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Board 54A: Student Impacts from Outreach-based Flood Risk Research in Rural Texas, USA

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Student impacts from outreach-based flood risk research in rural Texas, USA

ABSTRACT

Eighteen STEM major undergraduate and graduate students at two Texas regional institutions conducted a public research survey on rural flooding in the spring of 2022. This was accomplished in the largest regional flood planning area in Texas, the Canadian – Upper Red River Basin Regional Flood Planning Area, or Region 1. The student participants interviewed rural residents in portions of Western and Central Texas, using both phone and in-person interviews. The survey provided data that defined the nature of observed flooding in rural areas and needed mitigation efforts for future flooding risks. The students who conducted the public outreach study were from several different majors (Geoscience, Environmental Science, and Engineering) and cultural backgrounds.

The students who conducted the flood research interview were surveyed for a post-study assessment using two research instruments – a Qualtrics survey and personal interviews. All eighteen students were solicited for the Qualtrics survey and were asked questions related to the study's effectiveness, strengths and weaknesses, and impacts on professional development. A subset of eight students (four from each university) were also interviewed and asked a set of 12 questions related to the project roles, expectations, training, difficulty of work, and personal and professional lessons. The questions from the personal interviews fell into three major themes: research enterprise, student experiences, and educational gains.

Preliminary results indicate that students who conducted the flood research interview work found that it was a positive experience in terms of building their skills and confidence in conducting outreach research. In terms of student pre-study expectations, about half of the students interviewed had their general expectations met, while the other half had their expectations challenged. Students who felt a strong connection to their local community and university had the most positive perceptions of their outreach work with respect to both effectively gathering data for the research and building skill sets for future careers. Students found that there was a stark contrast between the perceptions of flooding in rural, private locales versus urban, shared community regions. The strong ties of regional universities to local rural communities, as well as the increased willingness of the public to speak to student researchers, were both found to be important aspects of study effectiveness. Results from the student surveys also elucidate the importance of paying students to participate in the research so that they are able to recover lost wages from their regular day jobs, and to allow as much flexibility as possible in student research participation. The students who participated in the flood research interview found the study to be highly effective in both meeting project goals (obtaining flood outreach data from the public) as well as building a wide range of valuable student skills (e.g., interpersonal, teamwork, leadership, time management, and interviewing). Finally, the work we present here highlights the need to involve student researchers during times in the academic semester when general availability is highest (i.e., the beginning of the academic semesters) and to recompense students sufficiently to mitigate salary loss from their regular employment.

INTRODUCTION

Motivation of study

Texas has increasingly experienced billion-dollar flood-related disasters. Flooding in 2017, including the impact of Hurricane Harvey, produced total financial losses near $200 billion [1]. Prompted by these financial costs and a desire to mitigate the deaths, injuries, and other hardships that accompany flooding, the Texas Water Development Board (TWDB) prepared a statewide flood assessment. The product defined Texas' flood risks, provided an overview of roles and responsibilities, and included an estimate of potential flood mitigation costs. The assessment noted a chief deficiency: much of the flood risk in Texas was based on antiquated or insufficient geospatial information [2].

The assessment moved the 86th Texas legislature (2019) to adopt changes to Texas Water Code §16.061, establishing a flood planning process led by the TWDB. Regional flood plans for each of the State's 15 major river basins (known as Regional Flood Planning Areas) were to be submitted to the TWDB in January, 2023. These plans will be subject to quinquennial updates [3]. Fifteen Regional Flood Planning Groups were formed and met to design and write plans which cover the entire state.

The Canadian – Upper Red River Basin Regional Flood Planning Area, or Region 1, encompasses a sparsely-populated portion of Texas. It covers 40,000 mi^2 of the high- and rolling-plains physiographic provinces of the northwest part of the state, bordered by New Mexico to the west and Oklahoma to the north. The largest population centers are Amarillo and Wichita Falls, home to roughly half of the Region's 600,000 people. Outside of these, it is a rural area served by widely dispersed small towns.

The Region 1 Flood Planning Group expressed a strong interest in understanding contemporary and historical flooding events to facilitate planning. Through the Panhandle Regional Planning Commission, the state contracted with Freese and Nichols Inc. (FNI), who constructed a survey (i.e. a research interview) for Amarillo and Wichita Falls. The firm conducted these with knowledgeable professionals (e.g. city managers, planners, and engineers). Following assessment of cities, attention turned to the rural sections of Region 1.

To extend the research interviews to the rural populace, FNI contacted engineering and science faculty at West Texas A&M University (WTAMU) in Canyon (adjacent to Amarillo) and Midwestern State University (MSU) in Wichita Falls. They contracted these faculty to enlist and train students to conduct research interviews at gathering points and hubs within the small towns that serve the region. Three faculty assembled a research group of 18 undergraduate and graduate students. Over the spring of 2022, the research group executed a flood survey that specifically targeted rural communities [4].

As discussed by Bird (2009), public surveys for risk management such as those implemented by students in this study for Texas flooding risks are effective for "acquiring valuable information…on developing risk management procedures" [5]. While there have been a number of recent scientific studies focused on flood risk mitigation in Texas [e.g., 6-7], few researchers to our knowledge have documented the "techniques used in the development and implementation" of risk management data collection [5]. In this study, we document a flood

research interview study from the perspective of lessons learned and impacts on the student researchers who implemented the survey.

The Value of Research Interviews

A research interview is the best means to acquire data from areas with low to no monitoring, like the wide rural area covered by Region 1. At its simplest, a research interview is the solicitation of response to a survey which obtains information on topics relevant to a project [8]. The technique produces qualitative or quantitative data through a consistent list of questions to a population of individuals. The United States Geological Survey (USGS) "Did You Feel It?" online survey is a simple, powerful example of this tool [9].

The research interview is extensively used in psychology and pedagogy scholarship, and is nearly ubiquitous in sociology research. As such, the process is a key graduate educational component in these disciplines, with increasing use within undergraduate curricula [10, 11]. STEM education has not traditionally introduced students to research interviewing. Empirical or theoretical research and design (i.e. apprenticeship style) projects have naturally been the primary avenues for student research, as they remain the major modes of quantitative exploration in STEM professional and academic fields [12]. However, there are other presumed merits to the research interview approach utilized here in the STEM environment:

- It forces students to confront the impact of science and engineering on a broad population.
- It can "humanize" STEM work, connecting data to people.
- It strengthens soft skills like communication, socialization, and ethics.
- It provides additional training beyond lab or workshop attributes.
- It familiarizes students with government policies that intersect with their profession.

Research interviewing on flood impacts is perhaps the most useful tool for providing widespread information on vulnerability in areas that lack monitoring. In doing so, it merges the social and applied sciences [13, 14]. In the survey process, the aforementioned sociological attributes are naturally combined with hazards assessment, geospatial science, and applied engineering. This provides a unique and holistic nexus for active learning in engineering [15].

STUDY DESIGN AND METHODS

The work to be discussed in this paper was a post-assessment study on the behaviors and attitudes of students conducting a funded research study for the TWDB. For the sake of clarification, the term ***study*** will only be used to refer to the funded TWDB research interview study, while the term ***post-assessment*** will only refer to the work being described in this paper.

Flood outreach study

The objective of the research study was to capture perspectives on flooding from rural residents, particularly in unincorporated communities of Region 1. Region 1's large size required work to be divided based on areas in close proximity to the university partners—WTAMU PIs and students surveyed residents generally in the Texas Panhandle, while MSU surveyed residents in the Upper Red River Region. **Figure 1** provides a general map of the flooding planning region with highlights of communities to be covered by each institution [4]. **Figure 2** presents a few

example images of historical flooding observed within Region 1 that were obtained from the rural public as part of the research study.

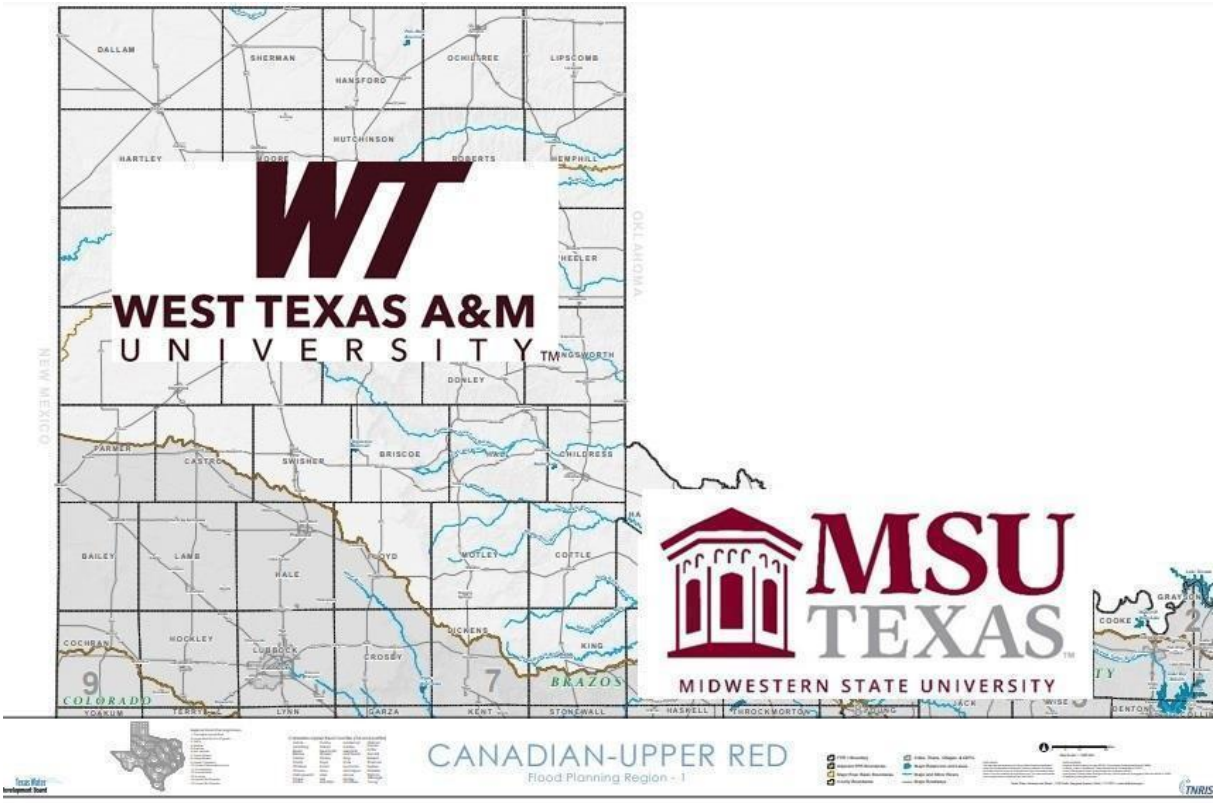

Figure 1. The Canadian-Upper Red (Region 1) map with its associated counties, major rivers, and drainage areas [4]. University logos designating the approximate coverage of the Region by each student group were added for clarity.

Figure 2. Example images of historical flooding in Region 1 obtained from rural residents as part of the research study. Urban flooding in Clarendon in Donley County (***top left***), flooding on Tascosa Creek in Boys Ranch in Oldham County (***top right***), flooding on the Canadian River in rural Oldham County (***bottom left***), and rural flooding along Sweetwater Creek in Gray County (***bottom right***).

The Region 1 group felt it was necessary to obtain perspectives from rural residents. These may aid in understanding potentially unaddressed historical and contemporary flooding issues, and provide potential solutions for mitigation efforts to solve problems. It was necessary to physically travel to these locations to ensure participation. For more details on the study, please review the ***Appendix***.

Student post-assessment activities

Approximately six months after the completion of the flood study, the students were invited to participate in post-assessment activities. These activities were conducted between mid-October and mid-November 2022. Two instruments were distributed to the students. First, an anonymous survey in Qualtrics consisting of a series of 25 questions that reflected on the overall student experience such as hiring, training, and the effectiveness of the flood study. The students were expected to spend no more than 20 minutes completing this survey. An example question from the survey can be seen below–

> *Region 1 is known for having significant, yet infrequent flooding events that impact rural residents. Did you get the sense that the infrequency of flooding observed in Flood Planning*

Region 1 resulted in interviewees providing less useful information because they either forgot or did not remember flooding experiences in their recent memory?

a. No

b. Yes

c. Probably

d. Unsure

Second, a personal interview was conducted in-person or on Zoom, with selected students from both university research teams. All students were invited to participate in the Qualtrics survey (15 participated), while eight students (4 from WTAMU, 4 from MSU) were selected to be interviewed (7 participated). Interviewees were selected based on the number of hours entered into each university's time management system. Students were asked twelve open-ended questions based on their roles, project expectations, training, difficulty of work, and professional and personal lessons gained from the experience. Students' responses were recorded using computer recording software for the purpose of collecting anonymous vignettes for this assessment. Prior to the interview, each student would receive a copy of the interview informed consent and interview questions via email. On the day of the interview, the PI would read the informed consent and request the student to sign the form. Students were expected to spend no more than 1 hr. participating in the interview. Each faculty member was randomly assigned to conduct two interviews from the list of selected students. One faculty member was responsible for coding the information from the recorded interviews using professional software. These were then coded into three broad themes as shown in **Figure 3**. Further details on both instruments can be found in the ***Appendix***.

Interview theme	Structural codes	Research questions theme addresses
The research enterprise	Research purpose Researcher role Onboarding Ways to improve	How did students perceive the idea of outreach-based disaster research?
Experiences	Expectations Training and preparation Difficulties Success and ease	What specific experiences did students have which shaped their view of "success" and enjoyment in social research?
Educational gains	Flood People, region Student growth and gain	What did students learn about the people, places, and phenomena they encountered? What about their own growth?

Figure 3. Structural codes summarization of interview themes and theme research inquiry value.

RESULTS

Summary of student observations based on the Qualtrics survey questions

The purpose of the ***demographic Qualtrics survey questions*** was to document information on the student's gender, age, university affiliation (MSU or WTAMU), racial/ethnic identity, and academic classification (**Table 1**). In addition, the demographic questions also documented the self-reported number of hours each student worked on the Flood Study and the distance of students' permanent extended family residence from their University campus. The diverse group of engineering, geoscience, and environmental science students were mostly senior undergraduate students and graduate students and were 73% female (37% male). Most students worked between 15 and 60 hours during their employment, although 3 students worked over 60 hours. About 60% of the students' permanent residence was located within 150 miles of their university, with 40% of the students coming from more distant locales.

Table 1. Demographic information (student counts) obtained from a Qualtrics survey of 15 student researcher participants in the Region 1 Flood Study.

Gender	Male	4
	Female	11
Age	21-22	4
	22 or older	11
University Affiliation	Midwestern State University	5
	West Texas A&M University	10
Racial/ethnic Identity	Caucasian	4
	African-American or Black	5
	Latino or Hispanic	3
	Two or more	2
	Other/Unknown	1
Academic Classification	Senior	7
	Graduate Student	7
	Graduated	1
Hours worked in total	Less than 15 hours	1
	Between 15 and 30 hours	4
	Between 30 and 60 hours	7
	Over 60 hours	3
Distance of permanent residence from University	Less than 50 miles	5
	Between 50 and 150 miles	4
	More than 150 miles	6

The Qualtrics survey can be divided into two categories: flood study effectiveness and flood study student experience and skills. In this section, we will provide an example of results from

the flood study student experience and skills section. Additional sample results from the Qualtrics survey can be found in the ***Appendix***.

Overall, student researchers who participated had a positive experience in terms of feeling empowered and learning new skills during the study. 71% of student researchers agreed or strongly agreed that their voice was heard in the study and that their ideas and opinions impacted how the study was implemented. However, most students (71%) would also have liked to have had more debriefing and modification of the interview plan and procedures after conducting the first set of interviews.

About half of the students in the survey noted that a lack of time in their schedules made it difficult for them to participate in the outreach research. Over half of the student participants Indicated that it was difficult for them to find time to participate in the study because it was conducted immediately before finals. In addition, a key challenge with student schedules was the half or full days required to conduct the in-person interviews.

A majority of students (>50%) felt that participating in the research study helped them develop a number of valuable career skills, including time management, interpersonal and leadership skills, problem-solving, and communicating with a diverse audience. The two specific skills needed for conducting the interviews (learning how to conduct interviews and gaining knowledge reaching rural communities and understanding their needs with respect to flooding) were also the two skills most selected as skills developed by student researchers (64-71%). In addition, 92% of students agreed that participating in the research study improved their confidence in conducting public research activities.

Summary of student observations based on the in-person and Zoom interviews

Using the three interview themes of the research enterprise, experiences, and educational gains (i.e. the structural codes in **Figure 3)**, we were able to discover the following vignettes from each of these themes. Further vignettes from other interview themes can be found in the ***Appendix*** section.

The research enterprise

Research purpose

We asked every student a question concerning their perception of the purpose of this research. For many students, they can understand their own desire to have “just another job”, and it is especially helpful if the job is an on-campus one. In this study, the students were doing work related to research, but they weren’t directing the research or analyzing the data. They didn’t necessarily need to understand the purpose of the research to engage participants or to process data. However, the students made the initial contact to conduct interviewing leading to the web survey on flood conditions and flood policy. In order for them to do their job well (that is to be persuasive for getting consent on interviews), they need to be confident and erudite on the purpose of the research. A typical resident might like to know, “What is in this for me or my community?”

Every interviewed student researcher was asked the question: “What in your own words is the purpose of this project?” We selected one response to share.

> I described to the interviewees that people forget that Texas floods because we are in, I think we are technically in a desert, and so people forget that our soil is heavily clay and that in cities, it's a lot of concrete, and those are two things that don't really absorb water. So whenever it does rain, it usually rains a lot at once, and that causes a lot of flooding. So **we just need to know where that flooding happens**. That's pretty much what I told people.– Pearl

There are a few observations on how the students perceived the value of their tasks. First, they communicated their sense of flood risk and instances of historical flooding in the areas that they visited. They saw correctly that there were no physical measurements of high water marks, stream gauges, or emergency rescue records that were going to make this possible. They had to find flooding witnesses to document it.

Second, the students communicated to rural residents that the research would shape policy. For the sake of hydrological education, there is certainly value in a student assessment of rural flooding. The students went farther than this, however, in explaining to the interviewees that they understood that the information which they were collecting would contribute to findings to the State of Texas which could potentially justify financial support for flood mitigation projects. Most students expressed faith that the research process would eventually bring a benefit to area residents. This point, which most of them made, is key because it provides a positive incentive for someone to agree to share personal knowledge and opinions with the student.

Third, the students had to address a degree of doubt in potential interviewees. They recognized the semi-arid nature of the research area. People were not terribly worried about flooding in general and certainly not in the drought year of 2022. The students had enough training to know that flooding, though infrequent, can be significant. They had to push past skepticism about the value of what they were doing and be confident that this research would be of benefit for flooding problems that, despite current drought status, will eventually return and need to be addressed.

Experiences

Some areas of the Experiences codes were covered in some fashion under Research enterprise. We thus chose to focus this results analysis on just Expectations

Expectations

What is most interesting concerning expectations is the ability of students to remember what they thought their project would be about and then for them to experience confirmation or refutation of those expectations.

Students experiencing confirmation of expectations included the following statements:

> So when we were first talking about this project, Dr. B explained it pretty well. It was in detail, so I didn't really have any preconceived ideas as to what the research was about, and I feel like my experience in the research was exactly as he said it would be. He explained that we would go out, talk to people, get their answers in regards to some of the questions that were being asked, and that's exactly how it went. – Mabel

Regarding pre-conceived project expectations, in general, about half of the students interviewed seemed to have their general expectations met and the other half had their expectations challenged in some way. Those that had their expectations confirmed had formed those expectations from project PIs or perhaps by individual life experiences. At least one student was from a small town he surveyed, and had a sense of what people would be like.

Some students who had their expectations challenged were challenged because of the work that they would be doing. Others were challenged according to the way that they would interact with the interviewees. Given these were all STEM students, some expected to be taking photographs and physical measurements of flood-prone areas. These students were surprised by the high degree of human interaction. Other students understood that this was an "outreach" project, meaning that they knew that this meant outreach…to people. These students were surprised by how much people wanted to tell them, the long duration of many interviews and surveys, the nature of the stories, and the small size of their outreach groups. In this area of expectations, it seems evident that students adjusted their assumptions concerning what constitutes "flood research," and that students grew to appreciate how much information could be had from area residents if they took the time to listen.

Educational gains

Flood

Considering that this report concerns the impacts on student researchers, it is fair to note that, from the student's perspective, they were learning what rural residents knew about flooding from first-hand experience. Students spoke in their interviews concerning what they learned about flooding in a practical fashion (e.g. risk to human life and property). Most students had educational backgrounds which related to flooding: hydrology, inundation mapping, connections with infrastructure, flood-based pollution, and concepts like sheet flow. Their interviews show that they learned much more concerning the experience of flooding and how decisions about flood risk mitigation are perceived by rural residents. Some of the particulars they said on these points include:

> "How does it impact your cattle, whenever it does rain?" And we have these big thunderstorms? I was speaking with one young lad and he said that his grandfather owned a ranch that his family still has, and it flooded one day and it just washed all their cattle down the road and they lost a hundred head of cattle. **So that's money**. – Margo

> I didn't know how bad rain was for farmers in our area post drought, you would think that post drought rain would be really good, but **I didn't realize that that can destroy a whole season's worth of crops just in one go**. – Pearl

> There was this one town, Crowley. I guess a riverbed runs straight through the town, or at least they built roads over it. And that was one thing. It was like anytime it floods, it literally follows the road all the way down to the other end of the river and just floods up. So that town usually had something to say. But then there'd be other towns you go into and they'd be high enough elevation and far enough from any creek or river. It was just like, "No, there's nothing going on. My front porch might flood up, but **I don't think you all can help with that**."– Ryker

It is likely of little surprise to most people in STEM education that flooding is most often taught in an urban context, and the students' statements frequently showed surprise at the impacts to crops and livestock. Another strain of thought in what students learned was how many residents, being more rural, wanted to see themselves as being independent. The residents were surprised and somewhat skeptical to learn that the government might help with a local flooding problem. Students picked up on the residents' skepticism. Though students learned that residents were more independent when it comes to both drought and flood, another side of that independence is a feeling of isolation. Residents expressed a "my problem" viewpoint, in contrast with one of a community problem. They might have also minimized flooding severity. Behind all of these statements is the reality that many instances of rural flooding concerns flooding on private property, some occurring due to decisions made by private individuals or small groups. In contrast to urban and suburban flooding, high water is perceived as an individual property problem. Unlike in more developed areas, it is frequently seen as a wider "community problem." This kind of lesson, the way that flooding feels when it is more rural, private versus urban, community, shared is something that students were able to experience as expressed in their statements though none of them made this growth in flooding understanding in any conscious way during the interviews.

DISCUSSION

In general, the survey responses from the student participants in the Region 1 rural outreach flood study confirmed earlier anecdotal evidence and perceptions from the faculty investigators on the strengths, weaknesses, and lessons learned. The take-away message is that utilizing regional universities in rural areas for public outreach is a highly effective and economical way to both serve the community and at the same time empower and train students in a number of important skills. As discussed by Tillinghast et al. (2020), STEM outreach research such as implemented in this study has been shown to "accelerate academic pursuits" and "career goals" for college student participants [16]. However, only limited research exists in the literature on documenting the strengths and challenges of utilizing regional universities and college students to conduct risk mitigation studies. Several examples exist of trained cohorts of university students conducting outreach research [e.g., 17-18], but overall such examples are very few and far between. In addition, relatively few research studies have documented the benefits of local and regional universities in conducting research and public outreach that assists in disaster risk reduction in the vicinity of those universities [e.g., 19-22]. We hope that this research inspires additional documentation and incorporation of trained cohorts of university students for outreach and research studies. A summary of the lessons learned and recommendations for future rural public outreach studies that might follow in the footsteps of this study are listed in the following bullet points. We will divide these points into two categories–those that relate to the study, and those that relate to the post-assessment study:

Flood outreach study

- Rural interviewees responded positively to student interviewers from a local respected rural institution. The importance of building trust and using students with local ties to the community cannot be overstated. We postulate that this is true for a number of reasons—1) students are less threatening and thereby more approachable; 2) students are less likely to have any direct correlation to the challenges being faced by the community members

(they are just “the messengers”); 3) some students have strong relationships to the community.

- Cold calling and in-person interviews as well as local media outreach (local television and radio stations) were found to be important in obtaining adequate community responses to the survey. Students strongly favored conducting in-person interviews despite the importance of cold-calling for identifying and recruiting potential follow-up in person interviews.
- Students participating in rural outreach learn valuable skills and gain real-world experience valuable for their resumes while conducting the public survey at a fraction of the cost that would be charged if the survey were carried out by private consulting firms. Thus, hiring college students is a relatively inexpensive yet highly effective approach for conducting public outreach.
- It is important to competitively pay students, to encourage the involvement of student groups that may require financial support to offset educational and living expenses to participate. Providing adequate student funding to encourage and facilitate student participation was a goal when designing the Region 1 Flood outreach study, because many students are required to work part- or full-time jobs outside of the university to support their education. This can result in challenges for students to allocate time to take part in research experiences that would ultimately benefit them in their careers. Providing competitive stipends for research can be an effective means for students to replace some of their regular day job work doing research. Providing paid research experiences for students is also important for supporting participation from “racial/ethnic minorities, women, and first-generation students” who are generally “underrepresented in paid internships” [23].
- Time is of the essence in conducting rural outreach studies in a university setting and we recommend that several months be allocated to university students conducting rural surveys. The overwhelming take-away message from student participants was that more time was needed, both for training and hiring the students, educating the survey participants, and conducting the surveys. We also recommend that the students should complete most of the outreach activities during the time in the semester when other responsibilities during the semester are minimized if possible. Yet this may not be entirely possible, given that state government agencies and universities differ in what is considered the calendar year and in what is needed to be done before funds can be disseminated. A possible suggestion might be to start the study a semester after funds are available.

Post-assessment study

- Students expressed many practical suggestions that were primarily related to how supported and equipped they felt to conduct outreach surveys and interviews. Some specific things they listed were tactics to prime interviewees to share their knowledge, more official clothing, and larger student groups with faculty accompanying at times, providing more training on safety procedures, more time for students to learn about flooding, and better communication from the faculty leadership group. These were lessons that would have been difficult to know before having conducted this first outreach study.

- Student researchers did not, however, see the extensive university onboarding and training (which certainly slowed down the hiring process, giving less opportunities for students to conduct interviews) as much of a hindrance as was expected before the survey was given.
- What did the students say that they obtained from their participation as researchers? The structured interview showed that they identified three important areas–(1) people skills and the ability to converse easily with someone new in a business or professional context, (2) a higher competency in research methods which expanded them beyond their core fields of study, specifically the value of social science research, the various roles required to do a larger research project, and the concept that research is "fun" when it is challenging and impactful to those being served, and (3) a growth in empathy and understanding towards rural residents whose lives are frequently very different from the typical STEM student.
- This type of study, an outreach study, was also important for students because for many of them it challenged their expectations. They didn't understand that they wouldn't be taking many physical measurements, and they didn't realize how much work it was to find people in local communities who have meaningful information. They had to learn how to be patient and listen to local residents tell "beautiful stories" sometimes for two hours or more. In the end, this challenge created an honest enjoyment for students in that they learned that their understanding of physical and environmental processes (i.e., flooding) has a unique positive intersection with local communities. They learned that these communities might not easily have a voice to express their concerns about water, drought, and flood unless someone with both patience and background knowledge in these areas will take the time to seek them out and to listen.

CONCLUSIONS

Student researchers thought that the public outreach survey study was effective overall, but they also suggested that simplifying some of the survey questions and providing additional flooding background as motivation education to the interviewees before taking the survey would have improved study outcomes. As discussed by Donohue [24], universities are often hubs "for the advancement of water science and engineering knowledge and innovations," and this study has provided a clear demonstration of using a regional university to further flood risk assessment while empowering research and outreach experiences for university students. We recommend future flood outreach to build on the results presented in this study, and consider a multi-year student-led outreach study that fosters multi-disciplinary and sustained student involvement for a longer duration (a successful recent example of such a study is given by [25]).

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Appendix

Details concerning the FNI flood study

Freese and Nichols (FNI) requested interviews to be conducted with residents using two online instruments–an online survey that allows residents to voice their opinion on potential floodplain mitigation strategies, and an interactive map that allows one to document a known incident of flooding in the region [1]. A resident accomplishes this documentation in the following way–1) placing a point on the map that represents the location of the flood incident; 2) answering a series of questions describing the event; 3) providing any supplemental documentation that would help further describe the event (i.e. photos). Since student outreach interviews were conducted in rural communities with limited Wi-Fi connectivity, it was decided that students would conduct the in-person interviews using printed copies of the survey and web map. Upon return from the interview, the completed paper copies of the survey and web map were scanned and uploaded to a cloud-based repository. From there the data was manually entered into the survey and web map. FNI requested for at least two survey participants in each county of the Region. **Figures SI 1** and **2** provide screen prints of each online instrument. **Figure SI 3** depicts images of different surface water bodies within the region.

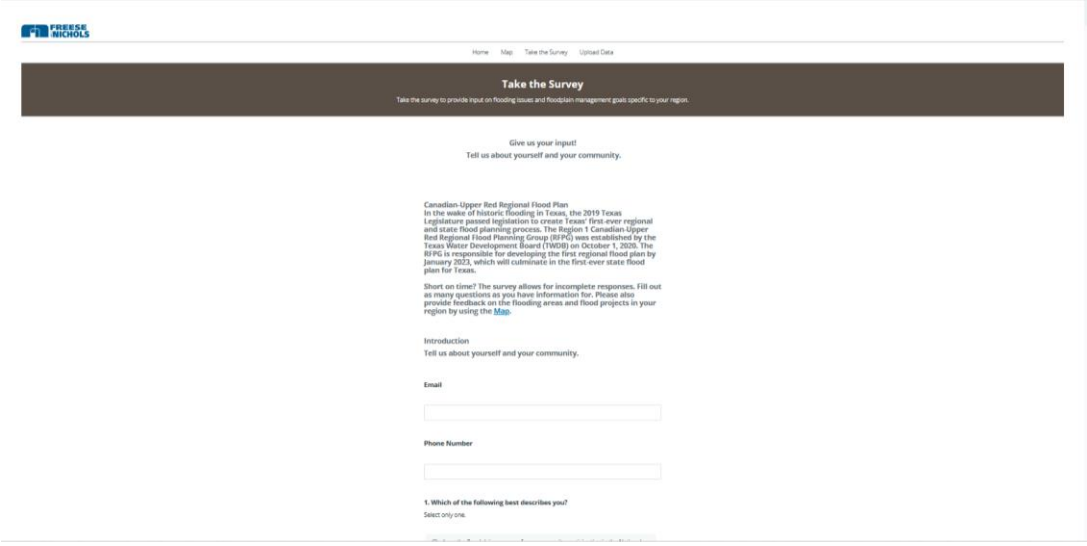

Figure SI 1. Screenprint of the FNI online survey [2].

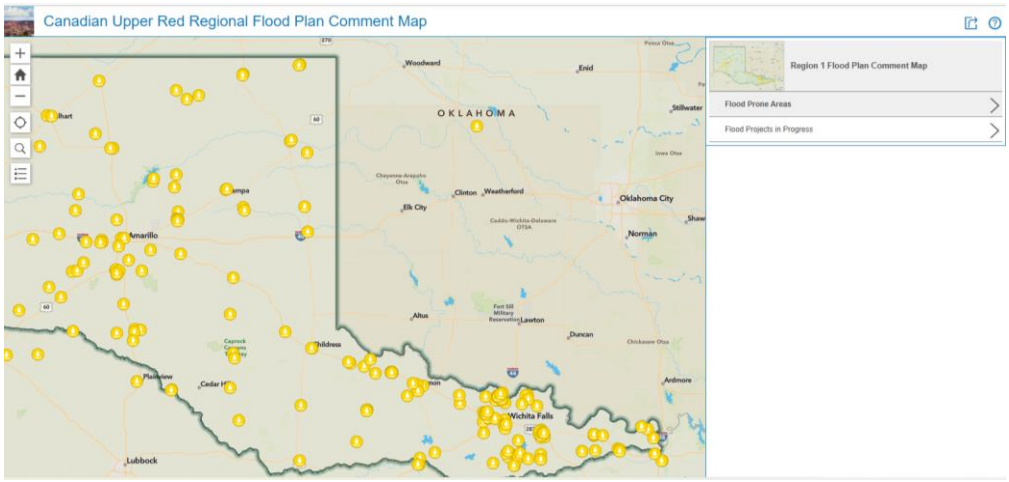

Figure SI 2. Screenprint of the Canadian Upper Red Regional Floodplain Comment Map [3].

Figure SI 3. Example images of surface water bodies in Region 1–Gageby Creek, Wheeler (***top left***), Canadian River, Boys Ranch (***top right***), Prairie Dog Town Fork Red River, Hall County (***bottom left***), Salt Fork Red River, Donley County (***bottom right***). Photographs taken by authors.

A summary of the method employed to conduct interviews is as follows [1]–

1. Two student groups from WTAMU and MSU were formed. These consisted of two PIs from WTAMU and one from MSU. A total of 18 undergraduate and graduate students

(10 from WTAMU and 8 from MSU) were selected. These teams would complete the work during the spring semester 2022.

2. Hired students were given training sessions for the goal of better understanding the overall scope of the project and the expectations of students for each of these roles. These training sessions were conducted both in person and online via Zoom and were led by the PIs. Each university team had its own series of pre-scheduled training for its student group. A group of students and the PIs from each university also met for a luncheon on a Saturday in mid-February at a Mexican restaurant in Childress, TX, a halfway point between the two universities (**Figure SI 4**). This allowed for students (and PIs) from both universities to interact with one another prior to the study. All student groups were also added to a GroupMe group. This group allowed for announcements to be communicated to everyone on the larger research team.
3. Students at each university were further divided into two groups with defined responsibilities—one group was assigned the role of conducting the in-person interviews, while the other group was to collate the information collected from the interviews, and manually enter the responses from the paper surveys and web map into the websites.
4. Solicitation of resident participants was done through various means—local radio, television, and press interviews with PIs and students, cold-calling local common gathering areas with each community (churches, diners, libraries, restaurants, etc.), cold-visits to public places such as grocery stores and government offices, and interviews established by students with friends and family from these communities. Students did not travel alone and were required to travel in groups of at least two with other students working on the project or a PI (**Figure SI 5**). Students at MSU mostly collected data using cold visits, while students at WTAMU scheduled interviews prior to traveling. This is primarily because MSU students did not need to travel as far as WTAMU students to conduct interviews.

Figure SI 4. A photograph of a few students from WTAMU and MSU following the meet and greet lunch in Childress, TX [4].

Figure SI 5. Two students conducting an in-person flood survey interview in April 2022.

Student post-assessment activities

The following provides details on each of the two post-assessment activities.

Qualtrics survey. The online Qualtrics survey consisted of 25 questions related to the study's effectiveness, strengths and weaknesses, and how participating in the study impacted the students' professional and skill-building development. An additional 12 questions related to their roles, project expectations, training, difficulty of work, and what they gained personally and learned professionally from participating in the project were asked of the students as part of the in-person interviews. 15 of the 18 student researchers participated in the Qualtrics online survey, and 1 abstained (89% response rate). The research questions were divided into two separate sections– flood study effectiveness and the flood study student experience and skills. A summary of the two has been provided below.

The **flood study effectiveness Qualtrics survey questions** sought to determine student researcher opinions of study effectiveness, since it was the eighteen STEM major undergraduate and graduate students that conducted the outreach research study. The **flood study student experience and skills Qualtrics survey questions** sought to determine student researcher opinions of their experience and skills learned during the implementation of the research study.

Flood study effectiveness

Table SI 1 provides sample output from the flood study effectiveness survey questions. The student researchers were asked about their opinions on the overall value and effectiveness of different aspects of the flood study. A majority (71%) of the students surveyed thought that this study of public attitudes on rural and small-town flooding was effective or highly effective for the purposes of flood risk mitigation in Flood Planning Region 1. Students also thought that recruiting interviewees in person was the most effective interview approach, with 66% of student

responses finding in-person interviews to be effective or highly effective (66%), compared to only 20% of the students who thought that cold-calling was effective. A majority of student interviewees (60%) felt that the infrequency of recent flood events in Flood Region 1 resulted in interviewees providing less useful information because they either forgot or did not remember flooding experiences in their recent memory. The students also generally thought that the three different survey components (web map, flood risk standards and flood management goals) were all effective, with 80-86% of student survey responses viewing these three components as effective or highly effective. 57% of student survey responses also thought that the media outreach conducted for the study was as effective or highly effective for the objective of "increased visibility and public response" to the flood outreach study. Students overwhelmingly agreed (86%) that interviewees were likely more open to being interviewed by University students compared to a non-student interviewer.

While most student participants found the study approaches overall to be effective, the students also thought that some of the survey questions provided were hard to understand and that educating the interviewees more would have resulted in better quality survey responses. While 86% of the student researchers thought that the questions related to identifying flood prone areas on a map were easily understood by the interviewees, about 30-42% of the student researchers thought that the main body of the flood study interview questions was not easily understood by the public interviewees. One of the key comments for improvement in the study by students included conducting pre-interview background education for the interviewees.

Table SI 1. Sample output from the survey questions pertaining to *flood study effectiveness* given to student researcher participants.

Questions 1-7 (and answers in student count numbers) on **Flood Study Effectiveness**					
Question 1: What are your general opinions concerning the value/effectiveness of the following aspects of the flood study outreach? Think about this from the perspective of the effectiveness of gathering data from the public on flood risk.					
	Not effective at all	Somewhat ineffective	Neutral	Effective	Highly Effective
Cold calling potential interviewees.	0	4	8	2	1
Recruiting interviewees in-person	1	2	3	7	3
Web Map Survey questions indicating flood prone areas	0	0	2	6	7
Flood survey questions on minimum flood risk management standards	1	0	2	8	4
Flood survey questions on establishment of regional flood planning goals	1	0	2	7	5
Question 2: The Region 1 zone is known for having significant, yet infrequent flooding events that impact rural residents. Did you get the sense that the infrequency of flooding observed in the Flood Planning Region 1 resulted in interviewees providing less useful information because they either forgot or did not remember flooding experiences in their recent memory?					
	No	Yes	Probably	Unsure	
	3	6	3	3	
Question 3: Did you get the sense that interviewees were likely more open to being interviewed by you because you were a University student compared to a non-student interviewer?					
	No	Yes	Probably	Unsure	
	0	12	1	2	

Flood study student experience and skills Qualtrics survey questions

Table SI 2 is an example from the sample output from the flood study student experience and skills. In response to the survey, 67% of student respondents agreed or strongly agreed that the hourly pay was adequate, with only one student noting that they thought the hourly pay was inadequate. In addition, there was a split among the students in terms of how important the paid research experience was to their ability to participate in the study. Nine students agreed with the statement "it was important to be paid for my work to support going to school." Five students agreed or strongly agreed with the statement "I needed to be paid to participate in this research project because I lost hourly pay from my regular day job while taking part in this study" while 5 students disagreed with the statement.

Several students also commented in the survey that having the study occur for a longer period of time during the semester would have helped them participate more and gain more professionally from the study. And while 92% of students thought that their training for participation in the

study was adequate, 64% would have preferred more practice doing interviews during the study training.

Only 4 students who took the survey participated in media outreach (radio, television interviews). 75% of those students agreed that participating in the media outreach was a great learning experience and boosted their confidence. The 10 students who did not participate in media outreach (due to mainly schedule conflicts) would have liked to have participated if given the opportunity (60%).

Table SI 2. Sample output of responses to survey questions pertaining to *experience building student skills* given to student researcher participants.

Questions 1-11 (and answers in student count numbers) on **Student Skill Building**			
Question 1: How would you characterize your feelings about the amount of training and practice conducting the public outreach research before and during the process?			
More than adequate training	Training was adequate, but I would have preferred more practice doing interviews	More training was definitely needed	More training was needed and would have made me feel more comfortable volunteering for more outreach activities than I ended up doing
4	9	1	0

Question 2: Were there any reasons that you did not volunteer for more outreach opportunities? Select all that apply.	
I did not feel as prepared as I would have liked.	1
I found it difficult to make the time for it.	7
I had a bad experience that colored my willingness to volunteer more.	0
I found that it did not pay enough to justify my spending more time on it.	1
I found it difficult to work with other students in my group.	1
I did not like having to travel so far.	0
I sometimes did not find the activities meaningful.	1
I found it difficult to "put myself out there" in conversations.	1
None of these reasons apply to my situation	5

Question 3: Please select the skills that you felt were most developed or improved by your participation in this study. Select ALL that apply.	
Organizing data	4
Communicating with a diverse audience	7
Listening and taking notes	6
Learning how to conduct interviews	9
Teamwork.	7
Multi-tasking	6
Time management	7
Gaining knowledge on how to reach rural communities and understand their needs with respect to flooding	10
Interpersonal and leadership skills	8
Dealing with unexpected problems or challenges	8
None of the skills apply in my situation	1

Interviews

Faculty were responsible for contacting students–a PI would directly contact the students assigned to him for an interview and set up the interview, while one PI would send a reminder email to all students every Monday morning throughout the allotted open period of the survey encouraging participation. Students were not required to participate in either instrument. However, students were encouraged to at least click on the Qualtrics link in the email and select the option to opt out of participating in the survey. This measurement was in attempt to obtain 100% student participation.

We were able to interview seven (7) of the students who participated as student researchers in the flood outreach study. We provide their general demographics in **Table SI 3**. To conduct the interviews, we wrote an interview protocol consisting of nine (9) questions. The questions and the general experimental design reasoning for each question is provided in **Table SI 4**. The questions and the method of recording and seeking consent for data to be used in research were approved as independent Institutional Review Board (IRB) processes for human subject research at each university. There were no comments from IRB members which required the interviews to be conducted differently between each university. We originally selected eight (8) students whom we would ask to give a 30 minute interview. We based the selection of students on the following factors--who spent the largest number of hours being involved in the study as a researcher, who represented a cross-section of the differences in university attending and major, and the geographic outreach area where the students were actually sent. We then assigned two students at random to each of the four study authors, and each author initiated an invitation for students to participate in the interview. Seven of the eight students responded in the affirmative. One student never responded to our interview requests after repeated attempts.

Table SI 3. Demographics of seven (7) students interviewed concerning their student researcher experiences.

category	interviewee breakdown
gender	male (2), female (5)
race or ethnicity	white (4), hispanic (1), black (1), mixed race (1)
academic level	undergrad (5), grad (2)
field	engineering (4), geoscience (3)
first gen	first gen (3), unknown (4)
hometown	within study region (4), outside region (3)

Table SI 4. Questions given to interviewees in the eleven question protocol.

no.	basic content	question
1	basic identifiers	Please state your name, university, and major field of study. Note that your name will be replaced by a pseudonym on the final interview transcript.
2	your role	How would you describe your role in this flood project? What were your responsibilities? What were your contributions?
3	pre-project expectations	When you first heard about this project opportunity, what did you think it was about? How was your experience similar and different from your initial expectations?
4	easy work	What did you find to be easy about your work on this project? What did you feel like you

		were already well-equipped to do?
5	hard work	What was hard about this project for you personally? Where did you struggle?
6	training and preparation	What training was beneficial? What training did you feel was lacking in any way?
7	onboarding	How would you describe the amount of time and the difficulty of this onboarding?
8	purpose of study	Having had this project experience, what do you think the purpose of the flood outreach study was?
9	gains from experience	What did you gain personally or professionally from your participation in the flood outreach?
10	people in our flood region	What did you learn about the people of our region that you did not know before?
11	advice for future	If you could give one piece of advice to someone that was to conduct a similar kind of study concerning natural disaster risk outreach, what would it be?
12	final thoughts	Do you have any final thoughts you would like to share?

One study author received the audio files from the interviews and had them transcribed with a professional service. That author then converted all mentions in the transcript and the metadata to pseudonyms. The names chosen were names found in no other students out of all of those hired as researchers, and we chose the names to maintain the gender of each student. Each de-identified transcript was then placed in ATLAS.ti 9.1.7 qualitative data analysis software to analyze with primary coding and summarizing. Only the analysis author maintained the pseudonym and real name key, and that author use structural coding of all of the interview data. By structural coding, we use the definition from Saldaña 2009 whereby a block of quote is marked with one or more codes with a short phrase indicating its content [5]. Rather than use many emergent themes from the structural coding, we choose to pick a few of the most common structural code groups to summarize student responses and sentiments in areas that most pertain to the study research questions.

The qualitative data analysis we did as structural coding yielded the code descriptions found in **Table SI 5**. The purpose of this coding was simply to describe what students were talking about. Clearly, what they talked about was highly dependent on the questions we asked them. Yet the content still varied significantly according to student responses. We grouped the codes into three board themes of content which are The Research Enterprise, Experiences, and Educational Gains. Each of those themes has three to four structural codes. In the text, we selected one from each interview theme. In this section, we will discuss the results from a few further examples.

Table SI 5. Explanation of structural codes used to analyze interview transcripts. Colors organized by interview theme–blue = the research enterprise; salmon = expectations; light green = educational gains.

structural code	code description
Research purpose	Direct or indirect information student researcher shares indicating the reason they feel that the research study was conducted. May include second-hand information from those the students interviewed concerning what they thought about the purpose of the research.
Researcher role	Identification of the purpose of or specification actions used in the research which students personally experienced
Onboarding	Impressions from students concerning the process of onboarding as it contributed to research study timelines. Also includes onboarding value in research jobs.
Ways to improve	Student researchers indicate specific ways that they feel the research experience could be improved or ways that flood/disaster outreach projects like this could be run better in other locales.

Expectations	Expectations student researchers had about what research as a job would be like, what the outreach experience would be like, or instances where they realized a previously unstated expectation was challenged in their experience.
Training and preparation	Explanation towards the training that students received, generally through a conscious provision of training by project faculty leaders, or impressions students had concerning their pre-project preparedness for this kind of social outreach research.
Difficulties	Difficulties student researchers faced in trying to conduct flood outreach interviews or other aspects of their researcher position.
Success and ease	Descriptions of aspects of the outreach project were easy, fun, enjoyable, or particularly rewarding.
Flood	Information student researcher shared specific to the nature of flooding or specific flood events or locations that they found through the community outreach.
People, region	Things student researcher or interviewer learned about the people that they met during outreach or aspects of the wider region including such areas as culture, climate, local government, attitudes, and community relationships.
Student growth/gain	Instances where students consciously or through their comments indicate a new perspective, a new skill, a challenge they overcame, or professional/personal growth.

The research enterprise

Researcher role

The researcher role content students provided transitioned from the larger purpose of the research to their particular perception of themselves within the research enterprise. A few choices phrases students provided on this include:

- Interviewer
- Brought back information
- Transcribed information and put into database
- Cold call on the phone
- Taking notes
- Asking questions
- Use our own networks to find good interviewees
- Travel on long car rides
- Keeping track of paper and signatures on informed consent
- Like a secretary/scribe

So students saw their role as three major functions within the research enterprise. They had to make calls or use their professional/personal networks to establish a time and place for an interview with a knowledgeable community member. They had to physically go out or sometimes on phone/video actually collect that information. Then they had to record, organize, validate, and return that information to the project faculty leadership. From the interviews, these students do not seem to indicate that any one person did all of these things. Some leaned more into what they felt was their strength in meeting people leading them to do more cold calling and conducting the interviews. Others felt that they were not as outgoing and chose and/or were selected to do more on documentation and storage of information.

Most students seemed aware that their role was not “the end” of the research. They were just the initiation of data collection. No student seemed to feel like their role was a chore, a bother, beneath them, or not beneficial. They expressed enjoyment in just getting out and away from their usual campus lives. On this point, one student said:

> I gained really great experience with the interviewing and just the overall, the background of flooding. I feel like I gained a lot of knowledge and data over flooding because we had to research it, we had to know why, we had to explain it. We had to be able to back it up our explanations. And for somebody that doesn't study or do this type of work with ours, just environmental engineering has to deal with water, every type of hazard and pollution in general. But other people might not even have an idea of what that type of stuff is, or they do not... They don't really care. One of those. But I feel like I did gain a lot of good stuff. It was pretty enjoyable. – Otto

This student was aware of how they had to have some knowledge to gain access to people from interviews, and they knew that they had a fair amount of environmental engineering background which should prepare them to do this. The impression suggests that the student felt the need to learn more than what their academic background provided and enjoyed to both explain more about flooding and persuade that it was important for the region that he visited.

Onboarding

The faculty researchers expressed frustration at the amount of trainings that students had to complete to be employed for the research project. The source of this frustration was an apparent mismatch between the amount of trainings that students had to complete and the amount of time which students would actually be working. Due to a compressed timeline for when outreach funding was available, many students might only work 5-6 weeks on this project but be required to go through successive trainings which might take several days to complete. The onboarding was thus perceived as such a barrier for students to get started and a chore for students, especially to the degree that some training seemed irrelevant for a simple community interviews.

The students were aware of the faculty wanting to lower the amount of training and onboarding in their efforts to expedite the process. Yet, did students feel that the training was beneficial? Did they feel as if the amount of training was overbearing? All seven interviewees had some opinion about the onboarding as relayed in these excerpts:

> It sucked. I filled out all the paperwork, I did everything I was supposed to, but they said we were supposed to get paid monthly and it wound up that I got paid a month into summer and I was just like, what? I just kept waiting and waiting and also, I couldn't swipe in. I couldn't do time punches 'cause they didn't get my information put in or I don't know what happened, but neither Ernest or I could punch in. **It was so awful. It was bad.** – Gwen

> **I do not feel like the onboarding process was difficult at all**. It was really truly a go at your own pace because everything was online, and I believe there was a deadline of when we had to have it completed, but it was enough time where you could have done one or two of the little training modules and all of those things a day at a... You could do a couple a day if you wanted. I prefer to get my stuff done as fast as possible, so I did mine I think within two days, and I felt like it was extremely easy. There was nothing difficult about any of it. – Mabel

> Three, four [weeks], almost a month and a half, like a month and a half. – Margo (regarding amount of time spent on trainings)

> I think, I spent probably a little bit more time than what was needed personally because I have anxiety, so I had to go through it thoroughly. I can't really remember how much time I ended up spending on it, but I do remember it not being that difficult of a process. – Wanda

> Yes. The human research modules and all that. **Definitely very time-consuming, but difficult**. - Ryker

We summarized these comments in a general sense on their sentiment about onboarding. We found that two interviewees were negative on the onboarding experience, four were neutral, and one was positive. This was an interesting finding in the **Research Enterprise** theme because it was an instance where what was considered onerous or unnecessary is experienced differently between faculty research leads and the student researchers. The difference in perception could be explained by the difference in roles between faculty and students. Faculty were more acutely aware of the time restraints on getting the outreach project done more than the students. Additionally the students knew very little about the work for some time and perhaps did not truly understand their role or the nature of the research until they had already begun interviewing or processing data. The students thus had come to expect long onboarding for jobs (as students change jobs often), and some did not mind a slower pace for something which was honestly new to them. They may have wanted more time to get used what the nature of the outreach project.

Ways to improve

When asked about how this outreach project could be conducted differently in the future, students provided many specific answers. Frequently these answers were related to surmounting particular difficulties they had experienced in their roles of setting up interviews, conducting interviews, or managing data. Specific improvements they mentioned were in three areas of rural resident interactions, timing and preparation, and practical issues.

Interactions with rural residents	Timing and preparation
Finding a way to "coerce" or "pry" information better out of potential flood interviewees.	Allowing more time than a month to conduct so much outreach in so many counties.
Being "accepting of the community" and allowing for the time it takes for some residents to talk a while.	More training on safety procedures given that these areas were unfamiliar to students.
Using the website for survey collection without the need to travel directly to area residents.	Provide more time and means for student researchers to know flooding more comprehensively.
Practical issues	More discussion on leadership in communication from faculty.
Use of more official clothing.	
Taking more people out than just two at a time.	
Bringing faculty with the students on interviews.	

Our interest in these improvement areas is less in how to conduct an outreach study of this kind and more into what these suggestions tell about what students feel that need to succeed in field studies. What students said indicates that they struggle to know what they are doing in flood outreach and how to envision success. Being that these were all STEM students, they did not have much training in how to conduct interviews or how to persuade or use salesmanship as might be the case if they had business or communication backgrounds. Ways to compensate for any feelings of uncertainty are expressed in the practical issues of more official clothing, more people, and having additional training on flooding background.

> Oh, the purpose of the flood outreach study to me was to gather as much information as we could from people who are being affected by the flooding, **especially in agricultural areas where it affects their farmland**. So we could turn that into the state so they could start the process of

trying to get those individuals who are affected by the flooding some resources to help mitigate those issues. – Mabel

I feel like that was a more, it was a right approach because we're getting the people's word and we're getting what people know because we don't live in that area. So we don't really say like, "Oh, this side's flooding." And the people there actually know what's going on and get... Doing the interviews and stuff, we got **more of a personal type of understanding of what they thought that the certain problems that they were having in their area**. In Childress or in Canadian, we were talking about the flooding and stuff. They said it was in one pinpoint in their city that mainly just flooded. But other than that, nobody else was bothered. But it was a big, big area where it would flood consistently or over a period of time. – Otto

I felt like the main purpose of the flood outreach study was to **understand how flooding works in an area that is where our climate is mainly dry**. And even though a lot of people that we've interviewed was like, "I don't understand your question, we don't get rainfall here." It was like, "Well, what has been your experiences when we do get rainfall?" Because I've only been here for five years and every time we get rain it pours. – Margo

Experiences

Some areas of the Experiences codes were covered in some fashion under Research enterprise. We thus chose to focus this results analysis on just two codes—Expectations and Success and Ease. Students experiencing confirmation of expectations included the following statements:

Expectations

I would say that my expectations were about the same as what happened. When I talked to Dr. B and Dr. C. **We had an initial meeting that just kind of outlined how the study was going to go, and it was pretty accurate**. I mean, I was part of the first half of the research group, research group A, so I was working with doing the actual interviews, doing all that stuff in person, and then research group B was doing the data or working with all the data, so it was pretty straightforward. – Pearl

Well, I mean, it pretty much said it all within the research title, Outreach Program for Rural Flood Communities… I guess I expected exactly how I thought it was going to be. It was nice getting out there, talking to the rural communities and just having a good chat with them about what they know of the town and how they see things during the flood. A lot of the memories were hazy because currently in a drought. But yeah. It met my expectations and I had a good time with it. – Ryker

Student experiencing refutation or surprise as to what the outreach would be like compared to what actually occurred were far more common:

Okay. My initial thought about what it was going to be like was that I'd be talking to a lot more people and **I'd be getting some crazy stories, which I did, but not as many as I thought I would**. And it was a lot harder to get people to talk than I thought it would be 'cause especially in small towns like Henrietta. They don't like talking to people that much, so we had to kind of wander around to see if we could get anyone to talk to us. – Gwen

When I first heard about the project, I actually thought we were going to go out and look at those specific sites that people were seeing were common flood areas and see their soil types, vegetation, which was kind what we did. We did go out and look at those sites. So we got a broad

of skew actually what contributes to those flooding areas, what was really different, **I didn't think I would be speaking to residents as much as I was.** – Margo

I didn't realize that some of these interviews will be two hours long because that's how much information and life, like history that they have with these actual events, because most of the time you ask a question, someone will answer it in maybe two or three sentences, you go onto the next one. - Margo

At the beginning **I thought we were going to be going in big groups and campaigning** at different local stores and trying to just get the word out. I think we were supposed to do that, but probably due to COVID effect, the defects and all that, we didn't, I believe it's had to do something with that… - Otto

Success and ease

There were 35 unique quotes in the interviews amongst the seven (7) interviewed students. All students said something concerning what they found easy or where they thought they were successful in the research. Some of the areas that they mentioned along with the number of students that mentioned this are provided in **Table SI 6**.

Table SI 6. Topics mentioned where students felt that they were successful or that it was easy for them. Total quotation in this analysis was only 28 due to some duplicative themes in the original 35 quotes.

topic	count	fraction
Being a student researcher	1	4%
Data recording	3	11%
Gaining experience	2	7%
Just fun	3	11%
Partnership and group dynamics	6	21%
Research itself mattered	2	7%
Speaking to residents	10	36%
Training, onboarding	1	4%

The two largest areas spoken of concerned the actual process of speaking to residents in rural communities and the process of working either within the larger group of students conducting research with professors or in small project outreach teams. A few quotes help illustrate the way that students felt about talking to residents. Though nearly all of the students mentioned speaking to residents as being easy or enjoyable, they experienced this differently or for different reasons.

People are more willing to talk to you if you're a student and you let them know that you're a student conducting research. If you just let them know, "Hey, this is what this is about and if you're not willing to participate, that's okay. We totally understand." But people are really, really, really into helping college students. – Mabel

The easy part was actually when we interviewed and stuff, **talking about flooding, talking about the natural disasters** that were happening and why the flooding was happening. That was pretty... I mean, it wasn't easy, but just being prepared led me to be more ready about that type of situation… - Otto

> I felt like I was well equipped to do the interviews. I have had previous work experience in sales, and so **I'm pretty good at just talking to people**. And also, I've never really been shy, so just talking to people was easy and I knew exactly what to ask and what I needed from them. – Pearl

From these quotes and others, it seems clear that many students felt that it was easier for them to talk with area residents about flooding because they were college students (less threatening), and they felt prepared to conduct these interviews. Several students acknowledged that they "liked to talk" or had jobs in sales or other fields that made it easier for them to speak with residents. There were two students who interviewed who certainly enjoyed the interviews, but they had to work up more of their ability to "take the initiative" to begin the interview or they preferred to do more of the work on the recording information because they were not as comfortable directly talking with residents.

An area that was surprising in terms of ease and enjoyment was that students just had fun with the experience overall. For the faculty researchers, they had a job to get to do, and students understood that they had a role in getting that job done. It would seem, however, that many students simply enjoyed the experience itself perhaps even more than being concerned with the amount or quality of interview data that they collected:

> I feel like we went over all the… **It was a fun project though. It was interesting**, really, when Dr. B approached me over the research and stuff, I really didn't know. I was like, "What? How, this and that." But after doing it was a pretty cool thing that we did, and it just gave me a lot of, it opened it up. Being in this type of... Or doing this type of work. It was really interesting. – Otto

> And getting to just travel to these different rural communities that, one, I've never even been to. Been to quite a few of them, so it wasn't unfamiliar to me, but **getting to branch out to different regions and just talk to different people in the communities, that was actually really fun**. Just getting to talk to the different people, hear their stories about the town and just feel out everything. And we got a lot of good information. Some people love to talk, so they would go on for hours about just decades of different information throughout their time in that area and just the stories they would tell along with it. So that was definitely beneficial. I just thought that was good. And then it was just fun to be a part of it and get the experience. – Ryker

From this last experience provided by Ryker, it is clear that he was aware he was there to do a job and get "good information". Yet much of his interview discussed the joy of "getting out there" and "socializing".

Educational gains

Student growth and gain

While students learned a good deal about flooding as both a physical and social concept, they also gained in more conscious personal and professional growth. We grouped student impressions of what they gained from the work, which has particularly bearing on their futures, into this Student Growth and Gain code. Looking through the data, there were eight (8) items which students self-identified as an area of growth for them. Three stood out most frequently in empathy/impact, people skills, and research methods.

As we have already discussed the nature of people skills in part in earlier themes, we wanted to focus here on empathy/impact and research methods. Most of the questions concerning where we

tried to elicit a response on what students gained from their experience were open-ended. The question was at the end of the interview protocol which could prime students for particular responses, but it seemed to us that these responses were genuine in part because they were unexpected.

There were several students who mentioned various aspects of learning how people in rural communities think, the challenges they struggle with, or gaining an increased respect for the lives that they lead. Students themselves might not have said in any exact way, "I grew in my understanding and appreciation of rural living," but their reflections on interacting with rural residents, sometimes those who are older and who tell "beautifully long stories" seems to bear this out.

> **I didn't know how bad rain was for farmers** in our area post drought, you would think that post drought rain would be really good, but I didn't realize that that can destroy a whole season's worth of crops just in one go. And I didn't really realize anything about the farming area that I've been around because I grew up in Amarillo and most of my experiences has been city based. So just getting to talk to farmers was really cool. – Pearl

> Personally, I gained interpersonal skills and **more respect for people in rural communities**. They were really nice and they were really helpful most of the time. They obviously wanted to participate in some way. It was really interesting. – Wanda

> I personally feel like it helped me to **understand a little bit more of what people are going through** when, let's say they live in unincorporated areas. I didn't realize how bad the flooding was out there, and I live in the city and it floods relatively bad here, so I felt that the knowledge I gained from participating in the outreach increased in regards to flooding in rural areas. – Mabel

Some of the interesting realizations concerning research methods concerned things like what roles there are in research, what methods count as "research", what objects of study are part of research, and learning that research is fun (perhaps for the first time). One interviewee had a particularly notable response on these points concerning what they thought their field and their research would be and how different it is to involve the lived experiences of others are part of research. She was not the only student who expressed this idea that students from geoscience and similar fields just "live in the rocks" or spend their time "talking to rocks".

> Professionally, I think it's just pretty good to have that kind of student research on your resume in general. Participating in something like this can help with future jobs as well because you had to go out and spend time talking to people, which is something that I tend to not do in my science**. I live in the rocks** basically. Yeah, it was something that doesn't necessarily 100% pertain to my research, but it was helpful to gain that kind of in experience from. - Wanda

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