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## INVESTIGATING ENVIRONMENTAL JUSTICE EDUCATION IN RURAL, TITLE 1 STEM CLASSROOMS

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INVESTIGATING ENVIRONMENTAL JUSTICE EDUCATION IN RURAL TITLE 1 STEM  
CLASSROOMS

by

Luis Prado

B.S., Southern Illinois University, 2020

A Research Paper  
Submitted in Partial Fulfillment of the Requirements for the  
Master of Science

Department of Earth Systems and Sustainability  
in the Graduate School  
Southern Illinois University Carbondale  
May 2022

**RESEARCH PAPER APPROVAL**

INVESTIGATING ENVIRONMENTAL JUSTICE EDUCATION IN RURAL, TITLE 1 STEM  
CLASSROOMS

by

Luis Prado

A Research Paper Submitted in Partial

Fulfillment of the Requirements

for the Degree of

Master of Science

in the field of Geography and Environmental Resources

Approved by:

Dr. Leslie Duram

Graduate School  
Southern Illinois University Carbondale  
February 23, 2022

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## CHAPTER 1

### INTRODUCTION

Environmental Justice issues are present across the United States and the world. As defined by the United States Environmental Protection Agency (EPA), Environmental Justice (EJ) is “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies,” and calls to correct the disproportionate effect of environmental burdens on low-income populations and people of color (POC) (EPA 2021).

Examples of these communities, disproportionately affected by EJ issues, can be seen in Southern Illinois. Through a partnership with the *SIU River Region Environmental Sustainability: Noyce Master Teaching Fellowship Program*, this project provided the opportunity to work directly with seven 3-12 grade STEM (Science, Technology, Engineering, and Mathematics) instructors, each from different Title 1 school systems in Southern Illinois. Title 1 schools are defined by the United States Department of Education as having at least 40% of their students belonging to low income households (Illinois Board of Education 2021). The National Science Foundation (NSF) funded this project and works to empower the participating Master Teaching Fellows (MTFs) through a 5-year program of “science, pedagogy, and leadership coursework, research experiences, and professional communication and leadership development” (SIU 2020).

Partnered with these MTFs, this study was provided direct access to several rural, low-income communities in Southern Illinois and a chance to team up with STEM educators who teach children from ages 8-18, providing an unprecedented chance to study EJ education in rural, Title 1 STEM classrooms.

Purpose Statement:

This research paper explores an area at the cross-section of the characteristics held by the MTF program: EJ, STEM, and Title 1 school systems. The focus of this research paper is to describe the classroom inclusion of EJ education from the perspective of the seven MTF instructors who participated on this project.

Research Questions:

1. To what extent was EJ content covered in MTF classrooms before this research project?
2. What are the perceived impacts of an EJ curriculum intervention as observed by MTFs?
3. What are the perceptions and opinions of MTFs on the teaching of EJ before and after a classroom lesson?
4. Based on their experience, what improvements would the MTFs recommend to better facilitate an EJ curriculum intervention?

## CHAPTER 2

### LITERATURE REVIEW

#### **Environmental Education**

Environmental education aims to instruct and empower individuals in concepts and issues of the environment. Students of environmental education are often inspired with a greater sense of accountability and call to action on behalf of the environment, prompting a more environmentally conscious and responsible citizenry (Stapp 1969; Hungerford et al. 1980; Howe and Disinger 1991; Hungerford and Volk 1990). While today the EPA defines environmental education as “process that allows individuals to explore environmental issues, engage in problem solving, and take action to improve the environment”, the first goals of environmental education were defined by the 1978 Tbilisi Declaration (EPA 2021). This declaration displayed the five main objectives of environmental education (“awareness, knowledge, attitudes, skills, and participation”), and the field has been centered upon the expansion and instilment of environmental mindfulness and environmental problem-solving across global populations (UNESCO 1978; Athman and Monroe 2001).

Environmental education programs have taken shape in a diverse array of forms. The field is constructed from a great variety of subjects, including science, social studies, mathematics, and philosophy (Carter and Simmons 2010). The foundations of environmental education can be found in the general studies of nature, outdoor education programs, and programs of conservation education, while intimately tied to environmental science (Archie 2003; Carter 2010). Environmental education’s relationship to science, in particular, has been remarked since its introduction into the curriculum of schools across the United Kingdom (Wheeler 1975). Over time, the field has been adapted into new iterations, adjusting to modern



standards, practices, and findings of research. Environmental education has continued to grow rapidly, in several manners, for at least the last three decades (Ardoin et al. 2013; Rickinson 2001; Stevenson et al. 2013).

### **Environmental Education and STEM**

With a growing global awareness of contemporary ecological issues, scholars have highlighted the value of environmental literacy and its effects on individuals' sense of concern for the earth (Sümen and Çalisici 2015; Roth 1992; Scholz and Binder 2011; Teksöz et al. 2010). While definitions of environmental literacy are plentiful and well debated, Scholz and Binder (2011: 13) define environmental literacy as “the capacity to perceive, appropriately interpret, and value the specific state, dynamics, and potential of environmental systems as well as to take appropriate action to maintain, restore, or improve these states” (McBride et al. 2013; Scholz and Binder 2011). Environmental literacy, then, is a result of environmental education (Roth 1992; Ardoin et al. 2020). Numerous studies indicate that general knowledge and overall relationships of students and teachers towards environmental issues are not strong enough and that a potential bridge for environmental literacy to be further introduced into public education is the field of science, technology, engineering, and mathematics or STEM (Sümen and Çalisici 2015; Atasoy and Erturk 2008; Ernst and Theimer 2011; Kaya and Gundogdu 2007; Lieflander et al. 2013; Teksöz et al. 2010).

STEM education and STEM literacy are aimed toward the instruction of individuals to cultivate greater understandings of STEM disciplines, as well as skills in problem identification, problem-solving, and innovation, particularly through scientific methods (Helvacı and Helvacı 2019; Bybee 2010; Bybee 2011; Balka 2001; Sümen and Çalisici 2015; Bybee 2013). STEM's interdisciplinary nature allows for its curriculum to be integrated across disciplines, inspiring

skills of innovation and well-rounded approaches to problem-solving (Corlu et al. 2014; Pitt 2009; Jacobs 1989). STEM, being adaptive and familiar to interdisciplinarity, has evolved to adopt environmental education as humanity faces contemporary environmental issues, forming the lesser-known but growing field of E-STEM, uniting environmental education with the field of STEM (Helvaci and Helvaci 2019; Fraser et al. 2013). Additionally, Nguyen et al. (2020) has identified that many STEM practices can be easily related to issues in sustainability. One example is the ability to draw upon real-world applications of the United Nation's sustainable development goals, as many of these goals maintain incredible complexity and the necessary utilization of a variety of disciplines to accomplish such difficult tasks. Although the newly regarded field of E-STEM, i.e., teaching STEM via a focus on environmental education, appears promising, and there exists great potential for concepts of sustainability to be taught practically through STEM, it is clear that the integration of environmental education into STEM teaching and learning can still be expanded upon.

### **Environmental Justice and Education**

The field of environmental justice studies emerged after national attention was drawn to Warren County, North Carolina in 1982, as civil rights activists organized to restrict the state from polluting a highly populated African American county with millions of pounds of contaminated soil (Mohai et al. 2009). While public awareness concerning environmental hazards grew during the 1970s, with landmark events such as the Love Canal crisis, Warren County served as a representation of ongoing environmental racism entangled in issues related to the environmental movement (Fletcher 2021). Environmental racism defined as the inequitable distribution of environmental burdens (Godsil 1991). It became increasingly clear, following Warren County, that the effects of environmental degradation disproportionately affect

impoverished communities and people of color (Mohai et al. 2009; Bullard 2000; Pellow and Brulle 2005; Roberts and Toffolon-Weiss 2001). Following Warren County, the field of environmental justice research grew with documentation and examination of environmental inequalities across the United States, including inequalities in environmental health risks and the distribution of environmental hazards (Lave and Seskin 1970; Brulle and Pellow 2006). Research in environmental justice has continually illustrated systemic issues of discrimination and how particular communities, such as the poor or people of color, suffer from exposure to unsafe working conditions, poor air quality and water quality, and unjust living proximities to dangerous dumping or waste locations (Haluza-Delay 2013; Agyeman 2005; Agyeman et al. 2009).

A renowned documentation of the field of environmental racism, the book “Dumping in Dixie: Race, Class, and Environmental Quality” by Robert Bullard is considered one of the first to examine the many effects of environmental racism on communities in which it targets (Mohai et al. 2009; Bullard 2008). First published in 1990, (current edition from 2008), the book exposed unjust and purposeful use of locations populated by communities of color for the collecting and dumping of waste. Sociologists and public health researchers such as Bullard, Bryant, and Mohai continued to lead the field of environmental justice in exposing the disproportionate effects of environmental burdens and environmental health risks as determined by factors of race and class (Mohai et al. 2009; Bullard 1983; Bryant and Mohai 1992; Bryant 1995; Mohai 1996; Mohai and Bryant 1992; Brown 1995; Szasz 1997; Evans and Kantrowitz 2002). The impact of this research resonated through the US government with the construction of the Office of Environmental Equity (to become the Office of Environmental Justice) and the passing of bills on behalf of the public’s new interest in environmental justice, culminating in

President Bill Clinton's Executive Order 12898, requiring government agencies consider environmental justice in all lawmaking (Mohai et al. 2009).

Since the conception of the environmental justice movement and the ongoing integration of environmental justice content into environmental education, the subject of environmental education has had some criticism for its lack of environmental justice content (Kushmerick et al. 2007). Lewis and James (1995) remarked on the unfortunate impact of environmental education programs lacking environmental justice content, such as the targeting of certain communities to unfairly endure environmental burdens, missing the opportunity to empower the very students populating such communities. Similarly, environmental education programs have been criticized for their inability to educate, empower, and represent certain populations or cultures, such as those of people of color (Sachatello-Sawyer and Fenyvesi 2004; Zbleski et al. 1999). While environmental education has received worthwhile praise for teaching many physical and biological processes and components of natural systems and the environment, the lack of focus on social issues has provided the field with more room to grow (Kushmerick et al. 2007; Grass 2002).

The North American Association for Environmental Education has affirmed the prioritization of environmental justice content into environmental education and, additionally, stated that the inclusion of such material has not yet been enough (Haluza-Delay 2013). The goal of growing the framing of environmental justice in environmental education has been recognized, and failure to follow through is a notable downfall of the field (Cole 2007, Kushmerick et al. 2007; Lewis and James 1995).

Diversity and inclusivity have been explored in environmental education and researchers have acknowledged their importance, with the recognition that these factors can be more greatly

valued as the field of environmental education improves (Marouli 2002). The inclusion of voices, ideas, and representation from a diversity of groups is essential to advance environmental education, including the inclusion of Aboriginal peoples, the LGBTQ+ community, persons with disabilities, and several other under-represented and/or marginalized populations (Haluza-Delay 2013; Cole 2002; Simpson 2002; Gough et al. 2003; Russel et al. 2002; Kato 2002; Wane and Chandler 2002; James 2003).

Environmental education has placed immense value in the incorporation of environmental justice content in the curriculum of environmental education, but still there is much more work to be done. Today, while the aims of environmental education move towards education in sustainable development, research in early childhood education, and increased importance in educating adults as well as youth populations, there still lies room for integration of social issues in environmental education (Castellanos and Queiruga-Dios 2021; Ardoin and Bowers 2020; Onopriienko et al. 2021; Maina-Okori et al. 2018). This research paper addresses teachers' perceptions on incorporating an EJ intervention into their curriculum and serves as a step toward addressing a larger effort to standardize such activities in K-12 environmental science curricula.

## **CHAPTER 3**

### **METHODOLOGY**

The data for this study was collected across two meetings with seven Master Teaching Fellows (MTFs) participating in the NSF Funded research project: SIU River Region Environmental Sustainability Master Teaching Fellowship Program.

On February 25th, 2021, the MTFs met for this study for first time. A PowerPoint presentation summarizing and defining environmental justice (EJ) as a subject was presented to the MTFs. This presentation introduced the EJ curriculum interventions that the MTFs would carry out in their classrooms. The EJ curriculum intervention asked the teachers to create a lesson on the topic of EJ, tailored to their students. The design of the curriculum intervention was an activity with content that was not covered regularly in the standard curriculum and that comprised at least one class period. During the 2/25/21 meeting, the MTFs began drafting their curriculum interventions. A pre-intervention survey was then distributed to each MTF. The digital survey covered information regarding 1) education backgrounds of the MTFs, 2) the classes in which the MTFs would present their EJ curriculum intervention, 3) the extent to which EJ content is covered in their classroom, and 4) the MTFs' perceptions on the teaching of EJ.

Following this meeting, the MTFs presented their classroom interventions to their respective classrooms. The intervention took place on their own accord between the weeks of February 25th and May 27th. Following their presentation, they completed a digital post-intervention survey. This survey asked the MTFs to reflect on 1) the impacts of the EJ curriculum intervention on the students of the classroom, 2) suggested improvements for future facilitations of an EJ curriculum intervention, and 3) their change of opinions on the incorporation of EJ material into their classroom. The surveys were collected for assessment, in

order to compare statements in the pre-intervention surveys, and to answer this study's research questions.

## CHAPTER 4

### RESEARCH FINDINGS

This chapter will illuminate the findings of this study. Specifically, for each research question, the corresponding MTF survey responses are presented, as well as a summary/interpretation of the responses. The responses are presented in random order, as A will not be the same individual as A in the following section, to protect anonymity.

#### **1) To what extent was EJ content covered in MTF classrooms before this research project?**

##### MTF RESPONSES FROM PRE-SURVEY

- A) Environmental justice is not currently covered in our curriculum. We do discuss human impact on the environment in multiple difference facets – climate change, use of natural resources, evaluating technology for managing mineral resources, and how human activity has been influenced by natural resources and natural disasters.*
- B) This topic is not currently covered in the courses that I teach.*
- C) We have not covered any EJ topics yet.*
- D) Its not really*
- E) It is not really covered other than a discussion of the book Henrietta Lacks and how her cells were unknowingly used for lots of scientific research.*
- F) None*
- G) During the ecology unit we touch on some factors but not as directly as this lesson will.*

##### INTERPRETATION/SUMMARY

Across all seven answers, the MTFs convey a lack of EJ content coverage in their classroom. Their answers range from a complete absence of EJ content taught in their classroom(5 of 7 MTFs, 71%) to notions of lightly covering EJ content (2 of 7 MTFs, 29%).

#### **2) What are the perceived impacts of an EJ curriculum intervention as observed by MTFs?**



## MTF RESPONSES FROM POST-SURVEY

- A) *Students showed interest in the new ideas of EJ they had not heard of before. Many asked questions about the Sandoval Superfund site (old zinc smelter) that is very close to our town and some other hazardous waste sites that are local. We had just completed a long unit on genetics, and this opened a discussion about how hazardous materials are mutagenic. We looked at the comparison of cancer in our region compared to other counties in our state and related that to the agriculture and oil/gas industries in our area. Many students wanted to relate stories about grandparents/great-grandparents who had diseases and other disorders they thought were mutagenic.*
- B) *My students had discussed this topic in their English course, so they were somewhat familiar with the ideas. They felt that education was an important, yet missing, piece in the discussion of bringing people out of poverty and to better understand their environment. One student said it was easier than ever to change economic classes with investing in the stock market. Probing further, we discovered that means extra income, the knowledge/understanding of the stock market, and access to a broker or internet. I feel it made the students realize that not everyone has the same access to knowledge and information.*
- C) *The biggest thing I noticed is just how many students had not heard of this idea of EJ or its impacts. It did not take long for the “light bulb” to go off and students to realize this really is happening and not just in faraway places.*
- D) *I started the lesson about a superfund site nearby in an area where many of my students live. I think this really grabbed a lot of their attention. It was a perfect article because the town is very high in immigrants and non-English speakers (that is what the article addressed, environmental justice for them). Many students did seem very interested and got into the lesson due to that. Participation was not super great; however that is the way it has been all school year (I guess to do hybrid, remote learning). I think that in a “normal year” there would have been a lot more participation. The graphs that we used from the environmental justice study were not only perfect for the topic (it showed data that “proved” the injustice) but also a great opportunity to practice interpreting graphs and CER (Claim, Evidence, and Reasoning) with students.*
- E) *I did the EJ lessons with my students during Earth Week and our focus was on the Big Muddy River. We did a big water quality unit involving the Big Muddy and citizen science earlier in the year, so this was somewhat of a theme all year. The impact it had on my students is that it really hit home for them. They learned that there is a history with the Big Muddy and pollution. My students also learned about the discrimination and unfairness of corporations strategically placing refineries and pollution hazards in low income communities. They also learned that they have the ability to protest and make a difference.*
- F) *Most Biology students in my classroom did not have a clear understanding of EJ before the unit. Overall, they thought that EJ was bringing people to justice that were doing harm to the environment. After the unit, they had a much better understanding of the themes of EJ and showed enthusiasm when discussing the topics. They were very interested in learning more about the superfund site at Crab Orchard National Wildlife Refuge. Students also were engaged when reimagining areas in the community that they identified as potential Brownfield sites. When they could see how these topics relate to*

*their specific community and how they could be a force for change, then students were more invested in the conversation.*

- G) Students gained a better understanding of environmental justice through this unit. In class, this unit opened conversations about inequities due to race and socioeconomic status that were based on data. Some of our students have never visited Crab Orchard National Wildlife Refuge even though it is just down the road from our school. Learning about a place that is so close and has been negatively impacted by toxic chemicals was powerful to students and they were very engaged during this unit.*

## INTERPRETATION/SUMMARY

Overall, the MTFs found that their students had not heard of EJ before, had misunderstandings of the true nature of EJ, or had only been lightly introduced to the subject in the past. Through their lessons, though, most students were enlightened to the true nature of environmental justice. The students were drawn in by connections to EJ issues local to their own school systems, struck by the reality of EJ, and able to engage in discussion over the topic.

- 3) What are the perceptions and opinions of MTFs on the teaching of EJ before and after a classroom lesson?**

## MTF RESPONSES FROM PRE-SURVEY

- A) I like the idea of including it and do feel it is very important. But, there are so many things vying for our time as teachers, it is very difficult to wrap my around incorporating it more along with all of the other mandates and standards. There are many areas where I could tie it in, such as the Flint water crisis, Crab Orchard superfund site, Henrietta Lacks, etc and if I am creative, I can incorporate it without missing a beat of other content, but I am not sure I am that creative.*
- B) I don't mind incorporating, but I need some strong math content involved. I don't see how I can incorporate the mission statement. Perhaps write their thoughts based on a set of questions where they have to support their ideas with the math involved.*
- C) I think it is an important concept and needs to be intentionally taught to our students. I am just now learning about this myself, even though I am a long-time biology major and teacher. When you know better, you do better.*
- D) I think it is relevant and could tie into our curriculum well in a few different areas with ample time to plan and prepare. It will take time to find resources that will be age and content appropriate. I also believe that EJ is a bigger topic that will take more than one day's lesson to adequately allow students to explore, understand, and develop a mission statement.*
- E) The topic could easily be added to the curriculum and be meaningful for the students. It will take some time to develop an engaging lesson for students in a virtual/in-person*

*format and find time to implement it into the curriculum, but I believe the topic is meaningful and the students would benefit greatly.*

- F) I think EJ should be taught at every grade level and in every subject.*
- G) I'm honestly not sure if this is going to work for me and my students given time constraints, and what learning lag and challenges there already are with COVID. I am not for sure yet if I will be able to devote my classroom time to this.*

#### MTF RESPONSES FROM POST-SURVEY

- A) Yes my opinion has changed due to this lesson. At first I was skeptical about devoting the time to it (especially given the COVID school year where we lost a lot of instructional time). However, several of my NOYCE classmates put together an awesome lesson that I was able to tweak and make unique to my local area. As I mentioned before, the study data was very beneficial to my students for CER and standardized test preparation, as well as sticking with the environmental justice theme. I think that I will include it in the future. I feel as though it was a worthwhile lesson due to the previously mentioned reasons. I am also sharing the lesson with my colleagues to use if they would like to.*
- B) Yes. I was hesitant to incorporate this into my curriculum because of the time constraints, but now realize it can be incorporated into things I already do and not require much additional time. Also, it is a very important topic that needs to be addressed.*
- C) I was glad to hear that my students had been exposed to the topic. I am not opposed to including it, but I need to do more to find a way to tie it in to the math curriculums I teach in order to set aside time for it during the school year.*
- D) I think I will try to incorporate EJ into my classes as a result of this study, whereas I did not before. I even signed up for an NSTA mini-course in EJ that starts in June 2021 to help science teachers incorporate it into their classes, so I am hoping to get more information on how I can better do this. Our students we have now are our future voters, and they are the ones who will be making a difference in the future, so we must educate them if things are to change or the status quo will remain.*
- E) Prior to participating in the study, I believed EJ was an important topic to teach, but it wasn't currently a part of our curriculum. I don't think my opinion about the incorporation of EJ material necessarily changed, however this study provided the necessary push to get it done. I will definitely use this lesson again in the future. Based on students' responses, they gained a lot and found value in the lesson. They voiced that they want to learn about things that matter and environmental justice matters.*
- F) I don't know that I really had an opinion about incorporating EJ material in our curriculum before the study. Typically, we look at the NGSS standards and that drives the direction of our instruction. I will definitely consider using the material that we developed in the future. It takes on more of a phenomenon appearance for what we are teaching. We were able to use the superfund site at CONWR to revisit trophic energy transfer and introduce bioamplification. I love that students have a better understanding of their community and a greater appreciation of the land around them. Furthermore, 40% of the students indicated that attending the field trip made them consider pursuing a career in fields related to conservation, forestry, and wildlife biology. Additionally, 21% remarked that the field trip didn't change their mind about the career that they want to*

*pursue, but the immersive superfund experience was engaging and it gave them an appreciation for the history of the land and the conservation efforts.*

## INTERPRETATION/SUMMARY

With mixed responses on their own incorporation of EJ into their classroom before their curriculum intervention, their opinions ranged from a hesitancy to present a lesson on EJ due to circumstances such as time constraints, to full hearted engagement and support of teaching EJ in their classroom. Throughout, the MTFs mostly believed in the importance of its incorporation into a classroom, even if unsure how they may do so. After their curriculum intervention, though, their opinions on the incorporation of EJ content into their classroom and the teaching of an EJ lesson to their students on a more frequent basis was resoundingly positive. Most opinions changed in support of including EJ content into their classrooms in the future, especially after seeing the result of the curriculum intervention on their students.

### **4) Based on their experience, what improvements would the MTFs recommend to better facilitate an EJ curriculum intervention?**

## MTF RESPONSES FROM POST SURVEY

- A) *I would suggest having students make a civics action plan along with their justice statement. For example, students could include writing their representatives or protesting a certain environmental injustice.*
- B) *I think that because the environmental justice statement was the last thing that we did with the lesson and at the end of class, students rushed through it and didn't spend as much time as they should have. Also, right before they wrote the statement I showed them a video clip about an example of environmental justice in the Lower 9 Ward of New Orleans. A lot of students just wrote about that specific example and didn't address environmental justice in general. I also gave them an example of a theme/value and how you would then do an action statement after it and of course many students used mine (even though it was general about equality) and didn't elaborate much more on their own. Lastly, some students just wrote about equality and mostly social justice and didn't tie in the environmental portion. I think to improve I would not give them an example and emphasize to take their time and make sure they were speaking on environmental justice not just justice.*
- C) *I need more time. I needed to wait until after students had taken the AP Exam and by then there was not enough time left for me to fully digest what I needed to do and how exactly*

to implement it. Also, after the AP Exam, many student “check out” of the course because they feel the hard part is over.

- D) *I used a shorter version of the Marion teacher’s google slide presentation that focused on the pollution, tree canopy, and effects of hurricane Katrina. It was a broad and quick look at the different ways Environmental Justice is being neglected. To really make an impact on the students, I would have needed more time to devote to it. However, the topic doesn’t fit in my curriculum and I would need to get creative on how to tie it in.*
- E) *The classroom justice statement seemed like a stretch for our science class. I think I should have framed it as writing a mission statement for EJ for our region instead of our class; especially after we had such a good discussion about what was occurring in our county related to mutagenic hazardous waste problems they were not previously aware of.*
- F) *Creating a classroom environmental justice statement is most meaningful if students are able to take action based on their statement. What can students do to make a meaningful, local difference that addresses environmental injustice? A fellow MTF in the Noyce program planned and prepared the EJ lessons that we used during our biology classes. I would honestly not have had the time to commit this semester to creating as great of a lesson that she put together. I’m grateful for the collaboration within our department and strongly encourage that for teachers moving forward. I would estimate that the fellow MTF spent at least 50-70 hours developing this unit for our students.*
- G) *We completely reworked the EJ presentation to be more interactive and engaging. Students do not retain new concepts through traditional lecture style. We created something that allowed them to have “student choice” and enabled them to discover the topic in a more self-led approach. Students were able to explore superfunds through a familiar location, Crab Orchard National Wildlife Refuge. They looked at the concept of bioamplification of PCBs in a refuge food chain by exploring a scientific article. They could choose from a selection of newspaper articles to learn more about the refuge and its clean-up efforts. They were also able to identify a local site that they believe would qualify as a brownfield and engineer a way to repurpose the land. Finally, students explored the topic of environmental justice mostly through the lens of tree frequency/green spaces in communities. They used a GIS program to compare tree canopy cover for Houston neighborhoods looking for a relationship between the % cover and race/income demographics.*
- The classroom justice statement is a difficult one to assign to classes if you aren’t going to actually implement the actions in the statement as a class. In other words, my class could come up with a statement regarding environmental justice and the actions/expectations that they have as a class, but it is hard to visualize how the implementation of that statement looks. It might be more realistic to have them generate personal statements and goals.*

## INTERPRETATION/SUMMARY

The main points made by the MTFs for the improvement of the curriculum intervention were issues of time, their ability to integrate EJ into their field of teaching, and the inclusion of

the environmental justice statement. First, teachers noted that if more time was allotted to create a lesson on EJ, the lesson would be better educationally. Second, the integration of EJ material into particular fields of STEM can be seen as a challenge, requiring creativity to smoothly integrate EJ into their classroom. Lastly, an earlier objective included writing an environmental justice statement for the classroom, but this was confusing to them and their students, likely due to a lack of experience with the term and concept of EJ. Overall, then, it is clear that the development of an “environmental justice statement” for a classroom must be developed in close collaboration with the teacher and their classroom expertise, timeframe, and teaching goals.

## CHAPTER 5

### DISCUSSION AND CONCLUSION

The drawbacks of this study are largely placed on the sample size of data collected and the depth of analysis done on collected data. This study began with fourteen possible participants, but due to challenges such as time restraints on the allotted group of MTFs and the contemporary societal battle of the COVID-19 pandemic, half of the anticipated participants were unable to complete the EJ interviews. However, this study acts as a worthwhile starting point for further research that refines the methods of an EJ teaching project, increases the number of teachers and classrooms studied, and expands beyond STEM classrooms in Title 1 schools.

Despite these drawbacks, there still maintains a valuable level of success from this study. The outcome of this project, interpreted through the survey data collected, indicates an enthusiastic support for the inclusion of environmental justice content in STEM classrooms. This is especially motivating information, as the EJ gap in education has been already identified and described in this study's literature review. With an understanding of the necessity to begin integrating EJ content into STEM curriculum, this study reflects positively on the actual integration process, illustrating an eager and welcoming attitude by the parties most central to the education system: teachers and their students. Even more so, the participants of this study not only share in their chosen profession as STEM educators but they serve the populations most often effected by EJ issues through their placement at Title 1 schools. These schools are defined by their composition of low-income students. These communities are at the highest risk of targeting for environmental burdens. The classrooms in this study were moved by their own intimate connections to the topic at hand. To see that these particular teachers have changed minds over the importance of teaching EJ, as well as their own capability to do so, demonstrates

that the necessary steps towards the integration of EJ content into everyday STEM classrooms is not only possible, but is likely to become a subject that is interwoven into their curricula.



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**APPENDIX**  
**HUMAN SUBJECTS APPROVAL**

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INSTITUTIONAL REVIEW BOARD  
OFFICE OF RESEARCH COMPLIANCE  
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To:            Luis Prado

From:        M. Daniel Becque  
              Chair, Institutional Review Board

Date:        February 3, 2021

Title:        *Investigating Environmental Education in Rural, Title 1 Stem  
              Classrooms*

Protocol Number: 20275

The above referenced study has been approved by the SIUC Institutional Review Board. The study is determined to be exempt according to 45 CFR 46.101(b)2. This approval does not have an expiration date. However, any future modifications to your protocol must be submitted to the IRB for review and approval prior to their implementation.

Best wishes for a successful study.

This institution has an Assurance on file with the USDHHS Office of Human Research Protection. The Assurance number is FWA00005334.

MDB:jh

cc: Leslie Duram

**VITA**

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Bachelor of Science, Geography and Environmental Resources, May 2020

Research Paper Title:

Investigating Environmental Justice Education in Rural, Title 1 STEM Classrooms

Major Professor: Dr. Leslie Duram