RESEARCH METHODOLOGY: COMMUNITY INPUT REGARDING AIR-QUALITY CURRICULUM FOR RURAL ALASKA

By

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Abstract

During the summer months in rural Alaska, poor air-quality due to wildfire smoke and gravel road dust can have negative impacts on respiratory health, disproportionately affecting Elders and youth who have weakened respiratory systems. After conducting initial research during the summer of 2019, after visiting twenty-nine communities in the Interior and Southcentral regions of Alaska, the research found that more community involvement is needed to bolster engagement in understanding the impacts of air-quality and implementing steps to mitigate those impacts. This research was in response to those findings, targeting schools and the educational system to drive community engagement and interest in air-quality. Qualitative research was conducted in five communities, employing face-to-face interviews and thematic analysis. The results illustrate the complex and unique relationships that communities, schools, and educators have in rural Alaska. The conclusion of this research finds that integrating air-quality as an important curriculum component will take long-term dedication from educators and the communities alike.

About the Researcher

My parents met in Ruby, Alaska, while my mother was a regional vocational teacher. My father lived in a remote cabin trapping during the winter and working on the riverboats in the summer. Ruby is located on the mighty Yukon River, with an approximate population of 200 people. Ruby is not accessible by highway, nor was the remote cabin my father convinced my mother to live in. The cabin was located forty miles upriver from Ruby, where my father had lived for many winters previously.

A couple of years later, we moved to Nenana, Alaska, a slightly larger community, with approximately 400 people, located on the road system. It was in Nenana that I attended public school from preschool to high school graduation. Nenana is demographically approximately about half Indigenous and half non-Indigenous. The Indigenous people from Nenana are Tanana Dené Athabascan. The Nenana Valley is one of the earliest archaeological sites in North America, dating between 11,000 and 12,000 years old.[1]

After moving, my parents purchased a tug and barge company, Demientieff Barge Lines, from a prominent Yukon River family. They renamed the company and operated *Inland Barge Service* for the next two decades. After I graduated from the University of Alaska Fairbanks with my undergraduate degree in Psychology, I spent the next ten years working for and eventually running *Inland Barge Service*. During this time, I worked seasonally, operating the port in Nenana during the summer and traveling to far-flung locations in the winter, many times as a solo traveler.

[1] "Tanana Chiefs Conference - Nenana," TCC ", 2007, https://www.tananachiefs.org/about/communities/nenana/)

During this time, I met and worked with people not only on the Yukon River but also people from around the world. As I worked seasonally, I was able to travel all over the world during the Alaskan winters. I gained knowledge of and access to cultures that were foreign to me, teaching me to sit back and observe to avoid inadvertently putting myself into unfortunate situations. Most of the time I was successful and learned to navigate complex cities and diverse cultures.

As a Rural Development master's student, I have learned from Indigenous perspectives, not only from my professors, but also from my fellow students who have told rich stories of their homes and powerful stories of their lives. These relationships have been invaluable to my learning, impacting my view of the world and my place in it. I was able to further develop relationships in rural Alaska during my 2019 internship with the Institute for Tribal Environmental Professionals which provided me with the opportunity to travel to many rural villages and communities. The pilot data from this internship project then contributed to this research.

This introduction to who I am as a person, and my lived experiences may seem out of place in an academic research paper, jarring to those accustomed to data devoid of a backstory. Shawn Wilson, an Indigenous researcher and scholar, addresses the need for relationality in Indigenous research. He states,

> An Indigenous axiology is built upon the concept of relational accountability. Right or wrong; validity; statistically significant; worthy or unworthy: value judgements lose their meaning. What is more important and meaningful is fulfilling a role and obligations in the research relationship –that is, being accountable to your relations.[2]

[2]Shawn Wilson, *Research Is Ceremony: Indigenous Research Methods* (Vancouver, B.C.: Langara College, 2019), p.77)

You will find this is not a paper full of statistical jargon, nor a conclusive how-to document. Instead, this graduate research project focuses on listening to stories, looking between the lines, and being open to inconclusive findings. Due to this approach, the forthcoming research might read as unstructured and amorphous. I am comfortable with this, I find value in flexible research techniques, in stories. "Storytelling is a practice in Indigenous cultures that sustains communities and validates the experiences and epistemologies of Indigenous peoples. Consequently, story-telling is a central focus of Indigenous epistemologies and research approaches."[3]

The desire to explain myself, to justify my methods, is rooted in my cultural background. I am not Indigenous, and I grew up in a Western-style education system full of importance placed on statistics and quantitative data. This worldview places importance on the individual and their work or success being earned and enjoyed by that individual. Whereas, Indigenous worldviews often focus on the collective good, the individual is part of the whole, not whole on their own. My research has pulled me in a different direction, towards qualitative data, which often answers more than just the specific question the researcher started with, and the "finding" is situated somewhere in the story, which the researcher is left to decipher. I have to admit that conducting this research was immensely enjoyable for me. Traveling to rural communities and talking with the residents was very fulfilling. This was due to the latitude I gave to the conversations. I let them take natural turns and sometimes great divergences.

Although the research felt very natural and worth-while, writing about it, fitting my research and writing it into a Western academic format has been challenging. During this

[3] Judy Iseke, "Indigenous Storytelling as Research," *International Review of Qualitative Research*6, no. 4 (2013): pp. 559-577, https://doi.org/10.1525/irqr.2013.6.4.559)

writing process, I avoided writing because I felt uncomfortable in a new format. My researcher-self is on shaky ground where I must weave opinions together or create a narrative out of my supposition. I have spent a lot of time questioning my contribution to the larger conversations, not only about air-quality but also rural Alaskan living and the daily challenges that are faced while living in the 'bush.' Wilson quotes a friend's statement, "If research doesn't change you as a person, then you aren't doing it right."[4] I hope this discomfort is indeed change and part of the learning process about myself as a researcher and writer.

Path to Research

I have changed research projects multiple times during the two years of studying for my Master of Arts degree in Rural Development at the University of Alaska Fairbanks. I finally decided to pursue the development of air-quality curriculum. I deem it an important aspect of living a healthy life in rural Alaska. Although we often hear of pollution in other parts of the world, wildfire smoke and gravel road dust are two culprits of poor air quality in rural Alaska during the summer months. Presently the emphasis on air-quality and its importance to respiratory health has become extremely pronounced as the world experiences the COVID-19 pandemic. It is becoming evident that compromised respiratory health compounds and complicates recovery from this new virus.

Air-quality and the impacts that it can have on respiratory health has only recently become a concern of mine, and more broadly international policy and decision-makers. As I mentioned before, I worked at Inland Barge Service, which was located on riverfront property in

[4] Shawn Wilson, *Research Is Ceremony: Indigenous Research Methods* (Vancouver, B.C.: Langara College, 2019), p.83)

Nenana, Alaska. We were located on the Tanana River, which is glacier-fed, with a large amount of sediment and silt in the river and subsequently along the banks. I used to spend hot, dry days covered in silt from working outside, loading, and unloading trucks. Wind would blow through the freight yard with visibly noticeable and irritating dust plumes. Cars and semi-trucks would drive down the gravel roads, with clouds of dust behind them. During my ten years of working at that location I never wore a dust mask, and I did not take precautions to protect my lungs and health.

American's have seen photos of devastating fires sweep through California in recent years, destroying homes and livelihoods. Alaskans have also lived through many summers of wildfire smoke. One summer, there was a wildfire within a few miles of my home in Nenana. The smoke was oppressive, with great clouds of it in the near distance, raining down ash and irritating eyes and airways. The summer of 2019 was the most expensive fire season on record[5] due to a record-breaking dry and warm summer.[6] The summer of 2019 was one of the biggest fire seasons on record for Alaska.[7] This wildfire season affected a large portion of the state, especially the Kenai Peninsula, which is one of the most densely populated portions of the state. I witnessed smoke as far north as Deadhorse, which is at the top of Alaska. It is unusual at those

[5] Zaz Hollander, "An Alaska Wildfire Is the Nation's Most Expensive so Far This Season," Anchorage Daily News (Anchorage Daily News, September 19, 2019), https://www.adn.com/alaska-news/2019/09/19/an-alaskan-wildfire-is-the-nations-most-expensive-so-far-this-season/)

[6] Jeff Parrott, "Anchorage's Extra-Warm Summer Is Getting Even Warmer in August," Anchorage Daily News (Anchorage Daily News, August 14, 2019), https://www.adn.com/alaska-news/anchorage/2019/08/13/anchorages-sweltering-summer-is-getting-even-hotter-in-august/)

[7] Yereth Rosen, "Late-Season Fires Flare up in Drought-Stricken Parts of Alaska," Reuters (Thomson Reuters, August 20, 2019), https://www.reuters.com/article/us-alaska-wildfires/late-season-fires-flare-up-in-drought-stricken-parts-of-alaska-idUSKCN1V91Z

latitudes because the northern part of Alaska is devoid of trees to burn. Yet the smoke was so dense that it was still noticeable as it was pushed north by the wind.

Pilot Research

During the summer of 2019, I had the opportunity to work with the Institute of Tribal Environmental Professionals and with Mansel Nelson, who was the Internship Coordinator. Their mission is to "strengthen tribal capacity and sovereignty in environmental and natural resource management through culturally relevant education, research, partnerships, and policy-based services."[8] After my first year of graduate studies, the opportunity to serve rural communities in partnership with ITEP was an ideal fit for me given their mission statement and work for Indigenous people. The ITEP internship also partnered with Dr. Jingqiu Mao of the Chemistry and Biochemistry department at the University of Alaska Fairbanks. Dr. Mao has been studying wildfires for over ten years and he has found that boreal forests in Alaska are poorly studied. In contrast to forest fires in the continental US, boreal forest fires are often ignited by lightening in remote regions and can last from weeks to months. When boreal forests burn, their smoke may have significant adverse effects on human health due to inhalation of the wildfire smoke produced by them.

To address these concerns regarding air quality, together, Dr. Mao and Mansel Nelson developed a plan to install low-cost air monitors throughout Alaska's rural communities with an emphasis on Indigenous communities most historically affected by wildfire activity. I was selected as the intern for the project due to my studies in Rural Development and confidence in

[8] Institute for Tribal Environmental Professionals, "About Us - ITEP: Tribal Environmental Management," About Us - ITEP | Tribal Environmental Management, accessed March 19, 2020, http://www7.nau.edu/itep/main/about/)

my ability to coordinate and travel alone to rural communities. The work of this internship became the pilot research for my graduate project. Thus, began my adventure of traveling to twenty-nine communities (see Table 1) over the course of three and a half months. These communities were selected largely based on historic data of boreal forest wildfire activity.[9] During this time, I drove and flew all over the state of Alaska, installing Purple Air monitors, which use WiFi and a power source to send real-time data to a website, purpleair.com, that is publicly accessible.

Table 1 – Communities visited during pilot research Summer 2019

Allakaket	Mentasta Lake
Arctic Village	Minto
Cantwell	Northway
Chalkyitsik	Seward
Delta Junction	Talkeetna
Denali Park	Tanacross
Eagle Village	Tanana
Fort Yukon	Tetlin
Gakona	Toolik Research Station
Healy	Tyonek
Homer	Venetie
Houston	Whittier
Huslia	Willow
Iguigig	

Dr. Mao and Mansel Nelson embarked on this project to gather air-quality data from rural Alaska areas that did not currently have any air-quality measures in place. To gather baseline data for communities, the focus of the ITEP project was to provide tribes low-cost air-quality

[9] Kevin M. Potter; Barbara LConkling, eds. 2018. Forest health monitoring: national status, trends, and analysis 2017. General Technical Report SRS-233.

monitors. These monitors were selected because the data collected is then sent and captured by a company that displays it online in real-time. All the Purple Air monitors that I installed were displayed on this map and the data was publicly available. Tribes were able to access their data not only in real time, but also as a data set to analyze changes over time. Dr. Mao and his project with the University of Alaska Fairbanks focused on collecting data regarding tracking and monitoring wildfires in rural Alaska.

In coordinating with the rural communities, I was generally successful in the installation of all intended monitors, but there were a couple of locations where the monitors failed due to lack of a reliable power source located on the outside of a building or weak WiFi signals as high speed internet is a rarity in rural Alaska. Due to the fact that I started my internship in May, and all of my travel began at the end of that month, it was not possible to coordinate with the schools to install the monitors on their facilities due to school closures in the summer. Working with the schools would have been advantageous to my internship because schools often have the strongest and most consistent WiFi in rural communities. Instead, I worked with the tribal administrators and primarily used tribal offices at the point of installation which do not always have reliable internet.

Participants from the community who were interested in and learning more about the project were invited to a central location in the community, where I provided fresh donuts and information about the project. Most participants responded positively to the fact that the data collected was public and not just for research purposes without being accessible to those who are being affected, community members. Yet, the reality remains that community members in rural areas do not have reliable access to the internet, thus they would not have reliable access to the data. For example, during the process of data collection in the pilot study, I observed particularly

bad air-quality in the north of Alaska, so I sent an email to one of my contacts inquiring about the wildfire I suspected must be in close proximity. He wrote back to me to ask how bad the air quality was because his internet connection is so slow that it was hard for him to load the Purple Air map at his location. Many of my contacts also had concerns about the amount of data that the air monitors would use as they are often working on the limited capacity for data usage. These limiting factors undermined opportunities for the public to use the air-quality data.

Beyond the fact that broadband service needs to be accessible to rural communities, I began to wonder how I could stimulate more knowledge and usage of the air-quality data by rural residents. This led me to investigate the other options for WiFi within rural communities required to access the air-quality data. I identified two other common locations besides the tribal/community office - the clinics and the schools. After discussing options with clinic workers in the various communities, I found that their networks are password protected with a special layer of security for patient privacy. Although it would be ideal to have the respective community clinics involved later on, currently it is not possible because of the above-mentioned concerns and barriers.

Therefore, the rural schools were deemed an ideal location for additional sensors in the communities that I had already visited in 2019. It was also decided that further interest would also be generated by a second visit to the communities where research had already been conducted, and another air monitor location will be identified and installed to provide additional air-quality data.

Beyond the stated benefits, the purpose of my graduate project is to create a curriculum that will generate interest, knowledge, and conversation regarding the impacts of poor air quality on the health of rural residents.

Limitations of the Study

There are many limitations to this study, some that I can easily recognize, and other limitations that may go unrecognized. First, the research burden that I imposed on the communities, including educators, tribal members, community members, and students, is significant. This burden is borne in "time." They corresponded through emails, gave me rides to and from airports, made sure I was comfortable, shared food with me, spent hours talking with me, and allowed me to talk with the youth of their communities. I am so grateful to the communities of Anaktuvuk Pass, Beaver, Eagle, Tanana, and Venetie for investing in me and my research.

Cost is also a factor. Traveling to these communities is very expensive and would have been cost-prohibitive had I not secured the Fire and Ice Travel Grant from Alaska EPSCoR NSF award #OIA-1757348 and the State of Alaska. At this time, the cost of traveling round trip to each community is as follows: Anaktuvuk Pass $380 roundtrip; Beaver $262 roundtrip; Eagle $340 roundtrip; Tanana $240 roundtrip; and Venetie $320 roundtrip, for a total cost of $1,542. During April, I intended to return to these communities to share my results, including the curriculum toolbox, and to garner feedback, doubling the total cost in airfare. However, I was unable to do this due to concerns around the Covid-19 virus and in order to keep communities safe. It is essential to recognize this expense as not only prohibiting myself as a student from conducting the research, but to also acknowledge the monetary cost of living and traveling in rural Alaska.

Communication was also a challenge. Communities were contacted through email. Often, these emails went unanswered, and it would require sifting through Google searches and past contacts to reach someone who would reply. Once I had secured permission to visit their

communities, I would suggest travel dates and coordinate with my contact. As I was working within a narrow amount of time for conducting my research, often, there would be less than a week lead time before I would travel to each community. This short window of time and planning meant that I was often visiting communities during a lesser opportune time without optimal coordination between schools, tribal entities, and health providers, sometimes conflicting with sports trips or class activities that had a limiting impact on my interaction with students.

It is also necessary to acknowledge the sense of urgency that is instilled in researchers coming from a Western worldview. Research driven timeframes and deadlines may seem arbitrary. The push for timely completion undermines relationship building with communities Scholars Ilarion Merculieff and Libby Roderick, who study Alaska Native cultures and communication within them, emphasize this relationship-building aspect. They write,

> There is a distinctive rhythm to Indigenous discourse. The pace is deliberately slow, and there are lots of pauses and silences. No one interrupts or talks over another. Traditional listening is an active process of consciousness, awareness, and attention that begins with mutual respect for and from each individual in the exchange. Listeners quiet their minds, give the speaker their full attention, listen without agenda, and take in as fully as possible each speaker's unique truth. As each speaker finishes, there is a pause for silence and reflection. The pauses give listeners important time to make meaning out of their observations and experiences. Reflection time helps each individual to be a positive force within the small, interdependent group and also able to think independently when circumstances require it. Competition and domination are minimized.[10]

Without spending a lot of time in communities, I also did not get to interact with students on a long-term basis. This means they did not have the opportunity to think extensively about air-quality and how they would be interested in studying it. Often it can take time for people to think of and formulate questions. As supported by the quote above, often reflection time is

[10] Larry Merculieff and Libby Roderick, *Stop Talking: Indigenous Ways of Teaching and Learning and Difficult Dialogues in Higher Education*(Anchorage, AK: University of Alaska Anchorage, 2013), p.22)

expected before formulating responses. During my research, there was only a small window of time for reflection and it was not conducive to follow up questions or further communication.

Moreover, as I am not an educator myself, finding the language to most effectively communicate with students was also, at times, challenging. I do not have a background in teaching or interacting with younger students. This was challenging when speaking to a group of teenagers. As I progressed through my research communities, I was able to refine and modify how I asked my research questions.

Another limitation of this project is the reality that school funding continues to be reduced. I recognize that a high-cost curriculum is not possible for rural Alaskan schools. When researching and reaching out to the contacts that I developed this summer, I was given a list of existing curriculums to look through to find pieces that I could pull from for my curriculum design. I used this list first to identify lesson plans that are age-appropriate for junior high students. As I am cognizant of the fact that many rural schools do not have a lot of extra funding, I focused on programs that are free or low cost. As most of the communities I visit will already have a Purple Air monitor, this also helps to reduce the cost of implementing my curriculum. By keeping the cost low or free, the curriculum toolbox will have a better chance of being used.

Lastly, a major limitation of this project is that it is unlikely that educators will use the curriculum toolbox. Educators, especially educators in rural communities, have a lot of roles and responsibilities to fill. For example, they are the coaches, ad hoc counselors, sometimes maintenance workers, along with a myriad of other responsibilities. They may not welcome the curriculum toolbox in addition to their existing curriculum. Also, many educators are in rural

communities for a short amount of time, reducing their tolerance for adding additional work to their existing workloads.

Background

Interior Alaska is a vast area, comprised of many small communities and one urban center, Fairbanks. The rural communities in this area are primarily of "Athabascan" communities. Athabascan is a Western word for the Dené people that are from very distinct and different cultures. During my travels to Anaktuvuk Pass, Beaver, Eagle, Tanana, and Venetie, I interacted with people from many different Indigenous backgrounds, including but not limited to: Inupiaq, Gwich'in, Koyukon, and Han. Every community has a complicated history with colonization, each existing in their current, permanent location due to forced settlement. The Indigenous people who live in this area were nomadic, traveling long distances in search of food, traditionally following the seasons and the animals to survive the harsh environment.[11] It was when Alaska was purchased by the United States from Russia that people were required to settle in permanent locations. This was due to the United States mandate to educate children and to establish Western-style schools.[12]

These schools are the epicenters of the communities. As rural communities shrink, it is a common concern that their student count will dip below the State of Alaska's required number of ten students to maintain a school. When schools close in communities, it can often force out people who have school-aged children, further reducing the population in rural Alaska.

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[11] Steve J. Langdon, *The Native People of Alaska*(Anchorage: Alaska, 1993))

[12] Barnhardt, Carol. "A HISTORY OF SCHOOLING FOR ALASKA NATIVE PEOPLE." *Journal of American Indian Education* 40, no. 1 (2001): 1-30. Accessed April 9, 2020. www.jstor.org/stable/24398586.

During the wintertime, schools host most of the entertainment in rural Alaska. They have gym nights so that the community may use the gyms for exercise and socializing. School meal programs are a form of relief for households that might be food insecure due to lack of monetary wealth or the inability to gather traditional subsistence foods. Schools also can provide shelter and safety during times of crisis. A salient example comes from one of the communities I traveled to. Just before my visit, the community had run out of diesel fuel. This was due to the fueling aircraft being grounded while being repaired. It was a worrisome time for residents, but they knew that if the worst came to pass, the school would be able to provide heated shelter if they weren't able to get fuel.

One community told me that they were so concerned about schools in their districts remaining open that they would actively participate in ensuring that the "numbers for the count" would be sufficient to keep all schools open. They actively recruit families with ties to the community to move home, if they needed to secure more students to keep the school doors open.

Schools are one of the strongest indicators, if not the strongest indicator, of the viability of a community. The immense importance placed on them is evident, especially on a long, dark winter evening when the school is the only location with regular activity. From my preliminary pilot research and personal experience, I understand the importance of schools and their strong influence on communities. Because of this, I seek to impact rural communities through the schools via the students, by developing air-quality curriculum.

Methodology

The planned initial phase of my research consisted of sending surveys to rural communities in the Interior region of Alaska. These surveys consisted of four questions –

1) Is there currently an air quality curriculum being taught in your school?
2) Would you like to see air quality curriculum integrated into your school's curriculum?
3) If so, how do you think it would be an effective and interesting way for students to learn about air quality?
4) If you do not think air quality should be included in your school's curriculum, why not?

I sent an introductory letter and requests for survey participation to three different school districts in Alaska and received not one response. Given the lack of response, it is apparent that school districts and/or potential participants did not prioritize filling out the survey over their other responsibilities. However, they were very short and required minimal effort to answer. This is understandable given the multiple responsibilities educators carry and the fact that I could not spend the amount of time necessary with each school district to build trust and relationships necessary to ensure that the surveys would be completed. Moreover, I believe there are additional factors that play into this lack of response, including rural community burden and historical relationships between researchers and Indigenous communities, which I will explain further.

People in rural Alaska are often working in multiple roles within their communities. Given the small populations, community members must have an expansive knowledge of multiple systems and participate in a wide variety of activities to keep their communities functioning. Consider the maintenance person at the rural school fixes the boiler and is also the janitor and lunch cook. The necessity for these multiple responsibilities is often due to part-time employment, leading to the need for more employment and income to help mitigate the high cost of living in rural Alaska. This reality is coupled with the fact that there is often a shortage of

diverse, employable expertise in rural Alaska, thus necessitating the need for people to be versed in more than one employable skill so they can meet community needs. This happens at all levels of community involvement, especially as populations decline in rural Alaska.

In recent history, Indigenous people have seen their cultures researched by predominantly and almost exclusively white, Western researchers. Indigenous Alaskans have not escaped this fact. Universities have often been drivers of this research, engaging in knowledge accumulation without reciprocal relationships with Indigenous communities. Although we are beginning to see a shift in attitudes, research techniques, and knowledge access at a collegiate level, it is slow. This unbalanced relationship creates a burden on Indigenous people who are expected to spend energy helping researchers, yet they rarely are afforded the benefits of the research. As Lee states, "It is difficult to obtain Indigenous research participants in a general sense, due to a long history of cultural appropriation through the research practices of non-Indigenous researchers with little or no resulting benefit experienced by Indigenous peoples or participants."[13]

With no immediate response from my survey and a short amount of time to complete my research, I was changed tactics. I decided to use my contacts and the support of my committee chair, Dr. Jessica Black, to reach communities, directly requesting face-to-face research inquiries. Wilson points out, "This is how Indigenous communities work – a key to being included is not only the work that you have done in the past but how well you have connected with others in the community during the course of your work. Thus, the strength of your bonds

[13] Deborah Lee, "Indigenous Knowledge Organization: A Study of Concepts, Terminology, Structure and (Mostly) Indigenous Voices," *Partnership: The Canadian Journal of Library and Information Practice and Research*6, no. 1 (March 2011), https://doi.org/10.21083/partnership.v6i1.1427, p.9)

or relationships with the community is an equally valued component of your work."[14] As the Interior of Alaska community populations are interwoven with our lives crossing many different paths, with our combined connections secured, I was able to visit with five different communities. These communities include: Tanana, Anaktuvuk Pass, Venetie, Beaver, and Eagle.

Before visiting these communities, I would communicate with my contact and check to make sure that they had everything that they needed. As I had the opportunity to bring materials with me into fly-in only communities. I recognize that living rurally makes it difficult and expensive for people to get supplies. I used this as an opportunity to build or strengthen relationships with my contacts. Although nobody took me up on my offer, community members appreciated the sweets that I brought as a gift.

With the knowledge of the incredible expense of traveling to rural Alaska, during the fall time, I applied for a travel grant through the University of Alaska Fairbanks Established Program to Stimulate Competitive Research (EPSCoR). I was awarded a $3,500 travel grant through the Fire and Ice Project, which is studying climate-driven changes to Alaskan wildfire regimes and coastal ecosystems. This research project would not have been possible without the support of the Alaska EPSCoR NSF award #OIA-1757348 and the state of Alaska.

In most of the communities that I visited, I remained for only the day, flying in during the morning flight service and back to Fairbanks during the evening flight service. There were a couple of locations where I remained overnight, due to limited flight service. Coming from a Western upbringing and perspective, I perceived it to be easier not only on my own life but also

[14] Shawn Wilson, *Research Is Ceremony: Indigenous Research Methods*(Vancouver, B.C.: Langara College, 2019), p.81)

for my community contact if I was to remain for only the day. That way, they would not have to worry about finding a place for me to stay. I felt like my visit should be as unobtrusive as possible.

When I did stay overnight, I attempted to make it as low impact as possible. I would bring my own sleeping materials so that there would be no need to launder bedding. I would also bring my food, although many of the schools fed me lunch. One community member told me, "Shame, you should have come on Wednesday, that is when we have traditional foods day. We have moose soup and fry bread. The Elders come and we enjoy our traditional foods. Today you get grilled cheese and chips." When I brought food packaging into communities, I was careful to also bring it out, and it was my desire to leave minimal trash behind.

Neither one day, nor two days, is long enough to build new relationships and strengthen existing relationships in rural Alaska. Many people in all the communities asked me, "How long you staying?" I, often sheepishly, acknowledged my short visits with apologies and sincere promises to visit in the future. My intent was to return to these communities after defending my project and to present them with my findings and the subsequent curriculum toolbox. Although, in light of current world affairs and the impact that COVID-19 has had internationally, it is not likely that I will be able to fulfill that plan.

Once I arrived in the communities, I often went straight to interviewing various community members, teachers, administrators, and students. My interviews were based on my initial survey questions, but I often let the interviewee take the conversation in the direction that they wanted. My prompts were minimal, and I attempted to follow the flow of conversation rather than following rigid guidelines. This technique aligned with Indigenous research

methodology, which situates the participants' and communities' needs at the center and allows for conversations, stories, and knowledge to be expressed and flow.[15]

The research questions that I asked were –

1) What are junior high students currently learning about air quality in Alaska?
2) Will students benefit from learning about air quality in Alaska?
3) What are effective and interesting ways to provide air quality information and curriculum to students in rural Alaska?

I had the opportunity to talk to a variety of participants in each community. As part of the research I conducted for Mansel Nelson and Dr. Mao, I had many contacts and established relationships with community members from various communities. This allowed me to complete the interviews for my research project for my Masters in Rural Development. Without these community contacts and their assistance and efforts to accommodate me, I would not have been able to gather nearly as much information as I did. It is with great gratitude that I recognize the effort that was made on my behalf including - the rides around town, the time that I was allowed in classrooms to speak to students, the disruption of everyday routines to accommodate my research, the curiosity, enthusiasm by communities for my work, and the genuine kindness extended to me.

The generality of my questions was intentional, and this broad scope invited a range of responses in addition to creating an informal space where a conversation could flow, and a reciprocated interview process ensued. For example, I purposefully created the interview to be open-ended, using a semi-structured technique to allow for storytelling as my primary qualitative

[15] Bagele Chilisa, *Indigenous Research Methodologies*(Thousand Oaks, CA: SAGE Publications, 2012))

research approach. In Research Methods for Community Change, Stoeker states, "Qualitative research has typically involved interviews or document research or observation that the researcher then interprets rather than counts."[16] Qualitative research can be further described as "multimethod in focus, involving an interpretive, naturalistic approach to its subject matter."[17] This natural and interpretive method lends itself to conversational research, often diverging from the specific topic, but allowing for the discovery of the possible complexities of the situation.

Interviews were conducted in a range of settings and interactive combinations. I conducted interviews in classrooms, on informal tours of the communities, in people's homes, and at tribal offices. Often, these interviews were conducted one on one with adult community members or educators. These interviews were held in settings that were most comfortable for interviewees while still adhering to confidentiality.

Informative feedback garnered from students took on more talking circles or focus group methodology, which took place exclusively in classrooms or larger school spaces (e.g., gym), modeling a school assembly style. I did not interact privately with students, as this would have required a more stringent research process and protocol and time did not allow for that. Although the intended focus of my research was on junior high aged students, I talked to students of all ages. The upper level elementary students were more interactive and inquisitive in their responses to my questions.

I also made an effort in every community to talk to the IGAP (Indian Environmental General Assistance Program) representative, who worked for their respective tribe, in addition to

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[16] Randy Stoecker, *Research Methods for Community Change: a Project-Based Approach*(Los Angeles, CA: Sage, 2013), p.6)

[17] Norman K. Denzin and Yvonna S. Lincoln, *Handbook of Qualitative Research ; Edited by Norman K. Denzin; Yvona S. Lincoln*(Thousand Oaks: Sage, 1994))

tribal leaders. It is important to understand each tribe's environmental goals and where the focus of the upcoming efforts lay. With limited resources and human resources, a realistic focus on attainable goals is mandatory. By including the community members in the research, my initial and broader goal of spreading the awareness of air quality in rural Alaska is met. Tribal leaders tend to have strong connections to the schools as small communities are interwoven. Seeking a diversity of voices strengthened and enriched my research.

As I talked with people, I kept handwritten notes, transcribing them onto my computer later. I considered using a voice recorder, but after a fumbling attempt, I found it was easier for both my interviewees and myself if I just kept notes. All interviewees were assured that there would be no identifying details and that they would not be directly quoted. This stipulation made it easier for people to speak freely, and at times very passionately about the challenges that educators and communities face in rural Alaska. These conversations sometimes lasted more than a couple of hours, with topics ranging from rural shipping timeframes to the migratory patterns of animals to strategies for educator retention.

I decided not to conduct follow up questioning due to the recognition of the workload of all the people I talked to. As I have already been granted the resource of their time, I will only ask for more once I travel back to their communities with my air quality curriculum toolbox. Reciprocity is important, and as I have failed in my research timeframe to invest the time to properly build relationships, this return of knowledge is important to me. The curriculum toolbox that I create will be a living document, subject to change and modification. Once I deliver it, I will ask community members and educators to submit their ideas and suggestions if they are interested in doing so.

Data Analysis and Interpretation

As my interview style was very flexible and often led to multiple topics not relating to the air-quality curriculum, I used narrative analysis to analyze the notes from my interviews. As part of this method, I gathered stories, then analyzed the interviewees' stories for meaning and insights.[18] Then I compared and contrasted these stories to build connections that lead to the interpretation of the research. This type of analysis recognizes, as do I, that no one community member is able to speak for the whole community, much less for a whole region. A large part of my research was talking to everyone in the community that I was able to, not just my targeted demographic of students and educators. This experience gave me a clearer picture of the challenges that communities are facing and their need for air quality curriculum.

By analyzing my interviews after each community visit and reflecting on the information that I learned, it helped me to be better prepared in each subsequent community visit. I then comparted interviews in context to one another and sought the thematic threads across them. By reviewing and comparing my interviews throughout the research, I was able to modify my questions and interview style as I progressed through my work.

Findings

During my research, I traveled to Anaktuvuk Pass, Beaver, Eagle, Tanana, and Venetie between February 10th – March 10th. I had previously traveled to three of these communities during the summer of 2019 while working on my internship and I visited two communities for the first time during the course of my graduate research project. In all of these communities, I

[18] Luc Herman and Bart Vervaeck, *Handbook of Narrative Analysis*(Lincoln: UNP - Nebraska, 2019))

spoke directly with students, educators, and community members. Some of the people I spoke with were familiar with my research topic, but the vast majority were not.

While I made great attempts to engage and connect with students on the research topic, the actual level of student engagement with my research topic and subsequent questions was quite low. All the students respectfully listened to my presentation yet did not have many questions for me on the topic. A few questions that stood out were as follows:

1) Are there bugs in the air? – 3rd – 5th grader
2) Is burning trash unhealthy if you breathe it? – High School
3) How long does it take lungs to heal? – Junior High

I made sure that I was available at the school after my talks so that students could come to me and ask me questions that maybe they did not want to ask in front of a group, but I did not have a single student approach me with private questions.

In every interaction with students, I inquired as to the type of learning activities they enjoyed. The vast majority of students responded positively to learning about air quality through scientific experiments. A few of them were interested in talking with Elders about the air quality conditions of the past. Only a couple of students were interested in using the Purple Air website data to compare different regions of the world. One student asked if there was a way to make a math experiment for air quality.

In general, student enthusiasm regarding this project was gauged to be very low when asked about including air-quality information into their current curriculum. This response could be due to many factors, including but not limited to:

- Researcher credibility: Students are probably exhausted by so many people coming in and out of their communities. Researchers expect information from them and take their

time without providing feedback or results to them. This visit was the first-time students met me, and we did not have a chance to build relationships. Although in one of the communities that I stayed in overnight, one of the students brought me a painting that she had created for me at home.

- Interest in topic: For the students this was the first-time information on air quality had been presented to them. As I did not bring visual or interactive props besides the actual Purple Air monitors, this was a rather unengaging way to present information for all age groups, not just students. As I have minimal experience as an educator, I did not know the best way to make my presentations interactive and exciting. In the future, I will use my research findings to find ways to engage the students rather than expecting them to do that work. This encounter was a failing on my part as a researcher and one that could be remedied by performing a simple experiment or introducing visuals into my presentation.
- Context: Many people do not realize the implications of air-quality on their respiratory health until they are forced to deal with it. The information about air-quality may not feel important or even necessary until bad air-quality impacts their lives. Many of the students told me that they did not think about air-quality nor was it important. However, when I asked them about their Elders and if they might have problems with air-quality, the students could identify with that, and it resonated with them. In the future, having another person with me, especially someone from their community whom they have a relationship with who would talk about the impacts of bad air-quality, would give my research more credibility and context.

With the above factors identified, I understand that day trips to a community do not allow for trust and credibility to be established. Students have complex relationships with education and

also their educators. Student engagement is often impacted by factors that I, as a short time visitor, would not understand.

I was able to distribute new Purple Air monitors to two of the communities in my study, two already had existing monitors, and one community will hopefully get one during the summer of 2020. Having the Purple Air monitors in the classrooms helped generate student interest and also gave me a platform to talk about the research in a way that piqued students' interests. I hope that the installation of the monitors by community members or educators will be a collaborative process with the students, engaging them in the set-up and creating of ownership and interest in the project and its sustainability.

Rural Alaskan communities have a high turnover rate of educators. During my research interviews, I talked to educators who had been in the school for only a couple of months. Others had been working within their school for up to seven years. There were only a few educators who I interacted with that had been raised locally. Relationships within communities, in general, are complex and not easily understood by outsiders.

One of the Principal Teachers that I spoke with talked at length about their efforts to bring teachers into the community weeks before school starts. This process is an effort to mitigate the 'unknown' factor that many communities experience with new educators. By bringing the teachers in weeks before school starts, the community may interact with them and the educators with the community. This way, educators may have a chance of understanding the community and its dynamics before they begin instruction. Bringing educators in early provides an opportunity to expose the educators to local customs and ways of being. It is also an opportunity to introduce educators to community members before their children are sent to school.

Principal Teachers (PTs) occupy a complicated space with responsibilities not only to the community but also to the educators they oversee. PTs are responsible for not only educating students, which is their primary job, but also attending to the school's daily workings in an administrative role. This position can often be unbalanced, with the PT spending more time on administration than on teaching. This relationship may leave students without a teacher who is actively engaging them in lessons. One criticism that I heard of this system is that students will be left alone with 'worksheet after worksheet.' This learning style may be acceptable for a few students, but most Indigenous learning comes from observation, attempting, learning from experiences. "Their traditional education processes were carefully constructed around observing natural processes, adapting modes of survival, obtaining sustenance from the plant and animal world, and using natural materials to make their tools and implements."[19] For them, self-guided worksheets are not conducive to learning.

Common themes that I found in my research are as follows:

- Infrastructure: Each community expressed frustration with the availability and reliability of the internet connection. Often modern lesson plans and ideas will call for the use of online materials, yet students do not have access to high-speed internet. Every community spoke of the disadvantage of not having access to adequate internet. This not only impacted them as educators but it also personally impacted their happiness. Many teachers who relocate to teach in rural Alaska are used to the convenience of high speed, reliable WiFi, and the internet. They use the internet as a resource tool for teaching and lesson planning. Also, once they

[19] Ray Barnhardt and A. Oscar Kawagley, *Alaska Native Education: Views from Within*(Fairbanks, AK: Alaska Native Knowledge Network, Center for Cross-Cultural Studies, University of Alaska Fairbanks, 2010))

move to rural Alaska, their feelings of isolation may be compounded when they cannot easily contact friends and family back home. One teacher cited this as the primary reason why educator leave rural Alaska after a short time.

- Quality educator acquisition and retention: I was also informed, on more than one occasion, that finding teachers is hard in rural Alaska. Often educators who are unqualified, unfit, or have been dismissed from other regions will gain employment in rural Alaska. I heard stories of educators who had mental health disturbances that impacted classrooms, substance abuse issues, and/or others who physically disciplined students and who remained to teach while school districts struggled to fill positions. Alaska pays teachers at a much higher rate than the national average and offers a "generous" health care plan. At first glance this may appear to be an incentive that would work to drive competition for highly qualified educators. In my interviews, people shared their opinion that this health care incentive attracts educators that may have existing health problems. These existing health problems may negatively impact their work as educators especially if they need special medications or regular check-ups which takes them out of the community. Medical care is often limited in rural communities with trips into 'town' to see the doctor being time-consuming and costly.
- Community and school support: The need for more teacher aides and support was also mentioned in multiple communities. When educators need to travel or take a portion of students on trips for either sports or academic travels, their workload is not easy for other educators to absorb. This can put heavy strain on the educators and students left behind. By investing in more aides not only does it provide

more employment and distributing money more equitably into the limited economies in rural Alaska, but also helps to fill the gap when classroom teachers are traveling. With more members of the community employed by the schools, it increases engagement with the community and strengthens bonds of ownership. It can also help to lessen the workload and time commitment of educators. This support for educators could positively impact teacher retention.

- Funding sources: The retention of educators has broad impacts that directly provide for ties with the students and strengthen the community through longevity. Grants and outside funding sources will be more stable as educators become familiar with opportunities, growing and nurturing them. Once teachers leave districts, often the programs that they have started, or funding they have secured, will disappear with them. One educator informed me that although they recently enjoyed positive media coverage on a program that they are participating in, that educator has been sending press releases on a monthly basis to the regional newspaper, the Fairbanks News-Miner. They believe that this lack of printing positive press about rural schools is intentional. Their theory is that it is much more palatable to starve rural communities and schools of funding if people in urban areas are exclusively exposed to bad news about rural schools.
- Historical impacts: These relationships between educators, students, and their communities are complex and run deep. For example, in the past, Alaskan Native children were forcibly sent to boarding schools far from home. They experienced all types of abuse for a multitude of reasons, including for speaking their language, and yet attempts at wiping out Alaska Native culture and its current-day

impacts were rarely touched upon when speaking to educators and community members. The impacts of this colonial history and the resulting trauma that ensued are prevalent today and yet rarely ever referenced, let alone taught in public schools. Another educator told me that the loss of language in their area is inevitable and that it has been happening for all of human history and that evolution means that weaker cultures will die out and be absorbed by dominant cultures. This person then abruptly ended the conversation when I asked them about the importance of preserving worldview and traditions that have lasted for thousands of years. This type of rhetoric is painful for students and community members, embedding in their psyche feelings of a lack of self-worth and distrust of outsiders who may come bearing these same ugly assumptions.

Conclusion

Rural Alaskan schools are often the epicenters of activity in their communities, which places great importance on keeping schools open and operating in rural Alaska. This can often be a challenge due to many factors including but not limited to the retention of educators as well as the quality of educators. Educators are given immense responsibilities. Many of the educators that I spoke with told me that teaching in rural Alaska was the hardest work they have ever done, but also the most rewarding. Retaining quality educators is a challenge in many rural communities due to lack of WiFi access, poor hiring practices, lack of educator orientation and understanding of living in rural Alaska, and many other factors.

Without long-term quality educators, it is hard for students to develop deep and meaningful relationships with educators that last throughout their lives. Short-term relationship

can negatively impact any student's zest for learning within the school system. This negative impact is a systemic problem that, impacts my research immensely. To illustrate, imagine that an educator decides to use my air quality curriculum toolbox. This educator might find that using the experiments listed is an effective way to teach not only about air quality but also about how to conduct simple research methods. The next year that educator moves on to another school or out of state, leaving the curriculum toolbox filed away for the next educator. That new educator simply does not find or does not use the curriculum toolbox, leaving it to languish in a filing cabinet.

Without the engagement of educators, I cannot spread information about air-quality and its importance on respiratory health. Without their investment, this curriculum toolbox will not be of any use to rural Alaskan communities. By asking educators to take on yet another teaching responsibility is audacious. They are often already pulled in many directions and partaking in balancing acts between teaching multiple grades and meeting community responsibilities. Educators are also limited in their time to teach creatively due to the curriculum that they are often mandated to teach and the testing that students are required to pass.

The lack of response I had from students spoke volumes. Presently, air-quality is not a concern to students in rural Alaska, with many students telling me that even on the smokiest days, it does not impact their breathing. They can identify that other people have issues with air quality such as Elders but they do not self-identify as being harmed by poor air-quality. The likelihood that this air-quality curriculum toolbox, in its present form, will not impact many students or, in turn, their communities is quite high. The curriculum must be contextualized and brought to life through students' everyday learning styles within the contexts of their cultures and communities. It will require a substantial commitment and investment beyond the scope of

this master's project but worth investing in in the long-term to protect the health of rural Alaskans.

Current events

We are currently experiencing the COVID-19 pandemic, witnessing it spread across the globe with alarming speed. Scientists and medical professionals have confirmed that the virus may be transmitted through the air and on surfaces. This virus is also known to attack and impair the respiratory system aggressively. This leaves Elders and people with weakened respiratory systems medically vulnerable to the virus. The importance of good respiratory health and wellbeing has become even more of an urgent matter of life and death.

As the world's population struggles with containing this virus and saving human life, it is important to also push for more public awareness and knowledge of the toll that bad air-quality can have on respiratory health. In light of this health crisis, I will also distribute my curriculum toolbox to any interested clinics and healthcare providers that respond to my future outreach. These lesson plans and ideas may be useful for health care providers to educate their communities and keep their residents safe.

New research has been released indicating that air pollution is linked with higher death COVID-19 death rates. Initial research found that a "small increase in long-term exposure to PM2.5 leads to a large increase in the COVID-19 death rate".[20] The study indicates that regions with higher air pollution levels have higher levels of hospitalizations and deaths when impacted by the COVID-19 spread. The importance of air-quality on human health and wellbeing is

[20] "Air Pollution Linked with Higher COVID-19 Death Rates," News, April 7, 2020, https://www.hsph.harvard.edu/news/hsph-in-the-news/air-pollution-linked-with-higher-covid-19-death-rates/)

highlighted by this global pandemic, impacting the global conversation. This curriculum toolbox will be distributed to the clinics in the communities. Medical professionals will know which community members suffer from respiratory diseases and who might want more information about air-quality.

Next Steps

I initially planned to distribute of the air-quality curriculum toolbox in-person, but as shelter-in-place (quarantine) timelines are indeterminate, the alternative method will be remote distribution. There is great importance on relational accountability in Indigenous knowledge[21], and in an effort to build on the relationships with my contacts in Rural Alaska, I will be calling and emailing each community that participated in this research to distribute the curriculum toolbox. I will also offer to present the findings of my research to each community via a distance platform such as Zoom or other online meeting space. It is imperative to recognize and respect the relationships that we have built and the relational responsibility that I have to the communities that have assisted me in this research.

I also will be sending the curriculum toolbox to the twenty-nine community contacts I made during my summer 2019 pilot research. Those communities spurred me into this work and spreading the knowledge of the curriculum toolbox is essential to its effectiveness. ITEP coordinator Mansel Nelson has requested a copy of the curriculum toolbox. Given that ITEP is a national program, this curriculum could be circulated among tribes nationally.

[21] Shawn Wilson, *Research Is Ceremony: Indigenous Research Methods*(Vancouver, B.C.: Langara College, 2019

Without a website platform it will be challenging to make this curriculum toolbox a 'living document' subject to edits and additions by the educators, health care professionals, and other users. I will be investigating partnering with UAF and ITEP to host the curriculum on an online platform. If I am unsuccessful in creating a partnership with either entity, I will host a public Google document, the information about how to access it, and the curriculum toolbox. It is my vision that the air-quality curriculum toolbox will invite collaboration and modification among users. I would like for it to be a living, breathing document. It is also my hope that this document will be sustainable beyond the life of this project and beyond my involvement as the researcher. It is my hope that the curriculum toolbox will continue to grow and evolve on its own and through the involvement of communities and educators. Through this connection and collaboration, relationships between educators, health professionals, and community members invite the opportunity to be strengthened and exercised.

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AIR-QUALITY CURRICULUM TOOLBOX FOR RURAL ALASKA

By

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A Project Submitted in Partial Fulfillment of the Requirements

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In

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Air Quality Curriculum Toolbox for Rural Alaska

Introduction

The following document was developed and created during the Spring of 2020 to fulfill the University of Alaska's Rural Development master's project requirements. The intention of this curriculum toolbox is to provide educators in rural Alaska with free or low-cost ideas and resources to introduce air-quality and its implications to Junior High students. Many of the communities that I visited during the course of my research expressed interest in curriculum to address air-quality. Many of these resources and ideas identified and articulated as part of this toolbox may be modified to serve other age groups.

This curriculum toolbox is designed to be a living document. Modifications by educators, scientists, and interested community members alike are welcome to contribute.

Information about both indoor and outdoor air-quality are of high priority in Alaska. Wildfire smoke and dust particulates are the most prominent factors creating poor air-quality in rural Alaska. The American Lung Association "State of the Air" 2019 found that Alaska has some of the worst air quality in the nation (https://www.lung.org/media/press-releases/sota-2019-alaska). In order to get students interested in learning about air-quality and pollution I propose using hands-on learning objectives where students can visualize the experimental outcomes. Specifically, I propose using the Sensing Air Pollution and Pollution Patrol curriculums. Simple scientific experiments generated the most interest from students in the five rural Alaskan communities where I conducted interviews. Students will find it much more interesting when they are engaged with hands-on activities and where they monitor and consider air pollution on a regional or global scale.

The following assessments of air quality curriculum may be used and modified by classroom teachers in rural Alaska to teach about air quality and its diverse impacts. As part of my overall Masters in Rural Development research project I interviewed participants regarding the importance of integrating air quality curriculum in their schools and/or communities. I also researched all available air-quality curriculum appropriate for junior-high level students. I used the following criteria for evaluating the air-quality curriculum and its relevance to rural Alaska were curriculum(s): it would pique interest; it would allow for hands on activities; it is culturally relevant; and /or it is cost effective.

Experiments

- **Village Green Project** (https://www.epa.gov/air-research/village-green-project)

The Village Green Project is focused on bringing air quality data in real time to community members and fostering conversations about the effects of air quality. They state that lower cost air monitoring technologies can allow researchers and citizens to monitor local air quality to understand how air pollution varies from place to place. This project involves building specific stations with operations and maintenance manuals online. Building and maintaining an air-quality station as a community could foster and strengthen collaborative ties between the school, educators, and community members.

The website also contains a game that can be created at the school called the Generate Game. This is a tool that is used to teach the costs and benefits of the energy choices we make. It is an interactive way for students to learn about what energy choices mean for the climate, air, water, and overall environmental quality.

- **Will the Air be Clean Enough to Breathe?**
  (https://authoring.concord.org/sequences/389/activities/7674/5b847a32-7f7b-452d-9451-bfdf2ba7e9a8)

This is a program broken up into six different modules: air quality, measuring air quality, movement of pollutants, visible and invisible pollutants, pollutants making more pollutants, and preventing bad air-days. These modules are projected to take about four hours to complete in total, thus they offer learning activities that are relatively manageable to implement, in terms of time and resources. These factors are important as teachers in rural Alaska are already overcommitted in terms of teaching and extra-curricular activities. Of these six modules, it was assessed that the movement of pollutants module would be particularly useful for students in understanding not only local issues with air quality but also on a global scale. For example, students that were interviewed in the majority of communities, were concerned with the air pollution from burning at the trash dump. By learning and understanding the movement of pollutants students would be able better understand the transmission of particulates through the air. The preventing bad air-days module is also useful and relevant to rural Alaska communities as it specifically addresses thermal inversions, which are common in Alaskan communities due to geographic conditions. This module is particularly useful given the climate we have in Alaska due to our extreme cold temperatures which causes polluted air to get trapped at low altitudes, exacerbating poor air quality.

- **I Breathe WHAT?**

  (https://www.teachengineering.org/activities/view/cub_enveng_lesson07_activity1)

This is a STEM curriculum that uses a short video to describe the pollutants in the air. The lesson goes on to have students capture and examine air particles to gain an appreciation of how much dust, pollen, and other particulate matter is present in the air around them. To conduct this research, "Pollution detectors" are created and distributed at different locations, these locations can be determined by the educator. They can be placed at various locations around the school and also in the community at large. Then students may examine and describe the particulates to understand 1) what they are; 2) their health impacts; and 3) why measuring them is important. Not only is this curriculum interactive, but it is relevant to students in rural Alaska, as most rural communities have gravel roads with high particulate matter.

- **Sensing Air Pollution**

  (https://www.teachengineering.org/activities/view/cub_air_lesson09_activity3)

This is another hands-on activity that is offered by STEM. The intention of this lesson plan is for students to learn about electricity and air pollution. As part of the curriculum, the students will build devices to measure volatile organic compounds (VOC), which are solvents and chemicals such as perfumes, glues, air fresheners, and second-hand smoke. Students will then evaluate the impact of various indoor air pollutants in the air and hypothesize about their health impacts. This lesson's learning objective is for students to recognize that everyday products emit pollution and can have negative effects on human health. This information is useful because students can learn and go home and share with their family and larger community. Again, this is

relevant to rural Alaska as there is a lot of dust in the summer as well as wildfire smoke, both negatively impact air-quality.

- **Pollution Patrol** (https://tryengineering.org/teacher/pollution-patrol/)

This lesson has students use everyday materials found in the classroom to build outdoor air pollution detectors. They then test their devices by capturing outdoor particulate pollutants. They do so by placing the devices in various locations determined by the educator and students. This content is created by TRYEngineering and provides a full lesson plan and student worksheets. The questions asked in the worksheets direct the students to examine their custom designs and how they might possibly have changed their designs, in turn stimulating collaboration between the teams to decide what methods worked best. The collaborative teamwork approach of this assignment can be beneficial for students, especially in rural areas where class sizes are composed of mixed ages, are relatively small, and also where intergenerational learning processes are most beneficial. Also, concluding with a question about what the students think can be done to reduce particulate pollution, has the potential to increase collaboration and interest in the topic.

Interviews/Writing Prompts – Interviews and writing assignments may help bring curriculum to life for students. These prompts may be used as a writing assignment exercise, not only building on the writing skills the students are presently learning, but also by personalizing the information. Integrating air pollutant curriculum into the classroom or learning experience in this manner simultaneously teaches the students about research methods, journalism, and

communication skills. Educators should modify the following prompts/curriculum ideas to align with their respective teaching approaches as well as their individual teaching outcomes.

- **Elders and local knowledge** – The following prompts are useful for students to learn more about their regions. Interviewing Elders and community members can be a wonderful way for students and the community to work together and build knowledge and support systems around air pollutant curriculum and what can be done to mitigate air pollutants. Interviewing Elders has the potential to evoke memories Elders might have about how air pollutants have impacted their communities in the past (e.g., flu epidemic) and to facilitate sharing with the students their community's history. This exercise also helps to bring the community and school closer together, something that is needed in many rural communities, where the teachers are often from out of state and have very little interaction with the community. During the course of research for this project, many students expressed interest interviewing Elders and learning more about the air-quality impacts in their regions.

- **Worldwide knowledge** – During the course of this research project, some students who currently had a Purple Air monitor installed in their community, expressed strong interest in using Purpleair.com to compare and contrast worldwide air-quality data with their own community's air quality. After viewing the real-time air quality map that is provided on their website, there was a lot of interest generated among the students, especially when viewing countries that suffer from poor air-quality. A writing assignment focusing students on looking at data from certain regions and exploring, through online research,

the causes of poor air-quality may be coupled with learning about social, geographical, and/or historical themes.

- **Air Pollution: What is the solution?** (http://ciese.org/curriculum/airproj/)

This is a program for grades 6-12 that focuses on outdoor pollution by using real time data. The real time data is collected via the AIRNow website but is interchangeable with Purpleair.com. The learning objectives of this existing curriculum include:

1. Describing what air pollutants are, when and how outdoor pollution is formed, and what the health effects are from breathing polluted air.
2. Reading the Environmental Protection Agency's Air Quality Index (AQI) chart, record weather data, and determining the presence of air pollutants.
3. Creating graphs to help visualize or recognize trends.
4. Predicting when ground level ozone may occur.
5. Using knowledge gained to create awareness about air pollution and the associated health benefits.

This curriculum is especially useful for teaching students how to research air pollution globally and then connecting what they learn to everyday life. This curriculum is especially relevant given the global COVID-19 outbreak and teaching students how important air quality, or in the case of this curriculum, air pollutants are to our everyday lives.

A Note from the Researcher: During the writing of this curriculum we are in the midst of a global pandemic caused by the coronavirus. Currently the American population is attempting 'social distancing' and students of all ages are not participating in regular face-to-face classroom

time. This is a particularly stressful time for everyone, across the globe, as we navigate our current situation and the implications of poor air-quality, contaminated with viruses. This requires that we all collectively mitigate, plan and imagine the world and changes to come. The importance of good air-quality and respiratory health is of particular importance during this pandemic. This is due to COVID-19 having a disproportionately lethal impact on people with weakened respiratory systems. As our economic activities around the world slow down and major pollutants such as air travel and manufacturing are severely diminished, this impact will be well researched and documented.

This tragic time may reveal the importance of air-quality as a lesson in itself.