

Curriculum Units by
Fellows of the
Yale National Initiative
Guide
2020

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Preface

In April 2020 the Yale National Initiative to strengthen teaching in public schools® accepted teachers from seventeen public school districts in ten states and the District of Columbia to participate in five national seminars led by Yale University faculty members. The Initiative is a long-term endeavor to influence public policy on teacher professional development, in part by establishing exemplary Teachers Institutes for high-need schools in states around the country.

Teachers Institutes are educational partnerships between universities and school districts designed to strengthen teaching and learning in a community's high-poverty, high-minority public schools. Evaluations have shown that the Institute approach exemplifies the characteristics of high-quality teacher professional development, enhances teacher quality in the ways known to improve student achievement, and encourages participants to remain in teaching in their schools.

Thirty-six of the teachers, named Yale National Fellows, were from school districts that are planning or exploring the establishment of a new Teachers Institute for Chicago, IL; the District of Columbia; Pittsburgh, PA; Richmond, VA; San José, CA; Tulsa, OK; and Texas. Other National Fellows come from existing Teachers Institutes located on the Diné Nation, AZ and NM; and in New Castle County, DE; New Haven, CT; and Philadelphia, PA. Overall, more than half of the National Fellows are participating in national seminars for the first time.

The National Fellows attended an Organizational Session of the seminars held online on May 1-2. The seminars reconvened during a ten-day Intensive Session online from July 6-17 and concluded in mid-August when the Fellows submitted their completed curriculum units. The five seminars were:

- “American History through American Lives,” led by David C. Engerman, Leitner International Interdisciplinary Professor of History;
- “Teaching about Race and Racism Across the Disciplines,” led by Daniel Martinez HoSang, Associate Professor of Ethnicity, Race, and Migration, and of American Studies;
- “Solving Environmental Problems through Engineering,” led by Jordan Peccia, Thomas E. Golden, Jr. Professor of Environmental Engineering;
- “Politics and Public Policy in the United States,” led by Ian Shapiro, Sterling Professor of Political Science; and
- “Caretakers versus Exploiters: Impacting Biodiversity in the Age of Humans,” led by Paul E. Turner, Rachel Carson Professor of Ecology and Evolutionary Biology.

The purposes of the program are to provide public school teachers deeper knowledge of the subjects they teach and first-hand experience with the Teachers Institute approach to high-quality professional development. This reinforces their leadership in an existing Teachers Institute or prepares them to lead the development of a new Teachers Institute. Each teacher writes a curriculum unit to teach their students about the seminar subject and to share with other teachers in their school district and, through the website at teachers.yale.edu, with teachers anywhere. The curriculum units contain five elements: content objectives, teaching strategies, examples of classroom activities, lists of resources for teachers and students, and an appendix on the district academic standards the unit implements. In these ways the curriculum units assist teachers in engaging and educating the students in their school courses.

The curriculum units National Fellows wrote are their own; they are presented in five collections, one for each seminar. We encourage teachers who use the units to submit comments online.

The Yale-New Haven Teachers Institute® is a permanently endowed academic unit of Yale University, which undertook the National Initiative in 2004.

James R. Vivian

I. American History through American Lives

Introduction

The relationship between biography and history is a vexed one, especially but not only for professional historians. Often derided as a hopelessly old-fashioned genre celebrating the lives of great men – and certainly there are plenty of such books on library shelves – biography is suspect in the eyes of social historians and others who seek a more inclusive history. Yet, as this seminar discussed, biography can also be an effective way to understand crucial historical events in a new historical canon that focuses on modes of inclusion and exclusion, on inequality and struggles for justice.

At the same time, biography, as the readings in our seminar “American History through American Lives” revealed, can provide a particularly helpful tool for teaching students of all ages, from young elementary schoolers to high school seniors. The seminar for Summer 2020, which met for the first-ever (and hopefully last!) time solely by videoconference, explored different ways that biography could work in the classroom.

Our general readings focused on inquiry-based learning pioneered by Stanford Education professor Sam Wineburg, the author of *Why Learn History (When It's Already on Your Phone)* as well as some of the unexpected dilemmas of focusing on personal experience as an entry point into historical analysis. The bulk of our readings, however, were oriented towards specific topics shaped by the interests of the National Fellows participating in the seminar. Across the board, from elementary teachers to those working with older students, from teachers on the east coast all the way to California, topical interests revolved around groups facing particular forms of discrimination, structural and otherwise. This proved a neat inversion of the stereotypical biography of great (white) men.

Readings for the seminar centered around social movements, especially in twentieth century America; our readings examined new approaches to the Civil Rights Movement, using the life of unsung leader Bayard Rustin to both extend the timeframe and expand the content of the movement. We read of a number of disputes about who “owns” history, involving Native Americans like Black Elk as well as feminist leaders like Betty Friedan. We also explored in depth an unusual resource: a set of oral histories of former enslaved people undertaken during the New Deal. Those sources are complicated: interviewers were almost exclusively white (including some directly descended from slave owners), rendered the interviewee speech in “dialect,” asked leading questions, and did not accurately represent the distribution or full range of slavery as an institution. But recognizing these difficulties, we concluded, could introduce students to source study in general; there is no perfect historical source, and students should learn to interrogate all historical authority with similar questions that we applied to the New Deal narratives: how did this source come to be? How did it end up in front of us? How do the

circumstances of its creation and dissemination affect the ways historians can use it? These questions, not coincidentally, led us directly back to Wineburg’s approach to inquiry-based learning.

The bulk of the curriculum units for this seminar applied one or another element of inquiry-based historical learning to a topic in modern American history, and used the lives of individual Americans to understand some of the broadest concerns of American history. Many of the National Fellows came to the Organizational Session in May with a topic related to race, immigration, and inequality. The resurgence of Black Lives Matter in the wake of George Floyd’s murder in late May gave a new urgency to those topics, and led to some redirection of topics. History, as ever, is a dialogue between present and past. One of the National Fellows, Mark Hartung, wrote his unit on the narratives of formerly enslaved people. Many units focused on struggles for justice, especially racial justice – from Andrew Maples’s comparison of Frederick Douglass and Sojourner Truth in the middle of the 19th century to Brandon Barr’s use of Emmett Till’s murder (sadly, back in the news recently) to teach the Civil Rights Movement.

The National Fellows who worked with the youngest students – as young as first-graders – tended to focus on questions of immigration. Cindel Berlin, Taryn Coullier, and Lauren Freeman used exemplary lives of individuals to illustrate the range as well as the commonalities of immigrant experiences. Lisa Yau undertook an especially creative project to compare anti-immigration sentiment (and actions) to racism over a broad sweep of American history.

While our seminar focused especially on historical lives, Krista Waldron (a veteran National Fellow who served also as Seminar Coordinator) opted to use a fictional life story to illuminate American history. Using Toni Morrison’s brilliant early novel *Sula*, Waldron focused not just on the “craft” of this well-crafted short novel, but also its depiction of life in an African-American town undergoing, slowly and fitfully, the changes of the 20th century.

The challenges of 2020 – the Coronavirus pandemic and lockdown, the surge of activism for racial justice – made the seminar topics all the more charged and relevant. But these same events also led two of our initial National Fellows to withdraw, depriving us of potentially powerful voices – but also deprived us of work focused on Native American history. While we missed their involvement, we nevertheless felt our work to be all the more meaningful in these strange and distressing times.

David C. Engerman

Synopses of the Curriculum Units

20.01.01

“Emmett Till: A Historical Inquiry,” by Brandon Barr

In this unit, students will learn about the life, times, and legacy of Emmett Till through excerpts of recommended biographical readings and other visual texts. Emmett Till was a 14-year-old African American from Chicago who was lynched in Mississippi in 1955, after being accused of affronting a white woman. His mother's choice to display his corpse in an open casket funeral shocked many Americans. His death has been frequently revisited in the context of other injustices perpetrated against African Americans. This unit explores Till's relation to the broader civil rights movement and prepares the teacher reader with content-area knowledge to support a historical inquiry into Till. By the end of the unit, students should be able to answer the following question: What is Emmett Till's legacy and how is it relevant today?

This unit is designed for sixth grade students to build historical knowledge by using a guided inquired approach. The unit could be used in middle school or high school humanities or English classes. It assumes little-to-no background knowledge of the civil rights movement or of an inquiry approach to teaching history content.

(Developed for Reading, Writing, and Social Studies, grade 6; recommended for English Language Arts, History, and Social Studies grades 6-12)

20.01.02

“American History Through American Lives Celebrating Our Family History Through Immigration Stories,” by Cindel M. Berlin

This unit comes from a seminar about American history and how American lives have impacted that history or were impacted by the events in American history. This unit focuses on the history of immigration, the current policies on immigration, and immigrants who have made an impact in America. Students will tie in their own or their family's immigration story to America, while learning how to write an informational and narrative writing pieces. They will use inquiry based learning activities to solve the hands on activities they will be given to learn about the immigrants who have affected America in a positive way. Students will learn the difference between informational, narrative, autobiography, and biography texts through a multimedia approach to explore immigrant stories. My students are first graders in a Title 1 school. Most of their families have either immigrated to America or they are immigrants themselves. They need to know that their stories and experiences are validated and that they can achieve success in America. This unit will be able to help my students to find pride in their story, while meeting the guidelines of the curriculum and standards set by the state of Delaware.

Key Words: Immigrant, Immigration, Biography, Autobiography, United States, Multi-Media

(Developed for Writing, English Language Arts, and Social Studies, grade 1; recommended for Writing, English Language Arts, and Social Studies, grades K and 2)

20.01.03

“Faces in the Frame: More than a Narrative'-The Lives that Frame the True History of the United States through Primary Sources,” by Taryn E. Coullier

This curriculum unit will address the need to teach students about more African American heroes and other historical figures of color in United States History. This focuses on equity in the curriculum, and the necessity for *all* students to see themselves within it. The Unit itself will focus on four-hundred years of African American strength and struggle for freedom, equality and justice in the United States; approached from a biographical stance, linking the lives we learn to events, movements and the longevity and complexity of the Civil Rights movement. The final section will entail a collaborative display of mini biographies displaying how primary sources help us learn about the hidden voices of the 1600s, 1700s and 1800s and a display of one historical figure to showcase along with a writing assignment. This will display skills applied during the year. This unit is for Elementary History and Language Arts but can and should be adapted to other grade levels to address inequity within state curricula.

(Developed for History and Social Science, grade 4; recommended for History and Social Science, grades K-12)

20.01.04

“American Heritage: Unmasked, Unpacked and Uncloaked,” by Lauren E. Freeman

In today’s society, there remains much debate as to the problem and existence of achievement and opportunity gaps, equitable instruction, and the overall educational experience of students of color and historically oppressed culture and ethnicity. In examining these occurrences, the question of representation when addressing all students’ race, culture and ethnicity is raised. Does each child relate to text and tasks that are presented in class through the lessons of their instructors? If not, what is missing and how can the children themselves contribute to that missing portion?

This unit will focus on two marginalized groups, Native Americans and African Americans, while looking at multiple races and cultures and their experiences throughout the development of this nation. Each has experienced physical, and emotional atrocities as well as systemic racism and oppression that has discouraged progress and set them apart from what is perceived as the “All American” majority race and culture. Over a period of five weeks, students will participate in a historical journey that begins with a

thorough examination of primary sources such as The Declaration of Independence, The United States Constitution and Bill of Rights, The Emancipation Proclamation, slave narratives including slave documents and freedom papers, and Native American narratives among others. The goal is to look into the depths of this country's activities from the *viewpoint* of minorities that endured the pain, strife and struggle from America's youngest moments, to the present. The reasoning is to foster a well-rounded understanding of three specific ideas; how far we have come, if and how we have grown, and how we will proceed, together, as a nation.

Key Words List: Historical Content, African American Education, Native American Education, Slave Narrative, Culturally Relevant Pedagogy, Restorative Practices, Abolitionist Teaching, Educational Theory, Educational Philosophy

(Developed for ELA, grade 3; recommended for ELA, grades 3 and 5; Social Studies, grades 3-5; and History, grades 3-9)

20.01.05

[“In Their Own Words? - Using The WPA Slave Narratives in the Classroom,”](#) by Mark A. Hartung

Teaching about slavery in the United States is challenging yet crucial. This country was a slave holding country far longer than it was not. The history of slavery IS the history of the United States. I want students to develop their own learning by reading and hearing the stories of the formerly enslaved persons in their own words. The WPA Slave Narratives allow students to both see the experience of slavery and question historical sources. The narratives, however, are not the exact words of the past. Editing, transcription, memory issues, and racism all play roles in challenging the notion of a true ‘primary’ source. In this unit, students will investigate both the historical record of enslaved persons and the issues surrounding the use of historical sources in order to deepen historical thinking skills. Students will focus on historical significance, compare multiple sources, evaluate arguments, and make and support claims about the Narratives. They learn to address not whether a source should be used, but how to critically question any source available to them.

This unit is written for 8th grade social studies but could be adapted for other levels, including upper elementary and High School U.S. history.

(Developed for History and Social Studies, grade 8; recommended for Social Studies, grade 5, and U. S. History, grade 11)

20.01.06

“Rhetorical Inquiry Through the Lives of Douglass and Truth,” by Andrew K. Maples

This unit takes stories from biographies of Frederick Douglass and Sojourner Truth and uses a rhetorical inquiry framework to analyze them. The questions work well to study Douglass and Truth as persuaders in their time and space, but they are designed to resist commonly rested upon rhetorical analysis strategies that give students a way out without a lot of thinking or valuable teacher input. The questions push students toward values conversations and social critique and could be adapted as a battery to unpack any rhetorical situation with older high school students, especially those who study Douglass’s first autobiography. The additional activities extend, challenge, and complicate the inquiry framework and the lives and legacy of Douglass and Truth, offering other thresholds for how language choices and self-presentation persuade within speaker-audience dynamics.

(Developed for English and AP Language, grade 11; recommended for English, American Literature, and American History, grades 11-12)

20.01.07

“The History within Toni Morrison’s *Sula*,” by Krista B. Waldron

Toni Morrison’s *Sula* is a novel that has enough rich literary craft to stand on its own in a classroom, but it also lends itself to exploration of an additional context—that of the influence of history on setting, theme, and especially character. We will study the novel in the context of its historical background, focusing on all-black towns, black soldiers in World War I, and black labor issues between the two world wars. For each of these events or issues we’ll look at primary and/or secondary documents such as personal narratives, essays, videos, cartoons, and images, to give more perspective and some historical accuracy. Strategies will include historical inquiry and close reading activities. This mature novel is best for 11th and 12th graders and is intended for an English Language Arts classroom. The unit and the novel could also be taught in a 20th century history class with an emphasis on African American history and with room for the literary element.

Key Words: Literature, African-American literature, Toni Morrison, African-American history, Primary sources, Secondary sources, 11th and 12th grades

(Developed for English and Language Arts, grades 11-12; recommended for American History, grades 11-12)

20.01.08

“Boxing’ Asian American History,” by Lisa Yuk Kuen Yau

In teaching American history, students are often “boxed in” with ideas from antiquated textbooks featuring Presidents, heroes, dates and facts. Teachers understand the urgent needs to repair how social studies is taught with innovations. This K to 8th grade unit is designed with an easy-to-use “boxing” framework to include primary sources from Asian American history to challenge students to “historicize” our past and present. Students will discuss “hard history” and discrimination relating to hair, race, gender, hate, and the misinformed discourses of “America’s minority problems.” Hairstyles like queue and dreadlocks are loaded with a long political history in the forms of resistance. The Chinese Exclusion Act and Jim Crow laws were examples of legalized racism. Our current crisis due to the COVID-19 pandemic has intensified racial disparities and hatred inflicted on our Black and Asian American communities. Students will analyze American lives in purposeful pairings: the activism of Saum Song Bo and Robert Leon Bacon, public struggles of Afong Moy and Henry “Box” Brown, and murders of Vincent Chin and George Floyd. The ultimate goal is to assist teachers in preparing students to use historical thinking to analyze critical moments in our shared history, and act responsibly for social justice.

Key Words: Asian American History, American History, Chinese Americans, Hair Discrimination, Anti-Racist Lessons, Intersectionality, Hate Crimes, Model Minority Myth

(Developed for Social Studies and ELA, grade 4; recommended for Social Studies and ELA, grades K-8)

II. Teaching about Race and Racism Across the Disciplines

Introduction

2020 has been a tumultuous year, filled with endless crisis and loss, and also renewal and possibility. After the pandemic focused all of the YNI seminars into remote meetings, an extraordinary group of nine Fellows, hailing from diverse locations, settings and backgrounds—Tulsa, New Haven, Chicago, Richmond, Pittsburgh, Delaware, San José, and Texas—met for our seminar, **Teaching About Race and Racism Across the Disciplines**. The group included art educators, early elementary teachers, middle school language arts instructors, and those teaching journalism, language and social studies in high school.

Only a few weeks after our first meeting in early May, protests against police brutality and anti-Black violence filled the nation’s streets. Teachers across the country asked themselves how their classrooms and curriculum could provide a central site to help students understand, resist and transform the racist structures they confronted in their own lives.

The seminar provided Fellows with the pedagogical and conceptual tools and resources necessary to expand their capacity to teach about race and racism within their disciplines and subject areas. Moving beyond the more limited paradigms of racial colorblindness and diversity, the seminar introduced curricular strategies for centering race and racism in ways that are accessible to students from a broad range of backgrounds, and that work to advance the overall goals of the curriculum.

The first week of the seminar explored the ways in which particular academic fields, including legal studies, musicology, art education, and literary studies, became organized around principles of race neutrality and colorblindness, and the ways this framework sustained and reproduced broader forms of racial inequality.

The second week focused on practices of pedagogy, curriculum development and teacher education that disrupt these colorblind norms, drawing on traditions in Critical Race Theory, Ethnic Studies, and women of color feminism. Across all of these sessions, we drew on diverse examples—the art of Romare Bearden and Titus Kaphar, and social movement struggles over economic justice, queer intimacies, indigenous sovereignty and immigrant rights—to model the ways teachers can use cultural texts and primary materials in their pedagogy and practice.

The fruits of hundreds of hours of collective labor by five elementary and four high school teachers resulted in the curriculum units that follow.

Art and creative practice form the basis of the first three units.

Katherine Leung, an art educator in San José, California, developed “**Mexican-American Labor in California through Art Literacy**” to use the art of Ramiro Gomez and other Latinx artists and social movements to facilitate student discussion about domestic workers and farm workers and their representations in artistic and popular discourses.

“**Who Is In Charge Here?: Examining (in)visibility and Cultural Context of Jim Crow Era Monuments in Elementary Art Education**,” authored by Danielle Raddin Houdek, an art educator in Richmond, Virginia, uses the statues of Confederate generals along Monument Avenue in that city to teach students about the roles that public art, historical context and communal art spaces play in establishing and dismantling systems of power and control.

Carol Boynton’s “**Understanding Race and Racism Through Faith’s Ringgold’s Work**” introduces Faith Ringgold’s art and children’s books to primary students as a way to learn more about the artist’s life and influences and to take up questions of family, community, and kinship in their own lives.

Katherine Swann, a Kindergarten teacher in Delaware, developed “**Centering Race in Literary Studies in the Kindergarten Classroom**” using core literary studies concepts related to story structure, perspective, and literary traditions to introduce basic concepts about racial identity, formation and history to her students.

The three units authored by high school teachers and bring interdisciplinary traditions and frameworks to their pedagogy and objects of study.

Cristina Meija’s “**Race and Racial Formation in Latin America**” introduces Spanish Heritage language students in her Tulsa high school to dynamics of race and racial formation in Latin America by examining representations in film and literature across three national contexts.

Sean Means, a high school teacher in Pittsburgh, developed, “**Collusion in the Owner’s Box: How Racism and Oppression Have Built the American Sports Industry**” to help students consider the ways that professional sports and the NCAA facilitate racial subordination but also serve as a platform for new form of resistance.

Ray Salazar, an experienced journalist and journalism teacher in Chicago, authored “**Seeing the World through Race-Colored Glasses: Guiding High-School Journalism Students to Report in a Race-Conscious Way to Create a Race-Conscious World**” to guide teachers new to journalism with a set of pedagogical concepts and practices to support students in developing socially conscious and relevant news stories.

Literary arts and study form the basis for the final group of units.

Sabrina Evans, a language arts teacher from Richmond, designed “**We Are Family: The Importance of Community through an Exploration of *Johnathon* Upper Elementary Schools**” to introduce more explicit discussions about race and racism to her students through an interdisciplinary study of the novel *Johnathon* by Jo Ann Burroughs.

Debra Jenkins’s unit “**No Lye, Nappy or Straight, People Still Gon’ Hate: Getting to the Root of the Issue; Colorblindness and Neutrality within Hairstyles and Hair Types**” engages upper elementary students in an examination of the political power and meaning that a hairstyle or hair texture holds through different literary texts.

All of these units provide teachers with models that demonstrate the ways that anti-racist commitments must extend to the curriculum and pedagogy in order to truly transform public education for all students.

Daniel Martinez HoSang

Synopses of the Curriculum Units

20.02.01

“Mexican-American Labor in California through Art Literacy,” by Katherine Z. Leung

Mexican-American Labor in California through Art Literacy is a month-long middle school curriculum centering student discussion about domestic and farm workers as depicted in the canon and counternarratives.

Students write art critiques of ten artworks by British artist David Hockney, understanding that his work upholds white supremacy without acknowledging ongoing subordination of Mexican-Americans. Students write artist statements analyzing seven paintings by Ramiro Gomez that re-appropriate and reframe Hockney’s work, eliciting feelings of pride and solidarity with the indispensable legacy of labor. Using art-to-self connections to discuss how students see themselves in Hockney and Gomez’s work, students create an intentional domestic scene.

Students analyze twenty-five commercial fruit crate labels and theorize how misconceptions used by advertisers, including the Solar Theory of Value, diminish the strategic role Mexican-American workers play in labor organizing. Juana Alicia and Judy Baca’s murals celebrating worker identity introduce a reclaimed history and reframed genealogy. Students track project progress while creating a diptych comparing narratives.

Finally, students collaboratively curate art exhibits by writing proposals. Teachers foster affective and intellectual receptivity to learning by decolonizing dominant definitions of art and student-teacher power-dynamics. Students engage and imagine with Gomez, Alicia, and Baca, rehumanizing their own fundamental beliefs of Mexican-American workers.

(Developed for Art, grade 7; recommended for Art and ELA, grades 3-9)

20.02.02

“Who Is In Charge Here?: Examining (in)visibility and Cultural Context of Jim Crow Era Monuments in Elementary Art Education,” by Danielle R. Houdek

The unit uses the statues of Confederate generals along Monument Avenue in Richmond, Virginia and the activist street art that has recently been produced on and around the monuments to teach fourth and fifth grade visual art students about the roles that public art, historical context and the artists who reimagine communal art spaces play in establishing and dismantling systems of power and control. This unit engages students about the role public Confederate monuments and other monuments across the country play in promoting white supremacy and systemic racism. This unit curriculum was

developed because anti-racist teaching and pedagogy has taken renewed importance amidst all of the uprising and resistance occurring with The Black Lives Matter movement. This unit will allow students to explore counter narratives created by contemporary artists of color that dismantle unequal control of power and therefore facilitating the end of racist ideas of superiority. Centering race is critical to this project because it will facilitate critical conversations about race and socially engaged artmaking with students.

I plan to teach this unit over the course of nine weeks with the intent of having students invest in their own learning, and to design new public monuments that help to represent and capture a vision of society and community and justice with which they identify. It is essential that the students connect to the material covered and not just as distant spectators.

The unit could certainly be modified and adapted for use in the upper grades.

(Developed for Visual Arts, grades 4-5; recommended for Social Studies, grades 4-5)

20.02.03

[“Understanding Race and Racism Through Faith’s Ringgold’s Work,”](#) by Carol P. Boynton

This curriculum unit introduces Faith Ringgold’s art and children’s books to for primary students through a new lens. In this three- to four-week unit, primary students will learn the life story of Ringgold and her influence in the art world from the 1960’s until the present. Her award-winning children’s books tell the stories that began as her unique painted story quilts. Students will become familiar with four of Ringgold’s books, including *Tar Beach*, *Aunt Harriet’s Underground Railroad in the Sky*, *Dinner at Aunt Connie’s House*, *Bonjour Lonnie*, *If a Bus Could Talk: The Story of Rosa Parks*. They will learn about Ringgold’s life and the quilting traditions that influenced her work. Through a culminating project, students will communicate an important aspect of their lives visually by designing an art piece about their own family. They will learn about their classmates’ families through story quilt squares and family memory stories. Students will compose a one- or two-line family memory story and visually depict a family memory or a hope or dream for their family drawn in a well-developed piece of art.

(Developed for Literacy and Social Studies, grade K; recommended for Literacy and Social Studies, grade K-3)

20.02.04

“Centering Race in Literary Studies in the Kindergarten Classroom,” by Katherine A. Swann

Young children are exposed to race and racism from the beginning of their education. How can we change the way they see themselves and others? This unit begins to embark on that adventure. Through the use of literature, arts and music, this unit will allow students to speak about their community and have a better understanding of what makes up the community. This unit will use various authors to focus on story structure, author’s purpose, and open discussion on the impact of these stories and how they contribute to our community. This unit will stay with them and allow them to find the same themes in all their education. This unit is designed to integrate social studies concepts with the reading standards that are required for all teachers to use in their classroom. By using these standards, it creates a cross-curricular unit plan. This unit will create curriculum that has never been available for the students. The unit will incorporate activities for the students as well as assessments that will benefit the students in kindergarten.

(Developed for Language Arts, grades K and 2; recommended for Language Arts, grades K-5)

20.02.05

“Race and Racial Formation in Latin America,” by Cristina Mejia

Race and Racial Formation in Latin America is a six week long high school curriculum centering student discussion about race and racial formation in Latin America depicted in film and literature in a Spanish heritage language classroom. This unit will focus on racism and race formation in Latin America. The unit will focus on three different areas to demonstrate how racism and racial formation work differently in Latin America: the favelas in Brazil, Guatemala and Mexico City. This unit will focus on race and racial formation through literature and film is intended to use Brazil, Guatemala and Mexico as examples to show students how racism and racial formation is varied in Latin America. Students will explore racism and racial formation in Latin America and be able to compare it to racism and racial formation in the United States using the target language. Students will have an understanding that language instruction in the Heritage language classroom can be inherently racist as a base to start our conversations about race and racial formation in Latin America.

(Developed for Spanish for Hispanics, grade 12; recommended for Spanish and Latinx Studies, grades 11-12)

20.02.06

“Collusion in the Owner’s Box: How Racism and Oppression Have Built the American Sports Industry,” by Sean C. Means

The following unit analyzes the world of college and professional sports from a social justice lens. It identifies how race, power and politics play a part in athletic organizations, and how athletes have sacrificed their own careers to make the lives of others better. It begins by analyzing the for-profit enterprise of college football and its lack of equitable representation of people of color within its coaching ranks. The unit provides numerical data that defines college football’s system, its power players and its lack of equity in the top spots in The Power-5 Conferences. The unit transitions towards the boxing ring and Muhammad Ali, widely respected for his accomplishments within the ropes, his greatest bout was produced by the United States Government, the fight was held within the chambers of The Supreme Court, his career on the line.

Next student voice is highlighted on the campuses of Syracuse and The University of Wyoming. This section examines the students request for justice along with the responses by administration and coaches. This is followed by the drama, decisions and consequences that shaped the players’ futures. Lastly, the unit rolls the ball of justice onto the hardwood, reliving a time before Kaepernick, where the NBA dealt with its own peaceful protest against party-line-patriotism via blackball and coercion. The content of the unit is followed by a number of diverse articles, resources and activities that provide the class with a number of entry points to analyze standard based literature, facilitate informed.

(Developed for U. S. History and College in High School U. S. History, grade 11, and Social Justice, grade 12; recommended for U. S. History and College in High School U. S. History, grade 11, and Social Justice, grade 12)

20.02.07

“Seeing the World through Race-Colored Glasses: Guiding High-School Journalism Students to Report in a Race-Conscious Way to Create a Race-Conscious World,” by Raymond Salazar

This unit helps guide teachers with some and little experience with journalism to help high-school students find stories that challenge preconceived notions of race while developing their skills with research and writing. Essentially, students will be able to gather, evaluate, and synthesize information to produce news articles that provide their school communities with socially conscious insights.

This unit was designed for a high-school journalism class to accomplish what Cati de los Ríos and other authors articulate in “Critical Ethnic Studies in High School Classrooms: Academic Achievement via Social Action:” projects should “promote academic literacy

development, civic engagement, and critical racial consciousness for the young people involved.”

Students will learn how to see race and produce accurate articles and editorials. As students engage with mentor texts that present a race-conscious perspective grounded in facts and committed to accuracy over fairness, they’ll learn how to write about situations in a way that promotes empathy and insight about the systemic issues that perpetuate inequality. More importantly, they’ll learn about the importance of including a person’s agency in their reporting.

(Developed for Journalism, grades 11-12; recommended for Journalism and English, grades 9-12)

20.02.08

“We Are Family: The Importance of Community through an Exploration of Johnathon Upper Elementary Schools,” by Sabrina L. Evans

This unit resounds the truth that, “Real change happens when the people who need it lead it.”¹ It explores the need for students to critically think about issues of colorblindness, race, injustice and inequalities masked in neutrality. In addition, literature is one of the key elements of the exploration found in this unit. Utilizing the upper elementary and lower middle school level novel, *Johnathon* by Jo Ann Burroughs, students will dissect the text to explore areas of colorblindness and provide a new lens on equality. Johnathon is a young, African American boy who, despite all odds, succeeds in life due to his internal fortitude and ecological system. Johnathon’s two, of many, keys to success mirror the late 1964 Freedom School model. In Mississippi in 1964, a group of young professionals began Freedom Schools.² Freedom Schools broke barriers of segregation, forced integration and reframed the educational model. Using the Freedom School model, the students will learn the power of community and unity and debunk the narratives of the savior complex and Black exceptionalism. This will allow the students to comprehend that Johnathon isn’t just the main character, he is us. Students will be able to have a connection to the community of Johnathon through various pedagogical approaches to recognize their own personal ecological systems. Through literature and the intriguing teachings and discussions during the 2020 Yale National Initiatives Seminar: Teaching about Race and Racism Across the Disciplines, we will dive into annotations, character development, inferring, context clues, the arts, and more with the use of history to instill critical thinking and develop counter-narratives. We will confront the dominant narratives of the savior complex, exceptionality, and individualism and instill the value of internal fortitude, inherit desire for achievement and accomplishments, unity, and community. This crafts an openness for discussions beyond the topic at hand and equips individuals to challenge the norm now rather than later.

(Developed for English Language Arts, grade 5; recommended for English Language Arts, grade 6, and History, grades 5-6)

¹ Lowman, Sonia "Teach Us All." Netflix. September 25, 2017. Accessed July 13, 2020.

<https://www.netflix.com/watch/80198423?trackId=13752289&tctx=0.0.22858c3ae3682cef63baa606c558e6c0d6e1806c:3e2cc344c7ebb66336931485c04b20f949d0ebf8,22858c3ae3682cef63baa606c558e6c0d6e1806c:3e2cc344c7ebb66336931485c04b20f949d0ebf8>.

This documentary displays the importance of teaching all students of color through the history of the Little Rock Nine.

² Hoxworth, Laura. "Video: Jon Hale on Freedom Schools and Students as Political Activists." Curry School of Education and Human Development University of Virginia. March 25, 2019. Accessed July 13, 2020.

<https://curry.virginia.edu/news/video-jon-hale-freedom-schools-and-students-political-activists>.

This source helps to learn the history and pedagogy of Freedom Schools.

20.02.09

[“No Lye, Nappy or Straight, People Still Gon’ Hate: Getting to the Root of the Issue; Colorblindness and Neutrality within Hairstyles and Hair Types,”](#) by **Debra D. Jenkins**

Imagine your child being asked to sit out of a performance because of their hairstyle. No student or parent should be subjected to policies that intentionally disregards ones culture due to the style or texture of their hair. Unfortunately we live in a world where this was not an imagination but a reality. Lyzette Williams so eloquently states, “Black women’s natural hair remains political and persecuted. Writing—which, in this instance, I also conceive as narrative healing—about disquieting, mystifying, sometimes droll experiences vis-à-vis black women’s hair illuminates two conundrums: first, the absurdity of trying to enforce white haircare grooming standards on African American women; and second, the muted but invasive means by which society shames our natural hair from infancy through adulthood.” (Williams, Lyzette. "Trauma, Tresses, & Truth: Untangling Our Hair Through Personal Narrative.")

This curriculum unit will not be your run of the mill “culture day” celebration. Instead it will focus on teaching students the political power that a hairstyle or hair texture holds. This curriculum unit will also focus on intertwining children’s literature, art, history, and music with a focus on hairstyles and hair textures. If you are searching for a way to enhance student learning by using various forms of resources and strategies, including children’s literature, this is the perfect curriculum unit for you and your students. This unit provides clarity on social issues dealing with hairstyles and hair types while also providing content about stances of neutrality and colorblindness in the classroom. It offers pedagogical approaches and content knowledge that challenges not only the students, but the teacher as well. If you are hoping to be an agent of change the world so desperately needs, and want to do so by instilling ideological beliefs and truths in yourself and in your students, this unit is the perfect fit.

This unit has the potential to promote self-awareness and pride in hairstyles and hair textures that sometimes have negative views or connotations. This unit will allow teachers and students to learn the history of their own hairstyles and hair types, while also seeing and learning about representations of their culture(s) in children's literature, art, and music.

(Developed for Reading, grade 3; recommended for Reading, grade 3)

III. Politics and Public Policy in the United States

Introduction

This seminar was designed to help teachers craft teaching units about good public policy – what ought to happen – in light of a sound understanding of how the political system actually works. The motivation behind it is well captured in political philosopher John Rawls’s phrase “realistic utopianism.” The goal is to think about what public policies would improve the world, but to do it in ways that are informed serious attention to how they might be enacted and implemented. To this end, the seminar focused on a variety of public policy issues that interested the teachers, but we also devoted considerable time to understanding the peculiarities of the American political system and strategies for policy innovation that have been more and less successful in the past.

To help teachers think about these challenges we spent some time at the beginning on analytical tools. These dealt with the logic of – and obstacles to – effective collective action; the ways in which different people’s ability to leave situations – “exit costs” – shapes the possibilities for change; and different analytical models of why democracy in general and American democracy in particular does not produce governments that ameliorate the inequalities that arise in the economy. In fact, it often exacerbates them.

The central challenge posed by the political system is that the political parties are weak and decentralized. This makes them susceptible to disproportionate influence from activists on their fringes, lobbyists and other forms of outside money, and hostile takeovers—most recently of the Republican congressional party by the Tea Party after 2009 and the presidential campaign by Donald Trump in 2016. National parties are further weakened by America’s staggered electoral cycle, bicameralism, the separation of powers and federalism, all of which make it difficult for parties to enact the policies they run on at the national level. The system has many built in veto players whose capacity to stop legislation means they have to be accommodated, often limiting its effectiveness and undermining its purposes. The inevitable horse-trading makes it virtually impossible for parties to enact the programs they run on, a problem that has become worse in recent years as red states have become redder and blue states bluer, so that safe seats have proliferated. This magnifies the importance of low turnout primaries that are dominated by activists on the fringes of the parties and those who fund them. This makes compromise in Washington harder to achieve, exacerbating gridlock and voter alienation—making it easier for populist demagogues to gain purchase.

To illustrate the difficulties involved in enacting legislation for which there is broad support, we studied the decades of failed efforts to create universal health insurance since World War II. We also studied the self-defeating failure of efforts to expand home ownership to low income and minority populations that fed into the financial crisis of 2008, harming most the people it was intended to benefit. And we studied the ways in

which the decentralized system of public school funding and the large number of veto players make effective reform of public education such a dispiriting heavy lift.

And yet, sometimes effective social policies are enacted. To help understand how this happens, we spent some time looking at the creation of Social Security in 1935 and Medicare in 1965, two of the most effective, popular, and enduring pieces of social legislation in the twentieth century. The architects of both policies displayed a grasp of six building blocks of effective distributive politics. These are (i) assembling an effective coalition, which includes anticipating what the opposing coalitions will likely be; (ii) crafting effective proximate goals around which the coalition can be organized – goals that are both achievable but also way stations on a path to a better future; (iii) devising compelling moral narratives that can motivate supporters and hold coalitions together in the face of efforts to break them up before proximate goals are achieved; (iv) finding leaders who can both be strategically effective in moving toward the proximate goal and also articulate the moral narrative to motivate supporters to do what is needed to enact it (v); creating or finding the resources that will make the policy innovation feasible; and (vi) incorporating mechanisms to entrench proximate goals once they are achieved, so as to prevent future generations from reversing or undermining them.

The units designed by the teachers fall into three groups. Some are designed to illuminate particular features of the political system. Eun Jung Kim’s unit deals with the history, evolution, and current condition of America’s political parties. Christina Marsett created a unit to teach students about the interaction between the Supreme Court and Congress by comparing the conservative court during the Reconstruction era with the progressive Warren era court of the 1950s and ’60s.

A second group of units deals with different aspects of the political system seen through the lens of a particular policy issue. Alexander de Arana examines the financial crisis of 2008; Christiona Hawkins studies the interaction between housing and education policy; and Hunter Najera’s unit focuses on the changing role of money in American politics.

The third group of units explores efforts at policy reform by reference to the building block of effective distributive politics. Jennafer O’Neill’s focus is on improving public health; Jacqueline Travis studies the civil rights movement in the run up to the passage of the Civil Rights Act of 1964 and the Voting Rights act of 1965; Tiffany Robinson explores social mobility and the policies that affect it, Valerie Schwarz studies efforts to regulate the tobacco industry; and Christopher Fong’s unit centers on efforts currently underway to create a Universal Basic Income – a basic income grant that would be paid to all citizens regardless of work.

In one way or another, each of the units exemplifies the importance of thinking about policy and politics together in the service of realistic utopianism.

Ian Shapiro

Synopses of the Curriculum Units

20.03.01

“It’s the Economy, Stupid: Lessons in Economics, Banking, and Personal Finance from the Financial Crisis of 2008,” by Alexander W. de Arana

This curriculum unit studies the Subprime Mortgage Crisis and the events that led to the Financial Crisis of 2008. Students read, watch, and analyze texts and films such as *Understanding the Crash*, *The Big Short: Inside the Doomsday Machine*, and *Winning at the Loser’s Game: Timeless Strategies for Successful Investing* to inform themselves of the development of the housing bubble in the United States, the ensuing Great Recession, and responsible financial strategies. Students consider the responsibilities players such as commercial banks, investment banks, rating agencies, insurance companies, hedge funds, the Federal Reserve, and others had in the events that led to the crisis. Furthermore, students evaluate the impact the crisis had on the American and global economy, while also investigating the federal government’s response. Additionally, students will take a look at the political ramifications that resulted from the policies the government enacted. This way, students will evaluate the nature of the United States’ political system and its political parties. At the end of this unit, students will research their desired occupation to create a monthly budget to understand the importance of personal finance. Because of this, students will recognize how larger economic forces impact individual financial decisions while examining how the study of economics relates to the lived experiences of individuals and the human condition.

Key Words: Economics, banking, personal finance, monetary policy, fiscal policy, Wall Street, the Financial Crisis of 2008, the Great Recession, *Understanding the Crash*, *The Big Short: Inside the Doomsday Machine*, *Winning at the Loser’s Game: Timeless Strategies for Successful Investing*, personal budget

(Developed for Social Science, grade 12; recommended for Social Studies, Civics, Economics, and Personal Finance, grades 9-12)

20.03.02

“UBI (Universal Basic Income): Yay! We Don’t Have to Work Anymore?,” by Christopher K. Fong

UBI, or Universal Basic Income, is an economic policy where individuals are given tax-free money from the government to help pay for basic needs such as food, housing, and utilities. There are no work or financial requirement imposed on the recipients and no governmental oversight on how the money is spent. UBI has recently gained traction due to a global pandemic and fears that automation will continue to eliminate jobs, leaving a sizable portion of the population unemployed. Though UBI has support across the political spectrum, it is not a universally popular idea and there are many political and

economic hurdles to address before a comprehensive UBI program can be implemented. This curriculum will provide a broad overview of issues associated with UBI, including what is UBI, why people feel it is necessary, why people dislike it, overviews of various UBI pilot programs, and lessons we can learn from them. This course was made for a high school English class, but with minor adjustments, this course can be adapted for other classes, notably US Government/Economics, Speech and Debate, and other ELA classes that can utilize the topic of UBI as a vehicle to practice reading, research, writing, and oration skills.

(Developed for ERWC, grade 12; recommended for ERWC, U. S. Government/Economics, Speech and Debate)

20.03.03

“Codes of Conduct: Racist Housing and Education Policies that Impact Urban Students,” by Christiona M. Hawkins

This unit will be focused on the novel *Warriors Don't Cry* by Melba Patillo Beals, and the play “A Raisin in the Sun” written by Lorraine Hansberry. Both texts take place during the same decade of history; each author uses the setting of the 1950s and 1960s to reveal the realities Black families, men, women, and children lived during the violent Civil Rights Era. The unit is meant to bridge the historical and contextual gaps between existing curriculum around desegregation, the two anchor texts, and the students. Above all, this unit will cover two major conceptual themes between 1934-1970: racist housing policies and destructive educational legislation. Both concepts will help students to understand the bigger picture of each text and more closely draw conclusions around the notion of the *American Dream* and its implications for Black communities historically and presently in Washington, DC and other urban communities. The unit will address the unintended consequences of *Brown v. Board of Education* and the notion that educational desegregation requires effective desegregation of housing.

(Developed for English, grades 7-8; recommended for English, Social Studies, and Government, grades 6-12)

20.03.04

“What Have You Done For Me Lately; A Tale of Two Parties,” by Eun Jung Kim

Our Founding Fathers did not intend to create a two-party system, yet, our government has evolved into a “winner-take-all” system in which two major parties emerged. These two party that dominate American government is the Democratic Party and the Republican Party. In this curriculum unit, the students will read, analyze, and research the intricacies of how political parties work in the American political system. Students will learn about the role of political parties in the United States and the influence parties have in our political system, including the role of third parties. This unit

will cover the history and trend of party ideologies and explores the phenomena of why marginalized groups vote the way they do. Students will research the history, trend, and policies of each political parties ultimately concluding what political parties have done for them.

This curriculum unit is design to be taught in a 12th grade Advance Placement U.S. Government and Politics class, but can be adapted for 12th grade government, 11th grade Advanced Placement United States History and 11th grade United States History.

(Developed for Government and AP U. S. Government and Politics, grade 12; recommended for Government and AP U. S. Government and Politics, grade 12; and AP U. S. History, and U. S. History, grade 11)

20.03.05

“The Supreme Court: Allowing and Constraining Constitutional Change,” by Christina L. Marsett

This unit is meant to provide students with an understanding of the ways that the Constitution both allows for and limits change, in the context of the judicial branch’s Supreme Court. The unit is designed to fill in curricular gaps, relating to the Constitution and branches of government that it creates, by guiding students through a close analysis of one branch. In working through this unit, students will gain an understanding of the Constitutional articles that define the Court’s role, as well as the implied powers that have developed over time, to set a precedent for how this branch of government functions. Context is provided by examining the ideology of Supreme Court justices and their reaction to public opinion at three different points in time- following the Civil War, during the Civil Rights Era, and today. This progression will demonstrate the fact that a conservative set of justices is likely to prevent the government from changing despite legislation that seeks to do the opposite, while a liberal set of justices can result in an expansion of the power of the federal government. Students will than have the opportunity to extend their learning, as they analyze the makeup of the present-day Supreme Court and determine whether recent rulings have allowed for or prevented political change. This unit addresses the 9-12 grade benchmark for Delaware Civics Standard Two.

(Developed for Civics and Geography, grade 9; recommended for Government, grades 9-12)

20.03.06

“Money Talks: First Amendment Freedom of Speech and Campaign Finance,” by Hunter C. Najera

“Money Talks: First Amendment Freedom of Speech and Campaign Finance,” is a curricular unit designed for a fifth-grade social studies class, and could be adapted for American Government classes as well. To be taught for three weeks for approximately forty-five minutes per day, the objective of “Money Talks” is to teach students about the fundamental principles of the U.S. government and legislative system, as established in our Constitution, and how the past forty-four years of campaign finance reform altered the political landscape, in spite or because of these Constitutional principles—especially the Freedom of Speech, as established in the First Amendment to the Constitution. As such, “Money Talks” will necessarily begin with foundational lessons on the major provisions of the United States Constitution as a whole, and the Bill of Rights more specifically, with particular emphasis on First Amendment Freedom of Speech. Students will examine fundamental principles of the U.S. government including the separation of powers among the Executive, Legislative, and Judicial branches of government; the system of checks and balances between the three branches of government; and the competing and separate powers of the Federal and state governments, and their distinct spheres of control.

(Developed for Social Studies, grade 5; recommended for Social Studies, grade 4, and English Language Arts, grade 5)

20.03.07

“Health and Public Policy,” by Jenna L. O’Neill

Throughout the course of this unit, students will be introduced to the process of enacting policy on the topic of improving public health in terms of lessening diseases of lifestyle and promoting access to benefits of a long life span of good health and longevity. Through an in-depth study of current research on health, examples from around the world, and the current state of public health in the United States, students will have the opportunity to develop their own ideas about how to improve health outcomes in our country for more people. Once they have used this information to develop their own approach, they will shift to understanding the larger facets of making change in our governmental institutions. Through an analysis of what it means to build coalitions, to examine the power structure, and to examine how citizens make choices around what they do and do not support, students will have the opportunity to strategize how they would go about making positive changes that would ensure more Americans are able to enjoy the longest and healthiest lives possible. As a final project students will take the information and data gathered to create a method of taking action on their proposed ideas and the first steps towards putting policy into effect.

(Developed for Civics, grade 9, and Sociology, grade 12; recommended for Psychology, grade 12, and Government, grades 9-12)

20.03.08

“When Downward Mobility Strikes,” by Tiffany S. Robinson

By the end of the unit, students will be able to understand how upward and downward mobility has affected our communities on a local, national and global level. As a result of their engagement in this unit, students will be able to analyze and interpret information, define new vocabulary concepts, identify, characterize and explain upward and down mobility, its causes, effects and how it has directly affected us and evolved over time. They will examine how downward and upward mobility affects their livelihood. We will specifically discover and research how school systems, social security, healthcare, social mobility, job security and crime rates all play an essential role in both entities. Students will see how they are all intertwined as a result of downward and upward mobility. In seminar, we discussed how policy affects the workforce, school systems, social security and healthcare. Students will examine these policies. They will be able to make a direct connection with the policies that affect them and their families. They will understand that they have the power to change any policy that adversely impacts them. In the words of the late Dr. Martin Luther King, Jr., “If we don’t stand for something, we will fall for anything.” As we discussed in the seminar, education is important for everyone. Although we know that the school systems are not equitable for everyone, we must continue to work towards an eqi system. Without knowledge, you have no power. We must impart knowledge to give people power.

(Developed for Spanish, grades 3-6; recommended for Language Arts, grades 3-8)

20.03.09

“What Does a Camel and Vaping Have to Do with Public Policy?,” by Valerie J. Schwarz

This curriculum unit will examine how the tobacco industry developed strategies to promote the use of cigarettes and to mitigate the health concerns. The unit explains how the six building blocks of distributive politics apply to the case study of the tobacco industry. The resources and power of the industry enable it to spend massive amounts of money to lobby and influence public policy for its benefit. The unit will then examine how the tobacco industry is handling the current e-cigarette controversy through this historic lens. The students will create a mock General Assembly. The students will write legislation to regulate e-cigarettes to protect the health of children. A play will be written and performed as a way for the students to delve into the journey a bill takes until it fails or becomes a law. This curriculum unit is created for a fourth grade language arts and social studies classes, but could be adapted for middle school history or civics courses.

(Developed for Language Arts and Social Studies, grade 4; recommended for Social Studies, grades 5-8, and Language Arts, grades 4-6)

20.03.10

“Nothing Without Us: Bringing Justice to Public Policy,” by Jacqueline L. Travis

Even today, especially in light of what has happened to George Floyd, Breonna Taylor, Ahmad Aubrey and so many more, African-Americans are still fighting for equal rights and true equity. Because of this, I would like to inspire our young people to be active leaders in advocating for policy by exploring historic moments in which policies were won because of everyday people advocating for their rights. We will do this through learning about the Civil Rights Movement in a developmentally appropriate way.

This unit, designed for 2nd graders, will span 6 weeks. Students will learn to analyze sources like historians, asking critical questions to interpret them and learn about the past. They will also learn visual literacy strategies to support their interpretation of images. Using images, videos and a variety of text, will be engaging for primary students and helps make the content accessible for all students. Students will read, write, discuss and create art to learn about the Civil Rights Movement and demonstrate their thinking about what they learn. Students will also use the framework of the building blocks of distributive politics to design a mock campaign in order to seek a solution for a collectively determined issue.

(Developed for Social Studies, Reading, and Writing, grade 2; recommended for Social Studies, Reading, and Writing, grade 2)

IV. Solving Environmental Problems through Engineering

Introduction

The 21st century poses new, complex environmental problems and truly global challenges. These include adapting to and mitigating the effects of climate change, providing water and sanitation for the developing world, and the proliferation of synthetic chemicals in our air, water, and food.

The individual units contained in this volume address these contemporary environmental problems. They include units on the design of better storm water management infrastructure in cities where increases in extreme precipitation events have occurred, understanding and quantifying the complex environmental impact of the products (from electronics to plastics) we use, how heat islands in warming cities can be reduced through better urban design and social justice, and ways to reduce indoor air pollution in light of the growing incidence of asthma and allergies.

The units' topics are diverse, but all follow an environmental theme and contain the engineering principles of design and problem solving. By learning from this perspective, the utilization of these units can more deeply engage students in science and math, teach students how to interpret and solve complex problems, and provide new skills that will empower students to make changes.

Jordan Peccia

Synopses of the Curriculum Units

20.04.01

[“The Chemistry of Energy,”](#) by Luis Bello

Energy production and consumption are a hot topic in our society, as the economy and development of many countries depend fundamentally on the capacity of energy production. However, the production of energy despite being vital in modern society also has a negative side effect. One of the most important ones is the release of by-products that affect the environment like the release of carbon dioxide, provoking the increase of global temperature. The depletion of non-renewable sources for the production of energy is another issue of global concern. This Energy Chemistry Unit is part of the Thermochemistry chapter in the Chemistry curriculum for high school students from grades 10 to 12. The students will study concepts and laws such as Hess’s Law, exothermic and endothermic process, energy conservation, and different types of energy and enthalpy.

This unit is mainly for students at High School, particularly those taking advanced chemistry classes such as AP (Advanced Placement), IBSL (International Baccalaureate Standard Level), and IBHL (International Baccalaureate High Level). The main objective of this Unit is to study the different ways of producing energy where chemical reactions are present, such as the combustion of fossil fuels, nuclear reactions, hydrogen, and oxygen reaction and conversion of solar energy into electrical energy. The study of this unit will address not only the production of energy, but also the advantages and disadvantages associated with production and consumption. The 12 principles of Green Chemistry will be used.

(Developed for Thermochemistry, grades 10-12; recommended for Thermochemistry, grades 11-12)

20.04.02

[“Building a Heat-Resilient Community in Richmond, Virginia,”](#) by Ryan A. Bennett

The effects of excessive heat and climate change are being felt by people all over the world, yet some are more vulnerable to adverse outcomes than others. People who live in poverty residing in low-income areas across the United States experience urban heat more intensely than others who live in neighborhoods that are built to better resist heat. Factors contributing to the urban heat island effect include the amount of tree canopy, impervious surfaces, and reflective materials used in buildings.

In this unit, students will investigate the effects of heat in different case scenarios. Students will be exposed to the inequitable gap in resources that people of color who live in low-income areas experience every day. They will learn how to mitigate these effects

with research-based strategies in their own communities where they feel the increasing heat. To demonstrate their learning and become active change participants, students will design a response to combat urban heat in various Richmond neighborhoods and then write persuasive essays to their local city councilors

(Developed for Science, Math, and English, grade 5; recommended for Math and Science, grades 6-7)

20.04.03

[“Evaluating and Mitigating Stormwater Runoff Contamination,”](#) by Sally D. Cannizzaro

During NE Oklahoma’s flood in early summer 2019, there was a lot of speculation about what various authorities should or shouldn’t have done to prevent the flooding, and what pollutants the floodwaters were carrying. This unit will focus on students learning about, then developing solutions for, stormwater runoff in order to reduce the flow of pollutants into natural waters. After learning about the basics of stormwater runoff, nonpoint source pollution, watersheds, and current methods of stormwater runoff containment and mitigation, students will gather and test fresh rain and stormwater runoff at various points. They will then speculate the reasons for their test results, and learn about various solutions to any environmental issues they anticipate. Ultimately, students will ideate and engineer a solution that mitigates an environmental problem caused by stormwater runoff. Their solutions will be implemented or installed at the appropriate level whenever possible.

This month-long unit on stormwater runoff was written for Gifted and Talented middle school/junior high students but is also recommended for high school Environmental Science students. It also features flexible elements to accommodate distance and virtual learning options.

(Developed for Gifted Education and Talent Development High School Environmental Science, grades 6-8; recommended for Gifted Education and Talent Development, grades 6-8, and High School Environmental Science, grades 9-12)

20.04.04

[“The Life Cycle of Rare Earth Elements,”](#) by Cristóbal Carambó

Modern society depends on a wide range of industries and commercial processes to produce the many products and systems that we rely on. In recent years a group of elements known as the Rare Earth Elements (REE) have become central to our information, electronics and “green energy” industries. Although REEs have become indispensable components of nearly all of our modern technologies, their extraction and

refining processes possibly cause harm to the environment, the living organisms in the ecosystems where they are mined, and the workers that process them.

Understanding the complete life cycle of the technologies that are meant to save our environments is critically important to our students because “green technologies” will likely become more widely used in their future. The Life Cycle Assessment is a structured process that takes a holistic approach and provides a complete view of the environmental impacts over the entire life cycle of a process or product. The Life Cycle Assessment by virtue of its “cradle to grave” analysis of product systems is perfectly suited for this endeavor. This unit, written for the 10-grade chemistry or environmental science curriculum, uses Life Cycle Assessment processes to analyze the environmental impact of Rare Earth Elements.

(Developed for Honors Chemistry, grade 10; recommended for Chemistry, grade 10)

20.04.05

[“A Plastic Struggle for Mother Earth,”](#) by Marnita A. Chischilly

Plastics are a huge part of daily life. Many of the products we use daily are made out of or contain plastic. So what happens to the plastic product when we are done with it? When we think about this question, we have to consider the convenience of using plastic in our daily living. The convenience of bottled water packaged in lightweight plastic, which can be easily carried and thrown away as soon as the water is consumed. Is convenience worth it, knowing that more than one-third of all plastic disposable packaging like bottles and bags end up littering the environment? This is a concern for many environmentalist because plastic has become one of the major substances to have a negative impact on our earth’s environment. This curriculum unit brings awareness of this environmental issue. It is my intention to inspire students to become actively involved in learning about their surrounding environment and to engage in solving real world issues through environmental engineering. Navajo cultural teachings is part of the unit for students to grasp a deeper understanding of continuing our ancestral ways of keeping harmony with Mother Earth (*Nahasdzáán*).

(Developed for Science, grade 8; recommended for Science, grades 5-8)

20.04.06

[“The Engineering of Green Infrastructure and Stormwater Management Practices,”](#) by Michael A. Doody

This unit, designed for Advanced Placement Environmental Science, helps students connect the issue of stormwater runoff and urban flooding to land use and impervious surfaces. Students study the use of gray infrastructure such as curbs, gutters, and sewers and their environmental consequences, including flooding, erosion of stream banks, and

transfer of pollutants to surface water bodies. Green infrastructure is then introduced as a potential solution to these environmental problems. Students learn about management practices such as constructed wetlands, swales and bioretention basins, green roofs, rain gardens, and permeable pavements. Simple hydraulic runoff models are introduced as a tool for studying runoff and design effective management practices. Students also learn about flooding in two communities within our school district that experience routine flooding. Ultimately they are tasked with using their understanding of green infrastructure and stormwater runoff models to develop an environmentally-friendly and effective stormwater management plan for dealing with the flooding in these two communities. This unit addresses several science practices outlines by College Board, including explaining environmental concepts, processes, and models presented in written and visual format and proposing and justifying solutions to environmental problems. Students use these practices to satisfy AP Environmental Science Learning Objectives EIN-2.M (describe the relationship between land use and flood risk) and STB-3.E (explain how the use of green infrastructure can reduce the risk of flooding during heavy rainfall events).

(Developed for AP Environmental Science, grades 11-12; recommended for Environmental Issues, grades 10-11)

20.04.07

[“Confronting the Plastic Wasteland through Engineering,”](#) by Taissa Lau

It’s difficult to imagine a world without plastic. The easy manipulation to produce desired characteristics, and not to mention low cost, of this synthetic polymer makes it a necessity for our everyday lives. We use plastics in our packaging, clothes, electronics, household products, medical devices and so much more. With such versatility, comes one of our amounting environmental concerns: plastic waste. The production rate of petroleum-based plastics has skyrocketed since the 1950s, and the plastic waste we generate annually is outstanding. Due to its low degradability, petroleum-based plastics can last for hundreds to thousands of years in the environment affecting ecosystems in harmful ways. Within this unit, there are three overarching goals to be achieved. First, it aims to address the basic chemistry of plastics exploring the basic chemical synthesis of polymers through student investigations. Second, students will analyze the life cycle of petroleum-based plastics, which will reveal the challenges of plastic waste. Third, students will consider the future of plastics utilizing their newly acquired knowledge of current petroleum-based plastic production and disposal. They will address the need for more sustainable practices in synthesizing plastics by designing, creating and testing their very own bio-based, biodegradable plastic or repurposing petroleum-based plastic in another form. Ultimately, these three objectives will be met by the content of the unit, which will expose students to the engineering design process as well as the three dimensions of the Next Generation Science Standards.

(Developed for Science, grade 8; recommended for Science, grades 6-8)

20.04.08

“How Should I Get to School? A Life Cycle Assessment of DC’s Public Transportation,” by Zachary Meyers

Life cycle assessments (LCAs) have been at the forefront of many decisive pieces of environmental legislation; serving municipalities, governments, and companies as a tool for decision making. To further promote depth of knowledge and systems thinking, students will develop individual LCAs with regards to the District of Columbia’s public transportation system and decide which mode of transportation (i.e., bus, Uber, electric scooter, or metro) will be most energy efficient/cost effective for them. This three-week unit will integrate the physical principles of energy efficiency (i.e., conservation of energy and entropy) with economics (i.e., cost per kWh for metro, daily ridership cost). The locality of each student will affect their overall decision(s) based on availability of resources and access to various types of public transportation in their surrounding neighborhoods. This unit seek to address a rather simple question with underlying complexities and nuances, *how should I get to school?* Through the exploration of data analysis and modeling students will refine their skills in conceptual mapping with regards to energy networks among the transportation sector in the District of Columbia.

(Developed for Physics, grade 11; recommended for Physics and Engineering, grades 11-12)

20.04.09

“Investigating Surfaces and Water Runoff in Urban Areas,” by Ricardo Moreno

Urban areas are increasing in all parts of the world. With this shift in population into more dense and compact areas the need to increase infrastructure and to construct housing to meet these increasing demands come at a cost. Urban areas are dominated by surfaces which impact the environment. Impervious surfaces do not allow runoff to be absorbed into the soil. Examples of impervious surfaces include pavement, asphalt and buildings. These impervious surfaces contribute to increased runoff. Instead of water returning to the water table water runoff is redirected into collection systems where pollutants can be carried into local areas of fresh water. In extreme events, systems can be overwhelmed causing flooding.

My students will examine the immediate surrounding area of our school, Edwards Elementary in Chicago. They will examine the surfaces which encompass the surrounding area and begin to distinguish between examples of pervious and impervious surfaces and how much of these surfaces are represented. Students will participate in activities involving math by measuring amounts of rainfall and deducting the areas of surfaces, and proportion of permeable to total area.

This unit will teach my students how engineers take into consideration when planning construction projects and how surface areas can contribute both positively and negatively to their communities.

This unit will be part of the 7th Grade Math curriculum.

(Developed for Math, grade 7; recommended for Math, grade 7)

20.04.10

[“Engineers Wanted: Climate Change Experience Necessary!”](#),” by Rachel L. Odoroff

With both weather and climate changing due to increased fossil fuel consumption, humans are facing choices at personal, local, national and international levels: reduce carbon emissions or adapt our farming, housing, transportation, our whole towns and cities to the coming reality. Using a project based approach, this unit will explore the unique challenges that Philadelphia, Pennsylvania will face in the coming years and calls upon middle school students to design a retrofitted model of their school to address those changes. Embedded in the unit is multidisciplinary learning which requires students to read graphs, analyze data, conduct scientific experiments, and to justify their design choices with written and oral responses while they imagine engineered solutions to locally based problems. This unit should be adaptable for students and teachers in other locales with minor adjustments.

(Developed for Science, grade 8; recommended for Science, grades 6-8, and Environmental Education, grades 6-12)

20.04.11

[“Mask On: Clearing the Air: the Challenges of Indoor Air Pollution on Urban Health and Academic Performance,”](#) by Virginia S. Redwine Johnson

Deep breaths are like little love notes to your body. – Author Unknown

This unit intends to highlight the importance of breathing and the impact that indoor air quality has on children’s health. The unit specifically dives into the manner of which poor air quality is associated with chronic illnesses like asthma. These illnesses are linked to student performance and their overall success. Asthma is increasing in the U.S. In my elementary class, I remember being one of two students with asthmatic symptoms requiring an inhaler during the cold months. Now, in my own class, there are more students relying on tools to help their airways because of their asthmatic diagnosis. In my three elementary classes, there were approximately five students in each class that were coded as asthmatic.

Air pollution is a major component of our daily lives whether it is inside or outside of the home, but we often only focus on the air quality outside. There's no secret that outside pollutant emitters such factories, industries, chemical plants, and automobiles contribute chemicals and particles to the air we breathe, but being that 90% of time is spent inside, this unit is going to look into the pollutants that harm breathing inside. It is my goal for students to study the cause and effects that our home environment has on respiratory issues and have students develop a better understanding of the correlation between health and academic success.

(Developed for Math, Science, and ELA, grade 5; recommended for Science and Math, grades 3-4)

20.04.12

"Engineered Soil Moisture Sensor," by Jhansi Sunkerneni

With the ever increasing human population, the need for water cannot be underestimated. It is today's pressing issue and we need to act on it now, to conserve water. Future water shortages can lead to drastic impacts on food production, other ecosystems, and the environment. If water conservation is not practiced, the world could face irreversible consequences. In this curriculum unit my goal is to introduce the need to conserve water, the impacts of water shortage problems, how working as a team can help towards solving this global problem, and how to build and test a soil moisture sensor that can benefit farmers by not having to water farmland when it is already moist.

This unit is built to help teachers who are new to the field of Engineering to basic background knowledge of what they need to know in order to help their students build an electronic device. Students will learn about the engineering design process involved in building a soil moisture sensor. They will then learn about basic electronic components and their function. Then, they will then apply their knowledge, to build a basic circuit to light up an LED bulb. The end goal is to build an electronic soil moisture sensor with their teams, test it, analyze and communicate the results, and essentially use it in their backyards, and be ready to experiment to build other electronic devices. This unit was developed for Engineering Design, Grade 7 students.

(Developed for Science, grade 7; recommended for Science, grade 7)

V. Caretakers versus Exploiters: Impacting Biodiversity in the Age of Humans

Introduction

Our dominant influence on Earth's climate and environment has prompted the current geological era to be named the Anthropocene, or Age of Humans. These ecological impacts have been mostly negative for species biodiversity, through human changes to natural habitats that threaten the well-being of other species and increase their extinction rates. Is it our responsibility to be better caretakers of the planet, to ensure Earth's biodiversity is preserved for future generations? Or, should we exploit Earth at all costs to feed and provide energy for the growing human population? This seminar examined the many ways that humans impact biodiversity, and whether we have an obligation as caretakers who preserve other species even for purely aesthetic reasons, versus exploiters that ruthlessly modify Earth on our 'evolutionary path' as a species. We considered climate change and global warming, and how these ecosystem effects alter the biogeography and behavior of species – including humans. Mosquito and tick populations are expanding their geography along with vector-transmitted pathogens; plants are changing their flowering times and marine creatures are migrating, impacting agriculture and fisheries; and desertification and reduced access to clean water are already affecting human demography and agriculture. Pollution from fossil fuels and e-waste can threaten the health of wildlife, as well as humans. The ease of land, ocean and air travel can promote movement of animals, plants and microbes, allowing them to invade and displace resident species. Our landfills and built environments can actually improve survival of some species, such as bears, seagulls, mice, weedy plants and bedbugs – but this can threaten human safety and increase the risk of infectious diseases. If species go extinct, so do their natural products that might be harnessed by humans to discover new medicines, and to solve energy problems. We discussed book chapters and magazine articles on the seminar topic, and how it was portrayed in popular culture. The seminar led to curriculum units appropriate for K-12 classrooms, especially for instructors in biology and the environmental sciences. In addition, the seminar produced units valuable for K-12 teachers in math and statistics.

The overarching goal of the seminar was to empower teachers in their knowledge of human effects on earth's biodiversity, with the expectation that this understanding would enrich the classroom experiences of their students. The resulting units are diverse, reflecting the varied interests and backgrounds of the Fellows. Jesse Baker develops a unit for high school Geometry students concerning human impacts on ecosystems and particularly declines in pollinator species of bees, where students learn about the importance of hexagon shapes in biology and gain practice in evaluating data on the impact of disappearing species. The focus of Chelsea Best's unit for 5th-grade science students is the role of human activities in disease spread, especially for chytrid fungus that threatens amphibian species around the world, as well as for the global pandemic caused by SARS CoV-2 virus. Kendra Butler's unit for 3rd-grade science students

examines the role of parks in fostering biodiversity and educating young learners about natural ecosystems, while reminding that human activities nearby parks can promote problems caused by invasive species. Sara Conway's unit for 1st through 3rd grade Montessori students looks at the success of indigenous cultures that live alongside biodiverse communities without threatening species with extinction, especially in biomes on the continent of Africa. Jenn Frasher's unit for elementary school students concerns native versus invasive species, and emphasizes how outdoor instruction can aid student appreciation for biodiversity and that humans can be better caretakers of natural ecosystems. Tara McCrone's 5th-grade unit instructs students on the main ways in which humans are negatively impacting biodiversity to hasten extinction of species, as well as the unfortunate effects of these activities on human communities and health. The 5th-grade unit by Jolene Smith explores strip-mining of coal and how this practice has devastated animal and plant species, and has negatively impacted the health of Native Americans in locations such as Black Mesa, Arizona. Vanessa Vitug develops a unit for high schoolers that concerns changes in land-use practices, and how these human activities cause species extinctions and also may contribute to the ongoing threat of emerging disease pathogens capable of spurring epidemics and pandemics in humans. Jason Ward's unit for 1st graders examines the role of bats in ecosystems, and how human activities have factored in the threat caused by White Nose Syndrome, a fungal disease that can completely eradicate bat colonies. Lawrence Yee develops a unit for high schoolers in math and Advanced Placement Statistics courses, on human activities that promote growth of toxic algae, which can threaten other marine organisms and contaminate seafood consumed by humans.

Paul E. Turner

Synopses of the Curriculum Units

20.05.01

[“One Clover and A Bee: The Impacts of Bee Sustainability on Biodiversity in Allegheny County,”](#) by Jesse K. Baker

Why should we preserve biodiversity? Students will discuss the importance of maintaining ecosystems and will learn about the various arguments that people make in favor of preserving the Earth’s biodiversity. Background information on bee physiology and behaviors as well as the various ways the reduction or complete extinction of bees will impact other species will be researched, presented and discussed. We will investigate factors of their decline that include climate change, the use of pesticides, and monocropping¹ which utilizes the practice of relocating nonnative bee species that leads to colony collapse disorder through the infestation of Varroa mites. More importantly, conservation steps will be considered concerning Pennsylvania bees. Unless the students can bring about awareness to spark a fit of revery, we are headed towards a future where you’ll yearn to taste real strawberries or have grocery aisles that are no longer stuffed with foods, colors, and shapes that we are currently taking for granted.²

(Developed for Geometry PSP, grade 10, and Geometry CAS, grade 9; recommended for Geometry, grades 9-10)

¹ FAO of United, Nations. "Declining Bee Populations Pose Threat to Global Food Security and Nutrition." May 20, 2019. Accessed July 13, 2020

² Warren, Mobi. *The Bee Maker*. Pennsauken: BookBaby, 2019.

20.05.02

[“In Summary: Strands of One Braided Cord: How Humans Are Impacting Biodiversity Through the Spread of Disease,”](#) by Chelsea N. Best

In an ever-connected world that is being altered by climate change and invasive alien species because of human’s existence on our planet, we are seeing an increased rate in emerging diseases in humans and other species. This unit will examine the spread of chytrid fungus and discuss how its existence has led to an increased rate of amphibian extinction particularly in the *Atelopus* genus. The unit will discuss the Panamanian golden frog’s disappearance from the wild mentioned in the book, *The Sixth Mass Extinction, An Unnatural History* written by Elizabeth Kolbert. Then the unit will discuss the emergence of zoonotic spread from coronaviruses looking specifically at the SARS-associated coronaviruses, Severe Acute Respiratory Syndrome, SARS 2003 and SARS-CoV2. Finally, the unit will discuss how SARS, chytrid, and human interactions with the environment are all related to each other. The unit will examine how humans have impacted climate change in turn impacting the rate at which zoonoses occurs and how humans trading goods over centuries has led to accidental or purposeful redistribution of

amphibians. Overall, the unit will show how humans, viruses, frogs, and fungi are a part of one system, or one “braided cord”. The classroom activities for this lesson are based off the 5E model with a focus on English Language Learners. The unit should take approximately five days to teach. Activities include comparing and contrasting images, making connections, practicing observations skills, lab safety practice/review, and introduction to vocabulary to name a few. Both online and in person activities have been included into this unit. Use of technology has also been considered and it is recommended that a teacher using this unit downloads FlipGrid (which is free for all educators). By the end of the unit, students will be able to make predictions on how humans’ interactions with the environment impact the world from a micro scale to a macro scale.

(Developed for Science, grade 5; recommended for Science, grades 4-6)

20.05.03

[“Biodiversity in Pocahontas State Park: Being Caretakers with Wildlife Corridors,”](#)
by LaKendra T. Butler

This unit focuses on Pocahontas State park in Richmond Virginia, and how it’s changed over time. I will look at how humans have affected it by building around it since its origin in 1946 to the present. Pocahontas State Park also features three lakes; fishing and boating are also possible, depending on the season. Within the park, there are 64 miles of walkways. It is the largest state park in Virginia with nearly 8,000 acres. With our field trips to the park, students will be able to get a hands-on, real life engaging view on our unit topics.

My students will focus on the forest habitat and all the living and non-living organisms in it. We will explore food chains, populations and communities within this habitat. From this, we will identify animals threatened with extinction. Students will research causes of extinction in the park and what changes occurred that affected it (especially humans taking over more land, therefore disrupting the natural habitats of species). We will also explore the possibility of invading species entering the park due to effects of building in the surrounding areas, and how the invading species may displace species that were originally present. Students will list ideas of how humans can keep animals from being threatened from extinction and being displaced from their homes.

I will encourage students to make connections, identify cause and effect relationships, and also identify fact and opinion features; these are all language arts standards we practice in 3rd grade as well. The main activity of my unit is for students to design a wildlife corridor for a species of their choice. They may make 3D models or drawings on large posters. They will present their ideas to the class and possibly Pocahontas State Park rangers during one of our field trips.

My goal is for students to understand how we have to be “caretakers” of Earth’s habitats, and even as children they can make a difference.

Science Virginia Standard of Learning:

- Science 3.10 The student will investigate and understand that natural events and human influences can affect the survival of species. Key concepts include a) the interdependency of plants and animals; b) the effects of human activity on the quality of air, water, and habitat; c) the effects of fire, flood, disease, and erosion on organisms; and d) conservation and resource renewal.
- Science 3.6 The student will investigate and understand that ecosystems support a diversity of plants and animals that share limited resources. Key concepts include a) aquatic ecosystems; b) terrestrial ecosystems; c) populations and communities; and d) the human role in conserving limited resources.

Next Generation Science Standards:

- 3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all. [Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.]
- 3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.* [Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms.] [Assessment Boundary: Assessment is limited to a single environmental change. Assessment does not include the greenhouse effect or climate change.]

(Developed for Science, grade 3; recommended for Science, grade 4)

20.05.04

“Montessori’s Cosmic Curriculum and Biodiversity in Africa,” by Sara R. Conway

One of Dr. Maria Montessori’s core philosophies is the idea of Cosmic Education, or that no element in the world exists in isolation. In this unit, the philosophy of Cosmic Education is introduced to the students to help them have an admiration of and respect for the world and their place in it. This unit invites the student to undertake the study of the continent of Africa according to the biota that live there along with indigenous cultures that meet their basic needs within their biome. The students will explore, through research, three different biomes of Africa and how they are interconnected to the botanical and zoological species that adapt within them. The biomes being studied are the tropical forest, grassland, and desert. Human cultures and indigenous tribes are presented

in the context of their relationship to the biosphere. The tribes being studied are the Maasai of the grassland, the !Kung of the desert, and the Efe of the tropical forest. By studying the different biomes within the continent, the students will develop a strong understanding of how life adapts to different conditions found within the biomes.

Keywords: Montessori, Cosmic Curriculum, Africa, biome, grassland, desert, tropical forest, indigenous, Efe, !Kung, Maasai

This unit was developed for a Lower Elementary first, second, and third grade Montessori classroom.

(Developed for Montessori Cultures, Social Studies, and Science, grades 1-3; recommended for Science and Social Studies, Elementary grades, and Montessori Cultures, Lower Elementary grades)

20.05.05

[“Biodiversity Beyond the Four Walls,”](#) by Jennifer Frasher

This unit will help students become actively engaged in understanding scientific processes and problem-solving, through connected activities in their local environment. The overarching theme will be recognizing, understanding, and supporting biodiversity, while learning impacts of native and non-native species. Students will examine local phenomena and utilize science and engineering practices to deepen their understanding. They will develop a common vocabulary for biota and ecosystems, then analyze and evaluate choices within those environments. It is a flexible unit that can be valuable to urban settings, as well as suburban and rural. The unit also supports outdoor classroom usage and utilization of other school outdoor spaces. Exploring phenomena in the environment surrounding school and students’ neighborhoods will help teachers and students become active caretakers by supporting environment-to-self, environment-to-environment, and environment-to-world connections. Virtual lesson adaptations have been included for each activity.

(Developed for Science, Reading, Writing, and Social Studies, grade 2; recommended for Science, all grades)

20.05.06

[“Friend or Foe: Human Impact on the Earth’s Ecosystems,”](#) by Tara K. McCrone

Many science standards ask students to consider human impact on the Earth; although, very few provide in depth detail of such impacts. In terms of Earth’s history, humans are a relatively new species on Earth. However, no other species has made a more lasting impact than humans. The rate of human caused biodiversity loss and species extinction far exceed background extinction rates. This has led to an entire new geological era

called the Anthropocene. There are six variations of human impact on Earth's ecosystems: habitat fragmentation, invasive species, population growth and urbanization, pollution, overexploitation of natural resources, and climate change. These human-caused impacts are not just detrimental to the natural world, but also negatively affect human communities. Growing acknowledgement of indigenous practices and community-based conservation methods are being researched on how humans can live alongside ecosystems as caretakers. This unit will explore how the health of various ecosystems and how they are intertwined with the health of human communities by investigating the six major human impacts on biodiversity.

Keywords: ecosystems, mass extinction, human impact, Anthropocene, biodiversity, community-based conversation

(Developed for Living Systems and Elementary Science, grade 5; recommended for Elementary Science, grade 4, and Life Sciences, grades 4-6)

20.05.07

[“Ecological Effects of Strip Mining Coal on the Black Mesa Mine,”](#) by Jolene R. Smith

The demand for coal and strip-mining techniques can affect species biodiversity, and relates to humans as caretakers versus exploiters of the earth. During the 1960s through the 1980s, strip mining became the preferred way of mining in the USA. The term strip-mining precisely says what it does. It strips away vegetation with the topsoil and the overburden (layers of soil and rocks below the topsoil) to get to the coal. This newer mining method brings havoc to the land and the people who live on the land. The people, the wildlife, the water, native plants, vegetation used in traditional medicines, and ancient artifacts have been irreversibly changed.

Strip mining is occurring in previously undisturbed areas across the United States. Companies find coal beds clustered in thick strips in the earth. On the Dine Nation, strip mining is prevalent and seen as an indicator of progress. Peabody Coal Company, the largest coal corporation in the world, sought the coal in Black Mesa. Sixty-five thousand acres was leased to Peabody with the Hopi and Navajo (Diné) tribal leaders' agreement. Many residents on the mesa resisted, and yet a forced removal of families eventually happened.

The historical event of what strip mining did to the native people and their land is a curriculum unit our students need to know, so they can understand what corporations can do to people, land, water, vegetation, and wildlife. The effect of mines is still very evident today.

(Developed for General Science and Earth, grade 5; recommended for General Science and Earth)

20.05.08

“Viral Viruses: Land-Use Changes and Emerging Infectious Diseases,” by Vanessa Vitug

To what extent will humans ignore the fact that we share the earth with 8.7 million other species in our unquenchable demand for resources? In bulldozing, logging, mining, and over-farming humans drain the earth of its biodiversity. Human driven land-use changes create bare, dry, infertile landscapes in once thriving and fertile habitats. However, there is another consequence to human encroachment into once wild habitats. The consequence is the increased interaction of natural virus reservoirs and humans. This curriculum unit first examines the growing habitat loss in the Amazon and Southeast Asia due to human decisions to create more grazing lands and farms for food production. In its second part, the unit explores the potential link between habitat loss and emerging infectious disease. Three viruses that have caused epidemics and pandemics are examined: Nipah virus, SARS, and SARS-Covid-2. Finally, students experiencing this curriculum unit will debate if there are viable solutions to these problems, and if so, whose responsibility is it to cure earth of its exploitation through policy change? This curriculum unit is intended for students in 11th and 12th Anatomy and Physiology and can be modified for an Environmental Science class.

Keywords: Land Use - Change, Deforestation, Emerging Infectious Disease, SARS-Covid-2

(Developed for Anatomy and Physiology, grades 9-12; recommended for Anatomy and Physiology, grades 9-12, and Biology, grade 9)

20.05.09

“Saving Little Brown Bats: A Case Study of White-Nose Syndrome for Primary Grades,” by Jason J. Ward

Bats play an important role in a variety of ecosystems throughout the world through insect control and plant pollination. Events that kill large portions of populations, including natural or human induced disasters, increasingly threaten biodiversity. Invasive species are a major trigger of these declines, including invasive pathogens, against which native species can experience high mortality due to a lack of evolutionary defenses. Introduced fungal pathogens can be particularly dangerous as they can frequently survive in the environment for extended periods, affect a relatively broad range of hosts, and can be highly virulent, thereby driving mass-mortalities of native species of plants and animals.

This unit is focused on the common little brown bat. Over the past 20 years, the little brown bat population in North America has been decimated by White Nose Syndrome (WNS), a fungal disease that interrupts hibernation and has eradicated some bat colonies completely. The unit is designed for primary grades and aligned to first grade Next Generation Science Standards and Practices. The five hour long lessons include an overview of bat biodiversity, the role of bats in world ecosystems, reasons why some bat species are threatened, how humans can take on a caretaker role in bat conservation, and ends with a project that has students designing and constructing a bat roosting box to promote local bat activity.

(Developed for STEM, grade 1; recommended for STEM and Science, grades 1-5)

20.05.10

[“Marine Biotoxins: Invisible, Odorless, and Lethal,”](#) by Lawrence E. Yee

Humans have consumed seafood for thousands of years. Proper handling, storage, and preparation of seafood can prevent a variety of food-borne illnesses caused by bacteria and viruses. Some naturally occurring biotoxins produced by algae cannot be removed or mitigated by cooking and pose a serious health risk to consumers. Human contributions to changes in the environment including warming of ocean temperatures attributed to burning of fossil fuels and pollution runoff in waterways are creating conditions allowing toxic algae blooms to proliferate. Smaller ocean organisms including clams, mussels, sardines, anchovies, and crabs are relatively unaffected by some biotoxins. Larger predators including birds, otters, sea lions, whales, and humans are at risk of severe negative health complications, including death, from seafood borne illnesses when consuming toxin contaminated organisms.

This curriculum unit looks at Amnesic Seafood Poisoning (ASP) caused by domoic acid, a marine algae biotoxin, that is appearing more frequently and on a wider scale along California’s Pacific coastline. An overview of California’s Marine Biotoxin Monitor Program, the longest running program of its kind in the United States, and the techniques used to collect, sample, and make determinations regarding the safety of seafood are introduced. I created this curriculum unit for students taking AP Statistics so they can examine a current environmental problem, examine existing data collection techniques, analyze data from research journals and publicly accessible government databases and agencies, and propose solutions that address local, state, national, and global issues.

(Developed for AP Statistics and AP Seminar, grades 11-12, and Math Analysis, grades 10-12; recommended for Statistics and Biology, grades 9-12)