



# WPI



## **Implementation of Culturally Responsive Teaching & Asset Based Pedagogy**

An Independent Study submitted to the STEM Education Center of WORCESTER  
POLYTECHNIC INSTITUTE in partial fulfillment of the requirements for the Teaching  
Licenciature for High School Chemistry

By: Joelis Velez Diaz

2024

WPI Faculty Advisors: Professors - Kathy Chen and Jillian DiBonaventura

*This report represents the work of one WPI undergraduate student submitted to the STEM Education Center as evidence of completion of the Teacher Preparation Program. WPI routinely publishes these reports on the web without editorial or peer review. For more information about the projects program at WPI, see <http://www.wpi.edu/Academics/Projects>.*

# Table of Contents

<b>Table of Contents</b> .....	<b>2</b>
<b>Abstract</b> .....	<b>3</b>
<b>1. Introduction</b> .....	<b>4</b>
1.1) About Me.....	4
1.1.1) Teaching Philosophy.....	4
1.1.2) Positionality Statement.....	6
1.2) My WPI education.....	7
1.2.1) WPI Courses.....	8
1.2.2) Pre-Practicum Experiences.....	9
1.2.3) Other Teaching Related Experiences.....	9
<b>2. Education Policy</b> .....	<b>10</b>
2.1) No Child Left Behind Act (NCLB), 2002.....	10
2.2) Every Student Succeeds Act (ESSA), 2015.....	11
2.3) Massachusetts Education Reform Law, 1993.....	11
<b>3. School Overview</b> .....	<b>12</b>
<b>4. CAP Elements</b> .....	<b>14</b>
<b>5. My Practicum</b> .....	<b>15</b>
5.1) Courses Taught.....	15
5.2) CRT.....	15
<b>6. Instructional Materials</b> .....	<b>23</b>
6.1) Sample lesson Plans.....	23
6.2) Presentations.....	23
6.2.1) Unit 7: Ionic Bonding and Naming.....	23
6.2.2) Unit 8: Covalent Bonding and Naming.....	23
<b>References</b> .....	<b>24</b>

## Abstract

The focus of my student teaching was on fostering a safe learning environment with the implementation of Culturally Responsive Teaching and empowering the students by providing them the opportunity to apply their students' Funds of Knowledge. I performed my student teaching at South High Community High School, in Worcester, Massachusetts. My placement was with Joseph O'leary as my teacher mentor, and I taught high school chemistry grades 10-12th for a semester long. During this experience I enhanced my educational practices by observing other teachers, adaptation and improvement of my lessons, incorporating the feedback from my supervisor practitioner and my mentor, and following the rubric of the CAP elements defined by the Massachusetts department of education. Culturally Responsive Teaching demonstrated to benefit the students' learning, given that it increased their participation, engagement, and motivation to learn chemistry.

*Key words:* Culturally Responsive Teaching, Funds of Knowledge, Chemistry

QR Code to my e-portfolio:



<https://sites.google.com/view/jmvdteachingportfolio/home>

# **1. Introduction**

## **1.1) About Me**

### **1.1.1) Teaching Philosophy**

Having lived through difficult circumstances shaped the person and teacher that I have become, I understand the hardships that students can face when trying to obtain their education. It's for this reason that equity must be the core of the education, given that not all the students have the same resources available. I believe that every student must have an equal opportunity to learn and succeed. Culturally Responsive Teaching is key to achieve this, and to allow the students to be the leaders of their own learning. I am aware of the importance of each person's cultural experience and their own "Funds of Knowledge (FoK)"; hence I am devoted to contributing to achieving the maximum potential of the students by empowering them and giving them the most opportunities in the classroom to use their FoK. I am committed to persevering in improving the quality of life, our environment, and helping students visualize themselves as agents of change through education.

Furthermore, as teachers it's important to show that we truly care about our students not only to make them feel good, but to meet their academic needs. It's essential to implement culture into education, it's very helpful when we as teachers value the students skills and their abilities to guide them towards academic success. Additionally, the concept of humanizing pedagogy is also meaningful because sometimes as teachers it's easy to hyperfocus on the material that we need to cover and barely allow the students time to be human, and I think that realizing that not everyone can work at the same pace is fundamental. We are all human and have different types of learning, for this reason in our classrooms we must have differentiated learning and a humanizing pedagogy where students can relate to what is being presented to them and appreciate its value. Finally, fostering a safe environment is essential as well, because throughout the years minorities students have perceived school as a place where they can't be themselves. Therefore, we have to show the students that what they had and where they came from is very valuable. This can be done with the help of the parents because they are a valuable resource, they know the community, and some might know the culture of a certain place better than me as a teacher this can allow for the students to create connections, and as a teacher we can learn from

the parents and apply some of their skills into our classroom.

In my classroom, the assignments, assessments, and instructional resources I use allow my students to see themselves and see others; I foster a safe learning environment by letting students work in groups and they sit in tables that allow for collaboration with their classmates. In addition, my teaching is very student centered, they participate in front of the class if we are solving a problem and they get stuck I help them out without saying that they did it wrong, I just say that almost or we aren't there yet and help them. In addition, to review for the exams they get to use sort of like a video game (blooket) and by their competitive nature it encourages learning. I review the assignments, assessments, and instructional resources I use for historical accuracy, stereotypes, cultural relevance, and multiple perspectives; I review everything to make sure that there is nothing in my instructional materials that would be detrimental in any way. I also like to implement different ways of delivering content such as including videos for those students that find this more helpful. If there are students that struggle a bit more I help them one-on-one, or I try getting most of the students struggling in one table and that way I can explain the material to at least 5 of them at the same time, I also ask them questions and encourage questions, and let them help each other out. Moreover, I seek to learn about the students just by asking simple questions that can lead to further conversations, so open ended questions. Like what was your favorite thing of the weekend? Or some of my students stay during lunch in my classroom and we talk for a while. I think that also staying vulnerable and open with the students is important. For example, some ask me about WPI, and I tell them about my experience and help them to find more information about colleges and how to apply. In addition, just being nice to them and showing that I care and I really want them to learn helps because that way the students open up to you and tell you about themselves. I try to incorporate students' background knowledge, cultures, and family traditions daily as most as I can. It's a bit easier with the class where I have a lot of students that speak spanish the most and some don't know english so I can help them by speaking spanish and also translating what i say into english so that they can improve their english. In addition, I provide them the opportunity to go and help out other students with difficulty on the concept and they feel as teacher.

### 1.1.2) Positionality Statement

I was born and raised in the countryside of Puerto Rico; in the basement of my grandparents' house, where without having much, we had everything: family, friends, neighbors, and a profound sense of community. The resources were scarce, but having experienced this has made me who I am today. From a young age I saw the value of education, during 5<sup>th</sup> grade I decided to change schools to the Specialized Bilingual Education School of Cidra LMI. I wanted to learn English, because I knew that being bilingual could open multiple doors. The school gave me an interview and exam required to be able to enter. Days later, my mom comes home with used uniforms of the school and surprises me with the news that I had gotten into the school. I jumped! I was extremely happy, regardless of the fact that we didn't have the resources to buy the uniforms for school, because we had something more valuable... the joy of the possibility of a better future. The challenge of moving from a regular public school where all my classes were in Spanish to one specialized where the classes were in English, was very difficult. Here I was immediately immersed into English, and I didn't have the tools most students had to succeed. However, I was determined to succeed and despite this, I continued to earn all A's grades throughout my middle and high school career.

When I told my mom that it was important to learn English as a 10-year-old, little did I know what was ahead for me. Five years later, during my 10<sup>th</sup> grade in September of 2017, Hurricane Maria struck, changing our plans and lives. Right after this catastrophe my father moved to Massachusetts because he lost his job, and my mom, brother, and I stayed to complete our school year. Since we lived in the rural area, we were without electricity for nine months, and we didn't have a generator. There was no other option but to wash our clothes by hand, put the food in a small cooler with ice, and even study with candles. In June of 2018 we moved to Massachusetts, these obstacles I faced proved to me that “querer es poder”. I thrived in adversity and was able to see the path I know I want to follow. After leaving everything in Puerto Rico behind, it was still difficult. I was in a completely different environment and school system. In Massachusetts, I attended a high school, where there were problems with the students' behaviors, because they were not very interested in school and disrupted the learning. I was coming from Puerto Rico, the school just assumed I didn't know any English and put me in lower-level classes. I wasn't aware of honor or AP classes, because it's not something we had in Puerto Rico,

and the academic counselor didn't tell me anything about this. Thus, I had to advocate for myself. Nevertheless, the weaknesses I identified in this school allowed me to realize that I could improve it. Realizing that I can learn on my own and communicate knowledge with others provided me with a sense of mission. Guiding me to pursue the WPI Teacher Preparation Program to teach chemistry.

As teachers we have the great opportunity of spreading knowledge, and helping the students have a growth mindset. We can change lives for the better and stir the students into a positive direction. Our job goes beyond teaching our subject matter, it is about listening to the students to get to know them to be able to best help and support them in their career.

## **1.2) My WPI education**

At WPI I completed my degree in Chemical Engineering, with a minor in Materials Science, and a concentration in Environmental. On top of this I pursued the Teacher Prep Program to Teach High School Chemistry, it wasn't an easy path but it was certainly very fulfilling. I completed the coursework for my degree together with the coursework for teaching.

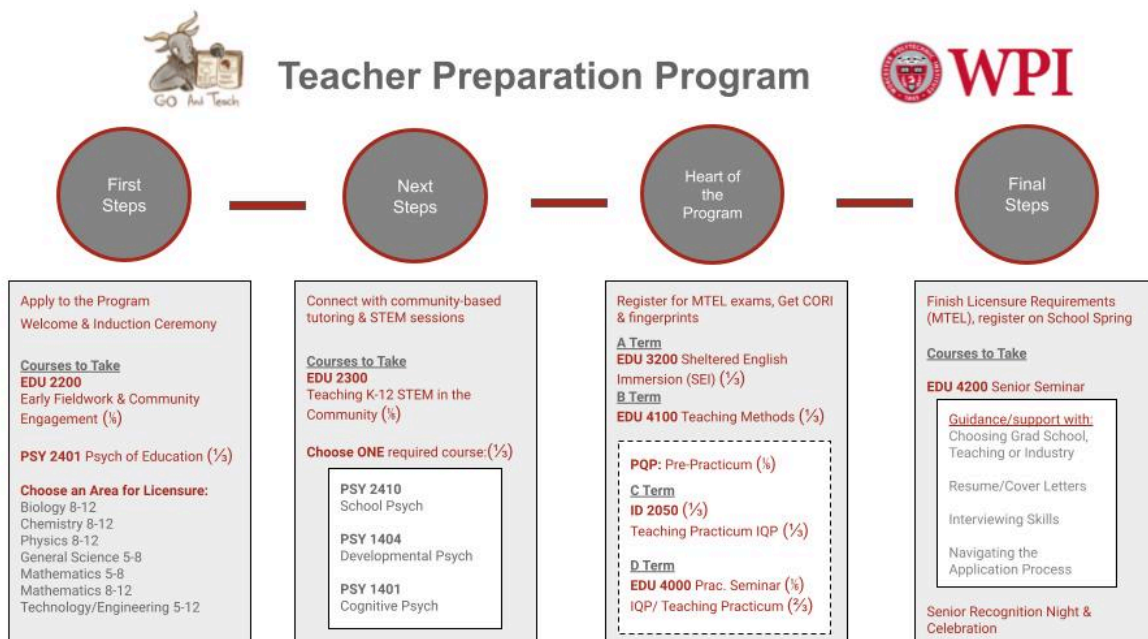
Furthermore, my favorite things about WPI are its people and spirit, as well as the space it provides to support others and share experiences in various ways. For example, the Global School hosted events focused on projects addressing complex global grand challenges. After the event "Reimagining Borders in Latin(x) America," where I spoke about my educational trajectory, a WPI librarian contacted me to exhibit my art titled "Transcendental Nature" in the WPI Gordon Library. This exhibit included a series of landscapes from Puerto Rico and other works of art more related to deep aspects of the soul. It's like a timeline that traces my journey from leaving Puerto Rico to getting adapted to Massachusetts. It portrays my personal experience, identity, and culture – my soul per say. Furthermore, as a Student Philanthropy Ambassador (SPA) for the Division of University Advancement, I share my experiences and thoughts with WPI donors. WPI provides a nurturing environment that facilitates connections and professional/personal growth.

When I first moved to the U.S. mainland from Puerto Rico, it was initially difficult to find a sense of belonging. I felt a clash of dual identities – feeling like I'm not Hispanic/Latino

because I am a citizen of the United States, but also not feeling American because Puerto Rico is not a state and Spanish is my native language. Nevertheless, during my college career, I was very fortunate to find friends that became family and support groups, which helped make WPI my home. I want my prospective student to be able to attend higher education and have similar enriching experiences to those I was very fortunate to have.

### 1.2.1) WPI Courses

The overall experience that I acquired at WPI and the courses that I took guided my teaching style. I was accepted into the program during my freshman year, and followed their guidelines as structured in the image below, except I got the chance to go to Thailand for my IQP during Junior Year, hence I completed my Student Teaching as an independent study during my senior year.



All Four Years: **Major Courses** for Subject Matter Knowledge Competency (SMK), **IDEA club** for developing educators, **Community-engagement** opportunities & events.

*Teacher Preparation Program requirements - wpi.edu*



### **1.2.2) Pre-Practicum Experiences**

My first pre-practicum experience was doing early fieldwork and community engagement. I completed this working as a STEM facilitator in the Latino Education Institute (LEI) for their Aspire summer program. Through this experience I was able to educate middle school students about STEM topics and scientific tools, as well as engage with them. Then I completed the requirement of teaching STEM in the community in Girls Inc, where we did a lesson on physics and made it engaging by relating it to the season at the time hence it was called spooky science. The students were able to have hands -on experience building their own designs of bridges and applying the physics concepts.

### **1.2.3) Other Teaching Related Experiences**

While studying in college during my sophomore year I continued working at the LEI through the program LASOS (Latina Achievers in Search of Success), where as a facilitator I was able to foster a connection with students of the sixth grade that were also Latinas. Working with LEI supporting the students, helping them believe in themselves, it meant a lot for me. Because it's important that they can feel empowered and know they can make a difference from an early age. It was very heartwarming to observe how the students related to me and told me I was a role model for them. This was something I was lucky to experience again by working at WPI as a Residential Program Advisor (RPA); when students that were from Puerto Rico or Hispanic background learned that I also was from Puerto Rico they came and talked to me, I would tell them my story and obstacles I faces, then they would leave realizing “wow if she can make it, so can I”. Being an inspiration for others is something I never expected, but something that I am very grateful for; I want to continue helping the younger ones realize their potential, and for them to obtain higher education.

Additionally, for two years in a row, I participated in the NSF Research Experiences for Teachers (RET) program as a researcher and prospective teacher. I conducted research towards the SDGs and enjoyed the opportunity to translate my research experiences into a high school chemistry lesson plan for teaching integrated STEM. I was able to present this lesson plan already and teach middle school students in the Latino Education Institute STEM EXPO 2023, as

a facilitator. Here students were able to conduct an experiment, and it was a very rewarding experience. I will be implementing it into the classroom during my student teaching next semester as well, to provide project-based learning for the students and portray what research is. I look forward to opportunities in motivating the younger generations with STEM education tied to real-world issues.

## **2. Education Policy**

### **2.1) No Child Left Behind Act (NCLB), 2002**

The advancement of disadvantaged students wasn't a priority to many schools, and concerns were raised regarding the education of the United States population given that it was not viewed as globally competitive. Therefore, a review of the Elementary and Secondary Education Act (ESEA) was done and the NCLB was created as an update for it, increasing the role of the federal government in the improvement of education. The NCLB law promised to make the schools accountable for the academic development of all the students. More specifically contributing to accomplish a higher performance for the students of identified groups with lower academic achievement. For example, students of color, English language learners (ELL), students in special education, and students in poverty. Before this act was passed, some students were excluded from general education as well as state tests. Hence, the law was now enforcing that the schools truly helped those students in disadvantage and provide more educational opportunities for them. It was expected that the learning achievement gap was closed by 2014. NCLB required schools to facilitate testing in math and reading once from 3rd grade-8th grade, and high school. If the schools didn't demonstrate growth penalties would have been faced, such as schools could lose federal Title I money or they could even get shut down. Nevertheless, the methods for ensuring that this goal was met caused dispute. The reliance on tests was heavy, thus the curriculum was affected by this. There wasn't enough funding for it, and what it attempted to achieve wasn't feasible in that manner which sought to cover the whole country.

## **2.2) Every Student Succeeds Act (ESSA), 2015**

The NCLB was substituted by the ESSA, it decreased the impact of the federal government on education policy and placed more of the responsibility on the state by allowing more flexibility and innovation. The states are now able to have the main role on the decision of how to account for academic performance of all the students. The law requires that the states have an educational plan which includes (but not limited to) the following: academic standards, annual testing, school accountability, goals for academic achievement, plans for supporting and improving struggling schools, state/local report cards. The testing requirements now remain the same as those of the NCLB, but there is now a focus on the accountability of the education of the ELL meaning that it shifted from being in the Title III to Title I. However, in the first year that these students are in the country their test scores aren't counted for the school rating - their scores are accounted for after they have been here for more than a year. As for the students in special education about 10 percent of them can obtain alternative tests. This Act gives the opportunity for schools to obtain grants; it reflects a more comprehensive view of education beyond standardized testing by consolidating many programs into a \$1.6 billion block grant and prioritizing activities that promote student well-roundedness as well as enhancing the support given to the most disadvantaged students. Note that under this act if a school is in the lowest 5 percent or it has a big amount of dropout rates the state evaluates the improvement after the school staff has developed an evidence-based plan, but if given plan doesn't work in four years the state must take over and priority has to be given to the students that needed more. If there are students of a subgroup struggling in a school the same procedure is followed.

## **2.3) Massachusetts Education Reform Law, 1993**

Considering that the state has the main decision on how they want to test the students, nowadays simulations are being considered to be put in place as a question to ensure that the students can apply their knowledge. The public has different opinions regarding the standardized testing, but this traces back to 1993 when the law was passed. Which required that for the high school students to graduate they needed to pass the Massachusetts Comprehensive Assessment System (MCAS), in the subjects of: math, science and english. The idea behind this law is to increase the academic standards in hand with the performance of students. It's for this reason that

statewide academic standards and curriculum frameworks were put in place, providing a high-quality education throughout all the grade levels and ensuring that at the end the students are actually able to meet the objectives identified for their class. If the students weren't doing well the school is responsible according to the law, hence maintaining them accountable and if these schools didn't improve the state takes it or could even lead to closure. Nevertheless, this law also allowed for more charter schools which can have higher standards and more flexibility, to increase the accountability of students' outcomes. In order to improve the general quality of education, it addressed financing gaps by giving low-income and failing schools more funds. Finally, this law also aimed to improve teacher quality by encouraging continuous professional development for educators and enacting new certification criteria.

### 3. School Overview

The school where I did my student teaching is South High Community High School:



- Student demographics: Based on the data from DESE 2021-2022, a total of 1,524 students are enrolled in this school; of which 818 are reported to be male, 705 female, and 1 non-binary. The school has a diverse community, and most of the students are Hispanic representing 46.3% followed by White being 23.1% of the enrolled students by race/ethnicity. About 16.8% of the students are African American, 10.4% Asian, 3.3 Multi-Race/Non-Hispanic, and 0.1% Native American.
- MCAS test scores: Compared to the state results the students meeting the expectations of the MCAS testing overall the subjects the school is on average about

half of the percentage of that of the state. My area of focus is on science, but in the DESE report it gets combined with tech/eng; here the students at my school are: 3% exceeding expectations, 17% meeting expectations, 42% partially meeting expectations, and 38% not meeting expectations. As for the MCAS in English Language Arts: 7% exceeding expectations, 30% meeting expectations, 42% partially meeting expectations, and 20% not meeting expectations. Finally, for the MCAS in Math: 5% exceeding expectations, 20% meeting expectations, 43% partially meeting expectations, and 32% not meeting expectations.

- Teacher demographics: Based on the data shown in DESE for 2022-2023 the staff of this school are mainly females being 131.6 in total, and there are 49.2 males. By race/ethnicity, the majority is White, representing 150.5 people. Next, we have 19.8 Hispanic, 5.7 African American, 2.6 Asian, 1.1 Native American, and 1.1 Multi-Race/Non-Hispanic.
- Teacher turnover: The retention rate of the school for the teachers is 89.7%, which is higher than the district and the state.

With the diverse community we have in our school various types of funds of knowledge can be identified. For example, all students have a unique experience, and many come from different places which provide multiple points of views; the individual experience of each student is knowledge they bring into the classroom. This and the different cultures portray the following type of funds of knowledge: gathered life experiences, and world views. In addition, I have realized that many of my students speak a second language, thus they are bilingual. This represents academic and personal background knowledge. However, there are students who also demonstrate knowledge based on hobbies and extracurricular activities. For instance, building a Rubik's cube, or playing an instrument. The amount of knowledge our students bring to our classroom is abundant and as teachers it is our job to build upon this promoting asset based education.

## 4. CAP Elements

The CAP elements structure what good teaching should look like and it provides a rubric for the evaluation of us as teachers. The Seven Essential Elements of CAP are the following:

Standard	Element	Proficient Descriptor*
1: Curriculum, Planning & Assessment	1.A.1: Subject Matter Knowledge	Demonstrates sound knowledge and understanding of the subject matter and the pedagogy it requires by consistently engaging students in learning experiences that enable them to acquire complex knowledge and subject-specific skills and vocabulary, such that they are able to make and assess evidence-based claims and arguments.
	1.A.3: Well-Structured Units and Lessons	Adapts as needed and implements standards-based units comprised of well-structured lessons with challenging tasks and measurable outcomes; appropriate student engagement strategies, pacing, sequence, , resources, and grouping; purposeful questioning; and strategic use of technology and digital media; such that students are able to learn the knowledge and skills defined in state standards/local curricula.
	1.B.2: Adjustments to Practice	Analyzes results from a variety of assessments to determine progress toward intended outcomes and uses these findings to adjust practice and identify and/or implement differentiated interventions and enhancements for students.
2: Teaching All Students	2.A.3: Meeting Diverse Needs	Uses appropriate inclusive practices, such as tiered supports and scaffolded instruction, to accommodate differences in students' learning needs, abilities, interests, and levels of readiness, including those of

		academically advanced students, students with disabilities, and English learners.
	2.B.1: Safe Learning Environment	Uses rituals, routines, and appropriate responses that create and maintain a safe physical and intellectual environment where students take academic risks and most behaviors that interfere with learning are prevented.
	2.E.1: High Expectations	Clearly communicates high standards for student work, effort, and behavior, and consistently reinforces the expectation that all students can meet these standards through effective effort, rather than innate ability.
4: Professional Culture	4.A.1: Reflective Practice	Regularly reflects on the effectiveness of lessons, units, and interactions with students, both individually and with colleagues, and uses insights gained to improve practice and student learning.

*CAP elements defined by the Massachusetts department of education - doe.mass.edu*

## 5. My Practicum

### 5.1) Courses Taught

During my student teaching I taught three chemistry courses, for a semester long. Impacting a total of about 70 students. The three classes I taught were: one honors, and two college levels. Together with teaching I also observed all the chemistry teachers in the science department deliver their lessons, including their AP chemistry class. This provided me a sense of perspective and allowed me to incorporate into my practice some of their teaching strategies.

### 5.2) CRT

Implementation of CRT and asset based learning is crucial in my pedagogy. Ladson-Billings framework includes these three components for culturally relevant pedagogy: Student Learning, Cultural Competence, and Critical Consciousness. I believe that chemistry can

help students in many ways and I always bring real world connections to incorporate CRT into the classroom so that they can see the value of what we are learning and be more engaged in the subject as a whole. Some of the real world examples we have talked about already are:

- i. Medicine - pharmaceuticals
- ii. Materials science
- iii. Biochemistry
- iv. Chemical engineering
- v. Environmental justice

The assignments, projects, and assessments I use empower and prepare students to solve problems in their lives, in their communities, and the world; by providing them the experience to do hands-on learning and lab experiments gives them a sense of agency and allows them to feel prepared to take on the problems of the real world. In addition, by allowing them to have a voice and choice. For example, the other day we did a marshmallow activity where they built molecular geometry structures and after they were done building these I asked them to choose one and presented it to the class either from up on the board or from their seats if that made them feel more comfortable. By allowing students space to present their projects it fosters a sense of community where what they are doing matters, and is being heard. By incorporating real world issues or real world implications and careers where the content that I am teaching can be applied, I connect to the students' daily lives the most. I think that with chemistry the most applicable connection is environmental justice and I have been using this to connect with racism and injustice; because due to the environmental injustice that currently exist the minorities get affected disproportionately.

An example of a lesson where I utilized CRT is the following:

### **WPI Lesson Plan Format (TPP)**

<p><b>UNIT or Lesson Title:</b> Covalent Bonding &amp; Naming and Molecular Geometry 3D structures <a href="#">Unit 8 - Covalent Bonding &amp; Naming 1.pptx</a></p>
--



**Teacher Name(s):** Joelis Velez Diaz

**Subject/Course:** Chemistry

**Grade Level:** 10th grade

**Standards and Learning Targets :** <https://www.doe.mass.edu/frameworks/current.html>

Knowledge LTs

**Curriculum Standard(s) addressed:** PS1. Matter and Its Interactions HS-PS1-1. Use the periodic table as a model to predict the relative properties of main group elements, including ionization energy and relative sizes of atoms and ions, based on the patterns of electrons in the outermost energy level of each element. Use the patterns of valence electron configurations, core charge, and Coulomb's law to explain and predict general trends in ionization energies, relative sizes of atoms and ions, and reactivity of pure elements.

Clarification Statement: • Size of ions should be relevant only for predicting strength of ionic bonding. • State Assessment Boundary: • State assessment will be limited to main group (s and p block) elements.

**Objective/Rationale:** Student will be able to (SWBAT):

- Students will master how to name and draw the Lewis dot structures for covalent compounds.
- Students will apply the VSEPR theory to predict the three-dimensional arrangement of electron pairs around the central atom in a molecule.

Unit/Lesson	Tier 1 (every day)	Tier 2 (school)	Tier 3 (science, lab, math)
Vocabulary	<ul style="list-style-type: none"><li>• Predict</li><li>• Model</li><li>• Explain</li><li>• Charge</li></ul>	<ul style="list-style-type: none"><li>• Properties</li><li>• Group</li><li>• Core</li></ul>	<ul style="list-style-type: none"><li>• Periodic table</li><li>• Elements</li><li>• VSEPR theory</li></ul>

<p><b>Learning Outcomes:</b></p> <p>What do students need to <b>KNOW</b>?</p>	<ol style="list-style-type: none"> <li>1. Students will be able to know how to write the formulas of the covalent bonds, name them, and draw their Lewis structures.</li> <li>2. Students will apply the VSEPR theory to build 3D structures.</li> </ol>
<p>What will the students be able to <b>DO</b>?</p>	<ol style="list-style-type: none"> <li>1. Students must draw the lewis structure of 6 different molecules.</li> <li>2. Students will identify the central atom, the number of bonded atoms and the number of lone pairs.</li> <li>3. Students must determine the 3D shape molecules.</li> </ol>
<p>As a result of this lesson, What will students <b>DISCOVER</b> or <b>CREATE</b>?</p>	<ol style="list-style-type: none"> <li>1. Students will create six molecules with marshmallows in groups of 3 or 4, with the correct angle.</li> <li>2. Students will present on one of the molecules they build and answer questions about it.</li> </ol>

**Assessment** - *In what ways will the students demonstrate proficiency of the standards? What products or performances will provide evidence that students have made progress in the desired understanding, knowledge or skills? (Include a link to your rubric, if applicable)*

[https://docs.google.com/document/d/1EhIgQVfFTOiumpq3xOu63iAGopD8Wja\\_Dwa-C2sbZG0/edit?usp=sharing](https://docs.google.com/document/d/1EhIgQVfFTOiumpq3xOu63iAGopD8Wja_Dwa-C2sbZG0/edit?usp=sharing)

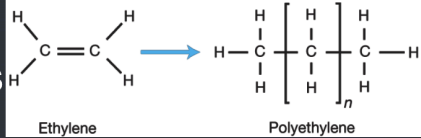
## Learning Plan (bulleted)

**Prior Knowledge:** *What concepts are students building upon or practicing in this lesson?*

- Covalent Bonds
- Electronegativity
- Bohr Diagrams
- Octet Rule
- Lewis dot structures


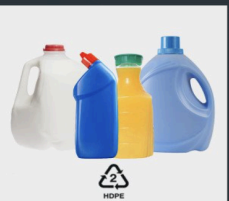
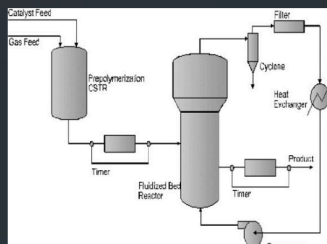
**Real World Application/Connection:** *How does this lesson connect to students' lives or experiences? We all use plastics daily!*

### Real World Connections



▪ The Lewis structure of ethylene is essential for understanding the reactivity of the double bond during polymerization reactions.

▪ Chemical engineers use this knowledge to design and optimize processes for the large-scale production of polyethylene with specific properties, such as high or low density, depending on the desired application (e.g., plastic bags or rigid containers).



**Materials/Resources:** *What supplies/equipment/resources will you need to implement your plan successfully?*

1. Marshmallows (big and small ones)
2. Plates

3. Tooth picks

**Pacing:** Complete the chart

below <https://docs.google.com/document/d/16JLH4Mb9w3MjyZtAmqdamo2AEICvH8GUiXtzkplLlA8/edit?usp=sharing>

(Note: If students should follow the problem solving/engineering design process to solve the problem presented to them. Be sure to include all of the components.)

Duration	Activity	Description/Instruction	Product
2	<b>Hook</b>	Why is it important for us to know about covalent bonding Lewis structures and molecular geometry!?	Connection to careers and gain engagement from the students into the subject
5	<b>I Do (demo)</b>	Teacher presents on VSEPR Theory and explains the concept. Slide 37 and 38	Students will learn about VSEPR theory and the different 3D shapes
3	<b>We Do (guided practice)</b>	Teacher builds molecules with the molecular kit and passes them around, letting the students know what is the shape of it.	Students are able to see a model of the 3D shape.

20	<b>We Do (partner or group practice)</b>	Do marshmallow activity for them to visualize the molecular geometry and have hands on learning - need six groups for each one of them to present their molecular geometry they can choose the shape they want to present.	Hands on activity
10	<b>You Do (individual practice)</b>	Have the students present one of shapes of the molecular geometry and answer verbally the following questions: Choose one of the six molecules you did and share: <ul style="list-style-type: none"> <li>● What is its shape?</li> <li>● Bond angle?</li> <li>● Number of bonded atoms?</li> <li>● Number of lone pairs?</li> </ul>	Apply the knowledge
2	<b>Closing</b>	How do you think advancements in our understanding of molecular geometry could impact fields such as drug discovery, materials science, chemical engineering, or environmental research in the future?	Research, could also have them do this at home and do it now for the next day.

**Attending to Equity** - *What strategies will you use to best meet the needs of your students?*

*(UDL: How will you increase engagement and include student voice & choice?)*

Strategy	Explain how the strategy contributes/relates to the lesson/activity
<i>Incorporate culturally relevant teaching</i>	<i>Connection to careers and students are able to use their funds of knowledge to answer how does the concept applies to their lives</i>
<i>Making it a safe place</i>	<i>Students can feel free to share ideas and trial an error (room to learn from mistakes and the power of yet), students are also able to choose the molecule they want to present, and they can talk either from their seats or the front (so that they feel like they have a voice and don't shy away)</i>
<i>Adjusting to the students learning needs</i>	<i>Get students from where they are to allow them to grow, instead of assuming they are supposed to know certain material already</i>

**Connections across the curriculum & to the field of STEM:** - *What cross-curricular skills are being grown or practiced in this lesson? In what ways are you building literacy skills? In what ways will you connect the activity to STEM?*

- Basic math
- Vocabulary words
- Chemical Engineering
- Pharmaceutical/medicine
- Materials science - because the way in which the elements are arranged can impact the way it reacts

My lesson was centered more on the student learning and the critical consciousness. The students were able to connect the subject to careers and students are able to use their funds of knowledge to answer how the concept applies to their lives as they do now and closing activity that involves more research to have critical thinking. Additionally, students can feel free to share ideas and trial an error (room to learn from mistakes and the power of yet), students are also able to choose the molecule they want to present, and they can talk either from their seats or the front

(so that they feel like they have a voice and don't shy away). Allowing the students to participate/present in the class lets them have a voice and empowers them, also a safe environment was fostered by letting them choose their own groups. The students were very excited to present, in the honors class the students decided to present from their chair but in the college classes the students came up to the front and presented their molecule. Also, in the conversations about how this concept applies to their lives most of them knew different careers that related to it and it created a more engaging environment. Throughout my student teaching I saw a big change in the students' participation, students that were usually on their phones now are intrinsically motivated and always want to come up to the board to participate.

## 6. Instructional Materials

### 6.1) Sample lesson Plans

- <https://docs.google.com/document/d/1d8PjssSjz-tl9m9intysotDgouvnrwgNt6mgCOCiRLA/edit?usp=sharing>
- <https://docs.google.com/document/d/1loP6bOf4yKheMVvmlNjmDphb6T5nmFGpLSQ94Cw5KkQ/edit?usp=sharing>

### 6.2) Presentations

#### 6.2.1) Unit 7: Ionic Bonding and Naming

- [Ionic Bonding and Naming 1 - unit7.pptx](#)
- [Ionic Bonding and Naming 2 - unit7.pptx](#)
- [Lab Ionic Bonding and Naming 3 - unit 7.pptx](#)
- [Review Ionic Bonding and Naming 4 - unit 7.pptx](#)
- [Assessment/quiz](#)

#### 6.2.2) Unit 8: Covalent Bonding and Naming

- [Unit 8 - Covalent Bonding & Naming 1.pptx](#)

## References

- 10 Education Policies Parents Need to Know.* (n.d.). Parent Cortical Mass. Retrieved January 29, 2024, from <https://www.parentcorticalmass.com/top-10-education-policies.html>
- Education policy in the United States.* (n.d.). Ballotpedia. Retrieved January 29, 2024, from [https://ballotpedia.org/Education\\_policy\\_in\\_the\\_United\\_States](https://ballotpedia.org/Education_policy_in_the_United_States)
- Klein, A. (2015, April 11). No Child Left Behind: An Overview. *Education Week*. <https://www.edweek.org/policy-politics/no-child-left-behind-an-overview/2015/04>
- Klein, A. (2016, March 31). The Every Student Succeeds Act: An ESSA Overview. *Education Week*. <https://www.edweek.org/policy-politics/the-every-student-succeeds-act-an-essa-overview/2016/03>
- Policy—ED.gov.* (n.d.). Retrieved January 29, 2024, from <https://www2.ed.gov/policy/landing.jhtml?src=ft>
- Student Participation—Massachusetts Comprehensive Assessment System.* (n.d.). Retrieved January 29, 2024, from <https://www.doe.mass.edu/mcas/participation.html?section=gr3-8and10>
- What is No Child Left Behind (NCLB)?* (2019, August 5). Understood. <https://www.understood.org/en/articles/no-child-left-behind-nclb-what-you-need-to-know>
- What is the Every Student Succeeds Act (ESSA)?* (2019, August 5). Understood. <https://www.understood.org/en/articles/every-student-succeeds-act-essa-what-you-need-to-know>