the rest of the poem?

Group D:
Read the poem at least twice.

How many narrators are there?
What do you believe to be the purpose of the final stanza?
Rewrite that stanza in your own words, explaining its meaning.

This poem is an example of what is known as the confessional school of poetry. Confessional poets use their poetry to show the repressed feelings that often lie beneath what they show to others.

Which line(s) best represent a confessional style?

Students were given fifteen minutes to complete their assigned task. They then went to their jigsaw group (assigned by column number) to discuss their analysis.
Each group (1) discussed their responses to the task, (2) identified three questions they would like to ask the poet, and (3) explained why the author chose to write the poem with two narrators rather than one. The general education teacher and the special education teacher visited the groups, providing guidance and taking learning notes on any student misunderstandings and confusions. These would be addressed the following day.

After about ten minutes, the teacher reconvened the class. She played the podcast of the poem to the class, this time including a short explanatory introduction by the author. She led a whole class discussion that analyzed the poem, including a review of the identified vocabulary. The class ended with students writing a short reflection based on the aim question. She asked the class to focus their response on the connection between the physical structure of the poem and the author’s reading.

As the students wrote, the content teacher and the special education inclusion teacher worked with students who needed help with the written response.

**Reflections on the Lesson**

Differentiated instruction is a constructivist approach to teaching and learning. It takes into account student differences in background knowledge, prior achievement, learning disabilities, interests, and talents. The goal of a differentiated lesson is the maximization of learning for each individual student in the class. Assignments may vary in levels of difficulty. Materials may be individualized. The teacher deliberately designs different entry points into the lesson to help students access the content.

The term *entry point* comes from Howard Gardner’s (1993) work on multiple intelligences. He identified five entry points or pathways to learning a given topic based on the multiple intelligences of students. These points are summarized below:

1. Narrational—the teacher uses a story to engage students in the learning
2. Logical/quantitative—logic or numbers are used to develop understanding
3. Foundational—key words and definitions
4. Aesthetic—the use of musical and visual arts

5. Experiential—students physically manipulate objects and materials

According to Gardner, when a teacher includes multiple entry points, she expands the possibilities for student learning. For example, in the lesson above, the teacher used a narration of the poem to allow students to enter the lesson. At the end of the lesson, she played the recording for the entire class so that all could learn from the narrative experience.

In our opinion, the hallmark of a good differentiated lesson is that it is distinguished by more student talk than teacher talk, and by more student work than teacher work. Although the difficulty or complexity of the task may differ, all students contribute their knowledge so that the class and each student can achieve the learning objective.

That is exactly what occurred in this lesson. Group A students, who analyzed the voice of the poet, were able to confirm for the group that the author created two narrators for the poem, not just one. From their listening experience, they were able to explain who those narrators were. Thus, students who are often silent during a whole class lesson became important experts in their groups.

The high achievers of the class were challenged by the Group D assignment. They were required to analyze the poem absent the scaffolding that was provided to the other groups. Their knowledge was extended by introducing them to the school of poetry to which the poem belonged. When the teacher assigned projects later in the term, she would design a project that incorporated more poetry from the confessional school of poetry. She would allow her students to choose their project based on their interest.

**Model Lesson: A Differentiated Mathematics Lesson for K–3 Students**

Mathematically proficient students . . . are able to identify important quantities in practical situations and map their relationships using such tools as . . . graphs. . . . They can analyze those situations to draw conclusions.

National Governors Association, CCSS for Mathematics, p. 7
Write informative/explanatory texts to examine and convey . . . information clearly and accurately through the effective selection, organization, and analysis of content.

National Governors Association, CCSS Curriculum: College and Career Readiness Anchor Standards for Writing, p. 18

Throughout the Common Core Standards in mathematics, from kindergarten through high school, students must be able to collect, organize, represent, and interpret data. Kindergartners learn to use numbers in context when they describe and compare items with a common measurable attribute. In middle school, students will use random sampling to draw inferences, and in high school students will interpret categorical and quantitative data (CCSS for Mathematics, pp.10, 50, 80). These mathematics skills and applications are also utilized in science and social studies. All students, specifically SEL and ELL students, must receive reading and writing instruction in each specific content area in order to succeed. Graphs are a common text feature in subject area textbooks. Mathematics lessons that develop a deep understanding of creating, reading, and interpreting data also develop a tool for learning subject matter through the specific writing genre of graphing (Calderon & Minaya-Rowe, 2011).

This differentiated lesson addresses mathematics standards for grades K–3 with each lesson expanding and applying the base knowledge of collecting and interpreting data and numeracy. The common theme of each component is that the teacher employs an experiential entry point for the lesson by using the students themselves as a living graph and the data or information focuses on the students themselves. Students fully engage in the lesson and easily make connections to the activities in each lesson, and thus retention is deepened. Students independently (Grades 2–3) or with their teacher (Grades K–1) will write sentences based on the data from the graph.

Although these activities can be used at any point in the school year, these self-awareness graphs, which show similarities and differences between a student and her peers, can be an excellent tool for helping students get acquainted in September. The added bonus is that a teacher will have beautiful bulletin boards filled with the most

(Continued)
important element in the classroom—the children themselves (Sullivan & O'Neil, 1980). Although the lesson can be used and developed in Grades K–3, teachers can expand them through the grade levels based on student interest and understanding.

This is the objective for each of the lessons:

*Students will collect, organize, and represent data in graphical form and write an informative sentence describing an interpretation of the data. Students will label the graph with a title and variables.*

**Self-portraits K–1**

Each student needs one sheet of construction paper and crayons. The size of the graph will depend upon the space in the classroom but usually three feet high by six feet wide will suffice for this initial activity.

Each student draws a self-portrait and writes his name on the paper. In kindergarten, some students may need writing assistance. When the portrait is completed, the children place their work on a large piece of paper. As each student places his portrait on the paper, the class counts aloud to determine the number of students in the class. When the graph is complete, each student stands and counts off to verify the number in the class. A sentence is generated and added to the class graph, “We have twenty-two students in our class.”

A question is posed, “How many girls are in our class?” Students quickly see that the gender information cannot be easily determined from the first graph. The teacher returns the portraits to each child, and asks the girls in the class to form a line across the front of the room. The boys do the same. Boys and girls should be in two straight lines so the number of each can be compared. Girls count off and then the boys. There are nine girls and thirteen boys. Which group has more children? Which has fewer? The original bulletin board paper is labeled *boys* and *girls* on the left. Students now place their portraits in the proper row based on gender. Now the graph is sorted by one characteristic, gender. The teacher records the number of each on the graph. Additional sentences are written about the graph: “We have nine girls in our class.” “We have thirteen boys in our class.”
The teacher can extend the gender facts with deeper questions such as, “How do we know which group has more students or fewer students?” The answer to that question should be derived from both the graph and from comparing the numbers. The teacher then asks the class, “How many more boys do we have than girls?” and then follows up with “How did you get your answer?” This question develops the concept of addition and subtraction. Students will approach this question in many ways. Each response should be validated using both the graph and physically with the students.

Finally the class must decide on a title for the graph. In a sense, this is determining the main idea of the activity. The teacher asks each student to think of a title and share that with a partner. Each pair shares ideas and the class decides on the final title.

**Birthdays K–3**

Birthday celebrations bring joy to all classrooms. Why not link this excitement to mathematics? This activity introduces the format of a graph that has two variables—month of birthday and number of students per month. The materials can be simple or more creative depending upon the teacher. The design of a birthday graph requires a large piece of paper (approximately three feet high by three feet wide). Teachers precut a uniform-sized symbol for each birthday month, for example, a snowman for January, a heart for February, or more simply, a uniform-sized sticky note can be used. On the classroom floor, the teacher tapes twelve pieces of construction paper, each labeled with one month. This is the model for the living birthday graph.

In K–1, the teacher will prelabel each variable on the board paper, listing the months along the horizontal axis and numbers on the vertical axis. In Grades 2–3, the students usually are familiar with a graph and should be able to contribute this information for each axis. Each student writes her name and birthday on the month symbol or writes the name, month, and day on the sticky note.

The teacher calls students by month to add their symbol or sticky note to the graph. These students then form a queue in front of their month on a line that is taped to the floor. After all months are called, the teacher and students match the number of students standing in each month with the number of symbols on the paper graph as each

(Continued)
(Continued)

student counts off. The teacher poses the first question, “Which month has the most birthdays?” She follows up by asking, “How do we know that?” For K–1, it helps to have children join hands across the months so that the first person in each month is holding the hand of the other first person, the second with all seconds, and so on. This makes the answer to these questions clearer from the physical evidence. “How many students have a birthday in that month?” The answers are verified by counting.

Students return to their seats. Looking at the graph, students verify the answers to the same three questions. Now the answer to “How do we know which month has the most birthdays?” has additional information as students see the tallest column on the graph. “Can we tell which month has the least number of birthdays?” Again the teacher verifies the response by observing the graph and then counting. If a month has no birthdays, she can ask the students with that birthday month to stand. When no one stands, the concept of zero is reinforced.

Hopefully at least two months will have the same number of birthdays. Using June and December as an example, the teacher asks the students with birthdays in those two months to come to stand at their month. “Which month has more birthdays, fewer birthdays?” When the students reply that they are the same, they can prove this by counting the students standing and by counting the notes on the graph. The teacher introduces the concept and the word equal. For K–1, the teacher can continue with comparative questions in a similar manner, counting off each time to reinforce number concepts. The teacher records a statement with each piece of information gleaned from the graph. For example, “We have the most birthdays in February, and we have zero birthdays in October.” “We have three students who have June birthdays and three students who have December birthdays. They are equal.”

For kindergarten students, these activities also provide concrete practice with the standards that ask students to “count to tell the number of objects,” “compare numbers,” and “classify objects and count the number of objects in categories” (National Governors Association, CCSS for Mathematics, p. 10).

For Grades 1–3, the conversation extends to how many more and how many fewer. The solution comes initially from physically counting and comparing the students and then by using the graph. The teacher
emphasizes that one column is taller or shorter than the other. For third grade and perhaps second grade, depending upon the student response, the questions are extended to include the concept of a fraction. “How many students are in our class? Twenty-two. How many students were born in July? Three. What part of the class was born in July? Three out of twenty-two or 3/22.” Repeat these questions with each month. Compare the fractions for each month “recognizing that comparisons are valid only when the two fractions refer to the same whole” (National Governors Association, CCSS for Mathematics, p. 24). In this case the whole is the class.

Grade 2 students can work with a partner or a small group to write a sentence about their birthday graph. Each pair or group can write a draft sentence that the teacher checks for accuracy. The students then transcribe the sentence onto a sentence strip. These fact strips are added to the birthday bulletin board. The Common Core Writing Standards suggests that students in Grade 2 should be able to “recall information from experiences and other sources in order to answer a particular question through their writing” and “write informative/explanatory texts in which they introduce a topic” (National Governors Association, CCSS for ELA, p. 19). These standards are initially addressed through writing in the content area of mathematics based on the self-awareness graphs.

Grade 3 students can take this lesson to another level with sorting, recoding, and analyzing data using Figure 4.2. Based on the class birthday graph, each student completes the table by recording the number of students whose birthday is in a given month. As a homework assignment, the students complete the graph to include a title and labels for the variables and record their observations. The observations are shared the next day with a partner. The partners verify the validity of the sentences and make corrections as needed. The observations will be shared by each pair of students with the class as a whole, and each one will be verified using the graph and with the students themselves if needed. As in the Grade 2 lesson, these observations can be transcribed onto a sentence strip and displayed with the class graph.

As an extension in writing, students can use the sentence strips as a resource to write an informative paragraph to “convey ideas and information clearly” and “develop the topic with facts and details” (National Governors Association, CCSS for ELA, p. 20).

(Continued)
Opening the Common Core (Continued)

**Figure 4.2 Birthday Graphs**

My Study

<table>
<thead>
<tr>
<th>Month</th>
<th>Birthdays</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td></td>
</tr>
<tr>
<td>Feb</td>
<td></td>
</tr>
<tr>
<td>Mar</td>
<td></td>
</tr>
<tr>
<td>Apr</td>
<td></td>
</tr>
<tr>
<td>May</td>
<td></td>
</tr>
<tr>
<td>Jun</td>
<td></td>
</tr>
<tr>
<td>Jul</td>
<td></td>
</tr>
<tr>
<td>Aug</td>
<td></td>
</tr>
<tr>
<td>Sep</td>
<td></td>
</tr>
<tr>
<td>Oct</td>
<td></td>
</tr>
<tr>
<td>Nov</td>
<td></td>
</tr>
<tr>
<td>Dec</td>
<td></td>
</tr>
</tbody>
</table>

Describe some patterns that you see.
Reflections on the Lesson

The lessons are a good example of how we can differentiate instruction by building on the multiple intelligences that our students have. The physical involvement of each student in creating a living graph becomes the means by which the class creates a paper graph, maximizing learning for each student. The teacher employed Howard Gardner's experiential entry point as students physically manipulated the learning materials. Additionally, the teacher focused on the bodily-kinesthetic intelligence from Gardner's work (1993) on multiple intelligences. However, she also incorporated linguistic intelligence, logical-mathematical intelligence, spatial/visual intelligence, and interpersonal and intrapersonal intelligences in the lesson. As noted in the reflections on the high school lesson, Gardner believed that students could be better served if educators presented instruction using a variety of intelligences. By blending the intelligences, the teacher helped students access the content and better understand the objective.

Students were fully engaged throughout this lesson with each student having a voice and taking part in creating the graphs. For special education, ELL, and SEL students, the creation of the living graph provided a physical and personal connection to the objective and both the living and paper graph provided a visual representation of the data to facilitate interpreting the data. The specific questions allowed these students to apply the data skills immediately and afforded the teacher the opportunity to check their understanding (Calderon & Minaya-Rowe, 2011).

The lesson incorporated a high level of student talk and participation rather than a teacher directed approach. All students contributed their knowledge and the teacher expanded her questions and reinforced the physical concrete model when appropriate, based on student needs. The teacher included how and why questions to challenge students and opened the writing part of the objective to allow for individual thinking and interpretation. All students achieved the objective.

The homework assignment for Grade 3, Figure 4.2, required each student to complete the graph from the table. The teacher provided an open-ended component by asking each student to describe patterns from the graph. Such a simple yet powerful item allows students to respond based on their level of understanding. The paired sharing and class sharing the following day provided all students with a rich conversation and insights from the graph.

The extension of the data to include the concept of a fractional part of a whole starts to build a solid foundation and understanding of the meaning of a fraction and the significance of the whole. Initially, students consider what is the total number of students born in June (three) and August
(four) as seven students in total. When this is extended to what fractional part of the class was born in June and August, students begin to understand that when $3/22$ is combined with $4/22$, the result is $7/22$ not $7/44$, the all too common error.

The graphing lessons described above are samples using student data. Graphs can be added throughout the year to include eye color, hair color, favorite food, favorite color, and more. The self-awareness graphs provide a concrete and visual model for multiple purposes to reinforce a skill such as comparing numbers, to introduce a concept such as comparing fractions, or to revise a graph to include a scale. Each graph adds to the portrait of the class where each student views himself as part of the class but yet uniquely different.

A Model Lesson: A Differentiated Mathematics Lesson With Algebra Tiles for Middle School Students

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include . . . concrete models . . . . Proficient students are sufficiently familiar with tools that are appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insights to be gained and the limitations.

National Governors Association, CCSS for Mathematics, p. 7

Apply the properties of operations to generate equivalent expressions.

National Governors Association, CCSS for Mathematics, p. 44

Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

National Governors Association, CCSS for Mathematics, p. 49

Perform arithmetic operations on polynomials.

National Governors Association, CCSS for Mathematics, p. 64

National Governors Association, CCSS for Mathematics, p. 7

Apply the properties of operations to generate equivalent expressions.

National Governors Association, CCSS for Mathematics, p. 44

Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

National Governors Association, CCSS for Mathematics, p. 49

Perform arithmetic operations on polynomials.

National Governors Association, CCSS for Mathematics, p. 64
Middle school students use and apply the knowledge and understanding of arithmetical expressions during the fifth grade and beyond as they learn to read, write, and evaluate expressions in which a letter represents a number in an algebraic expression. Teachers must introduce this concept in a concrete manner prior to moving to the symbolic level. Algebra tiles are an effective instructional tool for this purpose. Algebra tiles provide a concrete model of integers and variables. They usually are two colors with green on one side, to represent a positive value, and red on the other side, to represent a negative value. Students develop a deeper understanding of the meaning of polynomials and operations with polynomials when they have the opportunity to use algebra tiles. These tiles let them see and touch the integers and variables that make up a polynomial so that they can easily transition to the symbolic form.

This differentiated lesson focuses on addition and subtraction of polynomials using algebra tiles. In Chapter 5, we include a support lesson using a visual model for multiplying polynomials. Too often when a student looks at \( x + 2 \) or \( 2x \) or \( x^2 \), they cannot describe the difference between each expression. However, if the student viewed a visual of each expression and can touch the concrete model of each one, the confusion usually disappears.

All students benefit from this initial development of the concept of adding and subtracting polynomials. Having this foundation will assist all students in applying the understanding in computational and problem solving situations. The algebra tiles help bridge the gap in understanding for struggling math students, special education students, and ELL students and SEL students who have difficulty accessing concepts through language alone.

(Continued)
The objective for the lesson is: Students will be able to represent a polynomial in standard form and add and subtract polynomials.

Prior to the class, the teacher created twenty-four small cards (half of a 3x5 card). On each of eight cards she wrote a unique second-degree monomial, all with the variable x to the second power, such as $-2x^2$. On another eight cards, she wrote a unique monomial, all with the variable x, such as 5x, and on the last group of eight cards, she wrote unique non-zero integers, such as $-2$. As students entered the room, she gave each student a card. The Do Now activity, verifying that students understand how to combine like terms, was on the board:

Find other students with a term like yours. There will be eight in your group. Together, combine all of the like terms.

As the students found their like terms, the teacher circulated to listen to the group discussions, pose questions, and clarify any misunderstanding. The teacher asked each group to provide the final answer: $2x^2$ from one group, $3x$ from the second group, and 4 from the third group. The teacher asked students to recall the general name for each term, that is, monomial. She then showed $2x^2 + 3x$ and asked for the name of that term, binomial. She added, “Does anyone know any other word that begins with bi-?” Quickly students offered bicycle and binoculars. “What does a binomial have in common with a bicycle and binoculars?” she asked. Students easily discovered the common element of two. Finally she used the three terms as $2x^2 + 3x + 4$. Students offered the name of the term as trinomial. She followed the pattern and asked for any other word that begins with tri. Students gave the words tricycle and trinity and they linked the concept of three. The teacher presented an integrated web, Figure 4.3, to visually display each term and link them all as polynomials.

The teacher introduced each green (positive value) algebra tile—represented with light shading—as the integer 1, the term x, and the variable $x^2$. She displayed each on an overhead projector (OHP). She brought the students back to their class trinomial from the Do Now, $2x^2 + 3x + 4$. “Using the algebra tiles, let’s represent each of your monomials that formed this trinomial. How might we do that? Think for a moment and share your thoughts with your partner.” She invited one pair to display 4 on the OHP, a second pair to display $3x$, and the third pair to display $2x^2$. After each pair set the display, she asked them to describe how they arrived at that configuration.
Figure 4.3: Web of Polynomials

The Web of Polynomials (An integrated web)

![Diagram of polynomial categories](image)

**Polynomials**
- **Monomials** (one term)
  - $2x^2 + 2ab$
- **Binomials** (two terms)
  - $2x^2 + 3x + a + ab$
- **Trinomials** (three terms)
  - $2x^2 + 3x + 4a + ab + b$

**Key Notes:**
- Only like terms can be added or subtracted.
- A variable cannot appear in the denominator.
- Exponents are integers greater than or equal to zero.

(Do Now cont.)

(Continued)
She followed this with a few more models to be sure that the students were comfortable with the meaning of each tile. She then introduced the negative model for each tile showing the students the red side of the tile—represented with dark shading—and comparing $4$ in green with $-4$ in red, $3x$ in green with $-3x$ in red, and $2x^2$ in green with $-2x^2$ in red. Using student sets of the tiles, each pair modeled three polynomials that were taken from the student text as model examples. Using the models from the students, the teacher noted the standard form of a polynomial, and students displayed their models in this form of decreasing degrees. The teacher modeled combining a positive $3$ (green tile) and negative $4$ (red tile) resulting in $-1$. She used the term *annihilate* to describe the process: when a green and red meet they annihilate each other, or in math terms, they *zero out*. The students like the annihilate metaphor much better! She modeled this with the $x^2$ tile and the $x$ tile as well and then quickly showed a few more annihilations.

The teacher introduced adding polynomials using the model example from the student textbook.

Simplify $(3x^2 + 4x + 5) + (2x^2 - 3x + 1)$

Individual students displayed the model for each monomial in the two polynomials. Using the concept of addition as joining together like terms, the students, with prompting from the teacher, join the tiles $3x^2$ and $2x^2$ resulting in $5x^2$. Next, the combination of $4x$ (green positive tiles) with $-3x$ (red negative tiles) resulted in $x$ and the combining of the integers $5$ and $1$ resulted in $6$. The addition was displayed in both horizontal and vertical form to give the students both visual representations. With a partner, the students completed a second addition example. The teacher monitored the students and offered assistance as needed. One pair presented the solution to the class using the tiles.

The teacher again used the model example from the textbook for subtracting polynomials.

Simplify $(2x^2 - 3x + 2) - (x^2 + 2x + 1)$

Students displayed each polynomial with the tiles. Using students’ prior knowledge, the teacher reviewed subtracting integers as she posed the question, “When you subtract $3 - 4$, how do you find the solution?”
Students stated that they add 3 and -4. She wrote the two expressions on the board. “When you subtract -3 - 2?” Students stated, based on the process learned in earlier grades, that they add -3 and -2, that is, they add the second number’s opposite. Again the teacher wrote these two expressions on the board. The teacher asked for the proper mathematical word for the opposite of a number. After adequate think time, students offered suggestions and finally arrived at the term *additive inverse*. The teacher reinforced the word by asking the students to repeat the word three times after her. She returned to the two subtraction examples that were rewritten as addition examples and circled in red the 4 and -4 in the first example and the 2 and -2 in the second example. She wrote in red, *additive inverse*.

The teacher then applied this to the subtraction of the model problem for subtracting polynomials. “Let’s look at the second polynomial, \((x^2 + 2x +1)\). If we are subtracting that from the first polynomial, how can we add its opposite? Write down your thoughts.” After an appropriate amount of think time, students offered the suggestion of adding the opposite of \((x^2 + 2x +1)\) which is \((-x^2 - 2x -1)\). Each of the green tiles for \((x^2 + 2x +1)\) are now turned to red as the opposite is indicated \((-x^2 - 2x -1)\). The teacher repeated the words and the flip of each tile and said, “We are adding the opposite of \(x^2\), we are adding the opposite of \(2x\), and we are adding the opposite of 1.” The students then combined the like terms and determined the answer of \(x^2 - 5x +3\).

**Step 1.** Show the original expression: \((2x^2 - 3x +2) - (x^2 + 2x +1)\).
(Continued)

Step 2. Now apply the sign change for the additive inverse.

\[ 2x^2 - 3x + 2 \]
\[ -x^2 - 2x - 1 \]

Step 3. Simplify or combine like terms by adding.

\[ x^2 - 5x + 1 \]

The teacher and students completed a second model in a similar manner.

For homework, the teacher selected four polynomials from the student text and the students were asked to draw tile pictures of the polynomials. Similarly the students completed exercises from the textbook on adding and subtracting polynomials. Students had the option of drawing the algebra tile representation. The teacher differentiated the specific exercises depending upon the student. All students completed a common set of adding and subtracting polynomials to assess understanding of the objective of the lesson. The teacher, however, provided some students with a set of tiles to use for the assignment along with some exercises on combining like terms and writing the final polynomial
in standard form. Other students completed application of polynomial operations with geometry and word problems. The teacher offered an optional assignment of finding other familiar words that begin with the prefix of *mono-, bi-, tri-, or poly-.*

**Reflections on the Lesson**

Rather than use a sampling of five examples where students independently combine like terms, the teacher creatively assessed student understanding of the concept using an interactive Do Now engaging all students. She employed a number of Gardner’s entry points: experiential as students physically combined like terms, logical/quantitative as students used their math skills, and foundational as the class defined the key terms for the lesson. The initial task for students was to find students with the same like term, clarifying what makes two terms alike. Students collectively used their math skills to arrive at a final answer. For ELL and SEL students, the review of the academic vocabulary for the lesson incorporated students’ background knowledge and vocabulary knowledge giving meaning to each word (Zweirs, 2008). Further the integrated web for polynomials, Figure 4.3, helps students anchor the vocabulary and the concept for future use (Calderon & Minaya-Rowe, 2011). This web can also be used with the “words of a feather” strategy we will discuss in the next section (Zweirs, 2008). On the line between the words *polynomial* and *monomial*, the student might write the following:

*A monomial is a polynomial with one term.*

Likewise, between *polynomial* and *binomial*, a student might write this:

*A binomial is a polynomial with two terms.*

And finally between *polynomial* and *trinomial*:

*A trinomial is a polynomial with three terms.*

The algebra tiles provided a concrete visual model for adding and subtracting polynomials. Rather than following the procedural process used in the student text, the teacher used the same model problems but provided a bridge from the concrete to the symbolic procedural approach.
All students, both high achieving and struggling math students, benefit from this initial instruction to fully understand the operations in visual form. Many students struggle with subtracting polynomials as they try to understand distributing a \(-1\) to each term in the subtrahend or being told to "change the signs of each term in the subtrahend and proceed as in addition." Yes, mathematically speaking, \(-1\) is distributed to each term and you can follow the latter process; but does this really make sense to students without the visual component? This becomes another rote process with no understanding, thus limiting students from comprehending future problem applications using this skill. This web in Figure 4.3 and the algebra tiles will be used by ELL teachers, special education teachers, and math support teachers in their resource classes to reinforce the academic vocabulary as well as the concept and skills for adding and subtracting polynomials.

The lesson was student-centered throughout. The teacher consistently used Think-Pair-Share or small group analysis, thus inviting all students to partake in the class discussions and providing student-to-student discussion as an alternative opportunity to understand the objective. These instructional strategies provide the teacher with various means to assess that understanding.

**WORDS OF A FEATHER—A SIMPLE DIFFERENTIATED TECHNIQUE TO BUILD ACADEMIC LANGUAGE**

In his book *Building Academic Language*, Jeff Zweirs (2008) provides strategies on how to create visual organizers that allow students to link sophisticated content vocabulary together in order to learn the meaning of the words. One of those strategies is as follows. The teacher begins by placing related content words in circles or boxes on a paper. These become the "words of a feather that flock together" (p. 147). Lines are drawn between the words. On those lines, students create and write sentences that demonstrate that they understand the definition of, and relationship between, the two linked words.

Let's say for example, that elementary students are studying ancient Egypt. Their teacher wants to make sure that students understand the vocabulary for the unit. Some are academic words that are pertinent to the unit such as *hieroglyphics*, *pharaoh*, *papyrus*, and *pyramid*. She also chooses to highlight other academic words related to the unit that have broader usage—words such as *scribe* and *ancient*. 
On the line between scribe and hieroglyphics, the student might write—

*The scribes of Egypt wrote down history using hieroglyphics.*

Between hieroglyphics and papyrus, she might write—

*Hieroglyphics could be carved on stone or written on papyrus.*

Between scribe and papyrus—

*Scribes used papyrus as paper.*

We can differentiate the task by adapting it to meet student needs. Struggling students who might have difficulty with the task can be given verb prompts such as the words *write* or *use*. Students who quickly complete their sentences can add additional sentences or enhance their sentences to form a paragraph.

Below in Figure 4.4 are four related words that played a prominent role in this chapter. Coauthor Burris used the above technique with these words during a staff development on differentiated learning.

The faculty who attended found it to be a helpful way to deepen their understanding. For Carol, it was a way to assess that the participating teachers understood the principles that they were teaching.

One of the participating teachers, Ann Landenberger, who teaches English at Leland and Gray High School in Vermont, immediately began creating sentences. She then created supporting sentences to form the following paragraph:

The only way we can get to true heterogeneous grouping in our schools is to advance the faculty in the field of informed and
effective differentiation in all subjects, in all classrooms. Why should we care? Education may be the last salvageable vestige of true democracy. It has potential to be the ultimate equalizer and heterogeneous grouping ensures equity in education. Equity can be achieved through many channels, among them are entry points. We must grab the student early on in a period. Not at minute 62. The entry point for Joe will be different from Sarah’s which will be different from Jesse’s. Entry points are just one aspect of differentiation, but they are emblematic in that they establish first and foremost that each of us is coming from a different place.

Ann Landenberger, 2011

Annie, we could not have said it better!

WAYS TO INCLUDE DIFFERENTIATION IN ANY LESSONS

At times we will build lessons with a conscious effort to build in differentiated structures. At other times, we may need to use a more direct instructional approach and include differentiation in our presentation or questioning. Figure 4.5 provides what we believe are the most notable characteristics of a classroom that seeks to be a more equitable learning environment using differentiation.
Strategies for Equitable, Differentiated Classrooms

- The teacher believes that all students are capable of learning the content.
- The teacher encourages multiple student perspectives in class discussion.
- The teacher creates an atmosphere where errors are opportunities for learning.
- The teacher is cognizant of students who have an IEP or 504 plan, as well as students who are English language learners and Standard English learners.
- The teacher balances whole class instruction with individualized instruction and group work.
- The teacher thoughtfully prearranges cooperative group membership and monitors the progress of individuals and the group.
- The teacher assigns challenging extension activities to students who finish assigned tasks early.
- The teacher uses a variety of resources and materials and multiple modes of presentation based on the multiple intelligences of students.
- The teacher clearly articulates what successful student work looks like by using timelines for projects, rubrics, exemplars, etc.
- The teacher assigns cue cards or other scaffolded materials to students who are struggling.
- The teacher manipulates the difficulty level of materials and activities in order to provide access to higher level thinking and challenging learning objectives for all students.
- The teacher shares responsibility with coteachers or teaching assistants for classroom management of student behavior and routines.

CLOSING THOUGHTS ON EQUITABLE CLASSROOMS

Those who believe in the importance of the opportunity to learn must be vigilant and ensure that the college and career standards do not devolve into the college or career standards. Unless educators hold high expectations for all students and then tailor their instruction to meet the variety of student needs, we cannot achieve both excellence and equitable opportunity.

For school leaders, reduction in tracking systems that sort and select students is key. For teachers, lessons that invite all learners are the challenge and obligation.

Reflective Questions

As teachers create and examine lessons, the following questions should be considered:

- Are all students engaged throughout the lesson? Are reluctant learners given a voice? Are they held responsible for their classwork?
• Are multiple modalities used when I present information? Do I take into account the multiple intelligences that students possess?
• Are questions and problems tiered in a meaningful manner allowing ALL students to contribute to the discussion? Is there sufficient wait time after each question? Are questions asked on a variety of levels of Bloom’s Taxonomy?
• Are there different kinds of opportunities for students to show what they know? Are all students expected to meet the learning objective? Do I account for student weaknesses and showcase student strengths?
• Is the lesson well organized with clear instructions so that all students know what they are to do? Is a minimum amount of time spent on organization? Are group membership or tasks assigned thoughtfully and quickly?
• Do I search for materials and examples that will appeal to my diverse students? Do I share my plans with the ELL teacher, special education teacher, or other support staff?
• Do I make sure that my most able learners are challenged? Do I make sure that each lesson has questions or an activity designed to meet their needs?

Creating an equitable classroom is a tall order and sometimes supports beyond the classroom must be used to help all students succeed. That is why S, which stands for support, is our last letter of ACES. The next chapter focuses on how we can support those students who most need our help in becoming college and career ready.