Undergraduate Biology Students' Climate Change Communication and Training
Experiences

by
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Dedication

To my mom and dad, thank you for always being my biggest cheerleaders.

To my friends and roomates Abigail, Ashton, and Lillie, thank you for keeping me sane and reminding me that having a little bit of fun is necessary for my mental health.

To my amazing group of friends, thank you for always believing in me and supporting me at my lowest moments. I am very grateful to have you all in my life.

To my late grandmother, whom without I would not be who or where I am today. I am eternally grateful for the time I spent with you. Your passion for learning and support for me to be the first college graduate of our family has kept me driven throughout my degree and the thesis process. This is for you Grammy Peggy.

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Abstract

Although climate change is a major threat to humanity, scientists have had trouble effectively communicating about it. Undergraduate science students represent the next generation of science communicators and can be boundary spanners within their communities but there is little research about how undergraduate students communicate about controversial biology topics like climate change and how they are being prepared to do so. We wanted to explore a potential need for undergraduate student training on climate change communication. We surveyed 191 biology students at 38 universities about their communication frequency and preparedness. To understand student experiences in more depth, we interviewed 39 of the survey participants. We asked students to describe their experiences communicating, when they feel confident or not, and to describe their experiences and needs when learning about climate change communication in their classes. Descriptive statistics of survey data showed 25% of students communicated about climate change on a weekly basis. Students felt moderately confident discussing the causes (54%) and effects (60%) of climate change, but not the solutions (36%) to climate change. Qualitative coding of 32 interviews (Cohen's $\kappa = .90$) showed that while students are communicating about climate change, it tends to be only to those who already accept climate change. Students did not feel prepared to communicate about climate change to non-scientists or those who disagree with them about climate change, so most students avoided interacting with them. Participants described a lack of scientific communication training, even though students had a desire to be taught effective communication skills. These results indicate that students are already science communicators but tend to "preach to the choir". While the undergraduate biology students we interviewed wanted to be taught effective

communication skills, they were not getting it in their science curriculum. Further, our interviews indicate that if these students felt more prepared to communicate to non-scientists it may make them more willing to discuss climate change with people of differing views than their own.

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INTRODUCTION

Climate change has already caused widespread damage to the world's ecosystems and has greatly impacted the health and prosperity of the human race (WHO, 2015; IPCC, 2014). Scientists have difficulties communicating about climate change and other controversial topics as they do not know how to bridge the religious or political divide effectively (Kahan, 2015). In the case of climate change, there is evidence that scientists have not been communicating effectively. While 97% of climate scientists agree that climate change is being caused by humans (Cook, et al, 2013: Carlton, et al., 2015; Anderegg, et al., 2010; Doran & Zimmerman, 2009;), 42% of Americans do not believe that scientists agree that climate change is being caused by humans (Leiserowitz, et al 2019). Additionally, 47% of Americans do not believe that climate change will harm them personally (Howe, et al., 2015). Communication wise 64% Americans indicated that they rarely or never discuss climate change (Howe, et al., 2015). They also indicated that 66% only hear about climate change in the media at least once per month or even less (Howe, et al., 2015). This indicates that science communication hasn't been effective, as a large majority of the public does not accept, rejects, or is not concerned about climate change. So how can we have more effective communication?

Undergraduate biology students are the next generation of science communicators and communicators within their communities. This allows them to be boundary spanners by communicating about scientific topics on a regular basis with people in their community (Shah, et al., 2022). They are the future doctors, nurses, and scientists of the world. These students come from many diverse communities where they may even be the

only person in the family with college-level science education (Shah, et al., 2022). These diverse communities include communities of faith and conservative communities. The students may even be scientific communicators now, but there has not been a lot of research on how to train students on effective communication, especially with controversial topics such as climate change (Shah, et al., 2022).

There have been studies on how to teach students to present research on non-controversial scientific topics to other students, but not on controversial topics and to non-scientists, so why are controversial topics difficult to discuss? These topics have a lot of emotion behind them. So, to communicate effectively you must consider the emotions and values of the audience or person you are communicating to when trying to communicate these controversial topics to people who do not accept them. However, we do not know if students are being exposed to this knowledge or if they are currently using effective strategies to communicate about climate change.

THESIS STATEMENT

This project aimed to look at undergraduate science students' communication about climate change to non-scientists. This project was an exploratory study, as not a lot of research on this topic has been done. The research questions we explored were:

1) How often do students communicate with non-scientists about climate change, and how prepared do they feel to communicate effectively?

2) What are undergraduate biology students' experiences communicating climate change to non-scientists?

3) a) What communication strategies do undergraduate biology students use that they think are effective and ineffective when communicating about climate change?

b) Are the strategies they use recommended by published literature?

4) What experience, if any, have undergraduate biology students had learning about communicating climate change?

5) What do undergraduates think they need to effectively communicate about climate change?

METHODS

Middle Tennessee State University's Institutional Review Board approved this study (protocol no. 22-20267).

Recruitment

We recruited a national population of undergraduate biology students from R1 and R2 universities to survey and interview. In Fall 2021, a recruitment message was sent to biology department heads at 260 private and public research-intensive universities across the United States. The list of schools came from the Carnegie classification list; the emails for the department heads were found on the department website for each school (Carnegie Classification, 2022). The recruitment email asked the department heads to share a message asking their undergraduate students to volunteer for a survey and interview about their experiences when communicating about climate change in exchange for a chance to win a $50 gift card and receive a $25 gift card for interviewing. The undergraduate students completed a survey to collect quantitative data and serve as a sample pool for interviews. Survey participants were screened for students who had high acceptance of climate change and communicated about climate change more than once a year and emailed them to request an interview. Students that communicated about climate change semi-frequently, were screened as we wanted to hear from students who have

experiences with communicating about climate change. In total 115 students from 38 universities completed the survey, and 38 undergraduate students from 14 universities were interviewed about their experiences communicating about climate change. Students were from a variety of biology-related majors, including but not limited to, botany, environmental science, pre-med, and ecology.

Surveys

A survey was created to explore how often students communicated about climate change and how prepared they felt to communicate accurately. This survey was also needed to identify a sample of interview participants who were high acceptors of climate change and had experiences communicating about climate change. The survey asked students the extent of their communication about climate change, who they discussed climate change with, how frequently they communicate, and how they communicate about climate change on social media. These questions were adapted from a survey used in a prior study to study biology students' communication about COVID19 (Couch et al., under review). To characterize the student's level of acceptance of climate change we used a previously published instrument comprised of six questions (i.e., "The climate is always changing and what we are currently observing is just natural fluctuation," "The burning of fossil fuels over the past 50 years has caused serious damage to the planet's climate," etc.) on a 5-point Likert scale (Dixson et al., 2017). To build response process validity evidence for our measures (AERA, 2014), cognitive interviews were conducted with 5 undergraduate students to revise any language in the surveys that was unclear to students. To explore the frequency that students communicated about climate change, we asked, "How frequently do you talk about climate change with others?" We were also

interested in seeing with whom the students were discussing climate change and what percentage of the time they were talking with their family, friends, or others about climate change. Since social media has become of big interest in communicating science and especially controversial topics, we wanted to understand if and how students were communicating about climate change on social media. To do this, we asked about the frequency in which students saw, interacted with, or wrote posts on social media about climate change.

To contextualize the sample, we also collected the student's general demographic information including their gender, race/ethnicity, LGBTQ+ identification, hometown type, and parental level of education. The surveyed students were from 21 states across the United States (Figure 1). Additionally, the aggregated demographics of the 191 survey participants are in Table 1. All survey questions can be found in the Appendix.

Figure 1: States in which participants reside

Table 1: Survey and Interview Demographics

		Survey % (n = 191)	Interview % (n = 32)
Gender	**Male**	16.0	25.0
	Female	79.05	69.0
	Non-binary	4.0	3.0
	No Answer	0.5	3.0
Race	**White**	62.0	40.0
	African American or Black	6.0	9.0
	Asian	14.0	31.0
	Latinx or Hispanic	7.0	9.0
	Multiracial	8.05	3.0
	American Indian	1.0	3.0
	Other	0.5	3.0
	Decline to State	0.5	
Year	**First Year**	17.0	12.0
	Sophomore	17.0	19.0
	Junior	26.0	22.0
	Senior	36.0	47.0
	No Answer	4.0	
Major	**Biology**	83.0	94.0
	Non-Biology	13.0	6.0
	No Answer	4.0	
Career	**Research Sci**	24.0	22.0
	Healthcare Professional	47.0	69.0
	Other	28.0	9.0
	No Answer	1.0	

Interviews

The interview script was developed to explore undergraduate biology students'

experiences communicating about climate change, their current habits and strategies used

when conversing with people who may not accept climate change, and their prior

preparation in biology classes for communicating about climate change to nonscientists.

The focus was on their personal experiences with their friends, family, peers, and

strangers in person and online, what did they think made the conversations ineffective or

effective, how did they feel during conversations with people who disagreed with them, what strategies do they use to avoid potential conflict, and their experiences being taught how to communicate about climate change to non-scientists or people who don't accept climate change. A copy of the final interview script is provided in the Appendix. The interviews were audio recoded and transcribed via zoom and were an average of 45 minutes long. All interviews were conducted by a single researcher (M.A.) to ensure the interviews were consistent.

Interview analysis

Once an interview was completed, the researcher took detailed notes to begin to identify patterns. The interviews were analyzed using deductive and inductive coding, with constant comparison methods (Krippendorff, 2018; Cho and Lee, 2014; Glaser and Strauss, 1967; Glesne and Peshkin, 1992) among the team of coders. We used deductive coding to identify known effective communication strategies from prior literature that the students are currently using. The seven deductive codes were the following: meet them where they are ("Using words that lay people know can increase the receptiveness of climate change and other polarized scientific topics;" Frameworks Institute, 2015), respect and open mindedness ("Approaching discussions by being respectful, open minded, and ensuring you are listening allows for more effective communication about controversial topics;" Parker, et al., 2018), personal effects or local evidence ("Discussing personal impacts of climate change is effective for communication by focusing the broad topic of climate change to something easier for audiences to connect to;" Merzdorf, et al., 2019), trusted messengers ("Using trusted messengers that people

know and are reputable may allow people to be more receptive to accepting climate change;" Langan, et al., 2019; Fiske, et al., 2014), consensus messaging ("Stating the scientific consensus on anthropogenic climate change to climate change deniers can act as a mediator of attitudes about climate change;" Lewandowsky, 2020), hope ("Being hopeful when talking about climate change is beneficial for effective communication;" Li & Monroe, 2019; Ojala, 2012), and engagement ("Engaging with people who disagree as people may become polarized when they do not communicate with people with differing viewpoints;" Shah, et al., 2022). Inductive coding was then used to identify themes from the interview transcripts describing the students' experiences when communicating about climate change, what the students need to be better communicators about climate change, and current strategies that the students are using, and think are effective or ineffective. After all interviews were completed, they were transcribed, and pseudonyms were assigned to each interview transcript to protect the participants' identities. The interviewer (M.A.) and her research mentor developed a preliminary set of codes based on the 32 interviews conducted. Then the interviewer and a second researcher each read four transcripts independently and wrote down themes they noticed across the four interviews. We then met to compare the themes they identified. We iteratively developed a codebook by continuing this process until the two researchers agreed on a set of themes in the data. For five of the interviews, we completed an inter-rater reliability analysis to ensure that our coding rubric was cohesive across the raters. This was done by independently coding five interviews and then comparing the codes each researcher found, which resulted in a high Cohens Kappa interrater score (.90) (Landis and Koch,

1977). The final coding rubric and be found in the Appendix. Quotes have been lightly edited to ensure clarity and protect the participants and their institutions.

RESULTS

Survey

The survey population consisted of 80% female, 16% male, and 4% non-binary students. The demographics of the participants' race/ethnicity was 62% white, 14% Asian, 8% Multiracial, 7% Latinx or Hispanic, and 6% African American or Black. The majority of the sample population were biology majors (84%), and 62% were upperclassmen. Roughly half of the students are preparing to go into healthcare professions (47%), while 24% are interested in becoming biologists or environmental scientists working in research.

Finding 1: Frequency, Preparedness, and Audience

Just as it was sought out for the target population, participants scored an average of 4.6/5 on the climate change acceptance scale. For the frequency of communication, 39% of students communicate about once a month and 23% about once a year or never (Figure 2). However, the other 39% of students discussed climate change on a weekly basis with 14% of those students communicating more than once per week about climate change.

How frequently do you talk about climate change with others?

never	about once a year	about once a month	about once a week	more than once a week

| 5% | 18% | 39% | 25% | 14% |

Figure 2: Frequency of communication.

Additionally, we were interested in who students were communicating with. Students communicated most frequently with their friends (52% of the time). Students communicated around 32% of the time with their families. Only 15% of the time students communicate with their acquaintances or strangers.

But how prepared did students feel to communicate about climate change accurately? The students did not feel prepared to communicate accurately about the solutions of climate change with 9% and 47% of students having no confidence or a little bit of confidence. However, the students do feel prepared to communicate accurately about the causes and effects of climate change (84% and 54%, respectively).

How prepared do you feel you are to communicate accurate scientific information to others about __?

not at all	a little	a moderate amount	completely

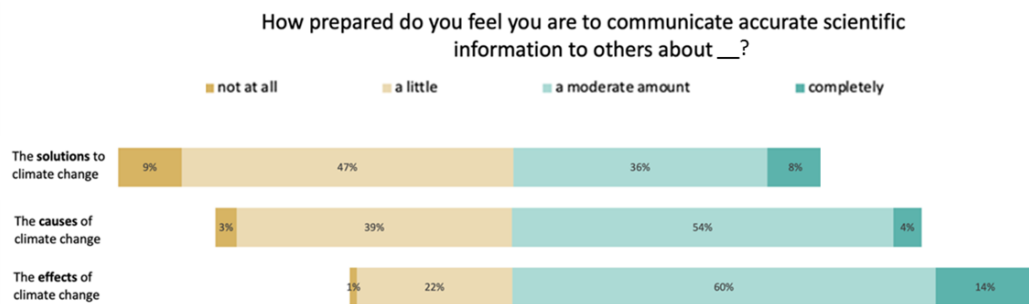|	not at all	a little	a moderate amount	completely
The **solutions** to climate change	9%	47%	36%	8%
The **causes** of climate change	3%	39%	54%	4%
The **effects** of climate change	1%	22%	60%	14%

Figure 3: Preparedness to communicate about climate change

When it comes to social media most students see posts/shares and like/dislike posts about climate change often; 32% of students said they saw social media posts at

least once per month. However, students were not actively communicating by writing their own posts or commenting on others' posts. Only 23% of students said they wrote their own posts or commented on others' posts about climate change once a month or more (Figure 4).
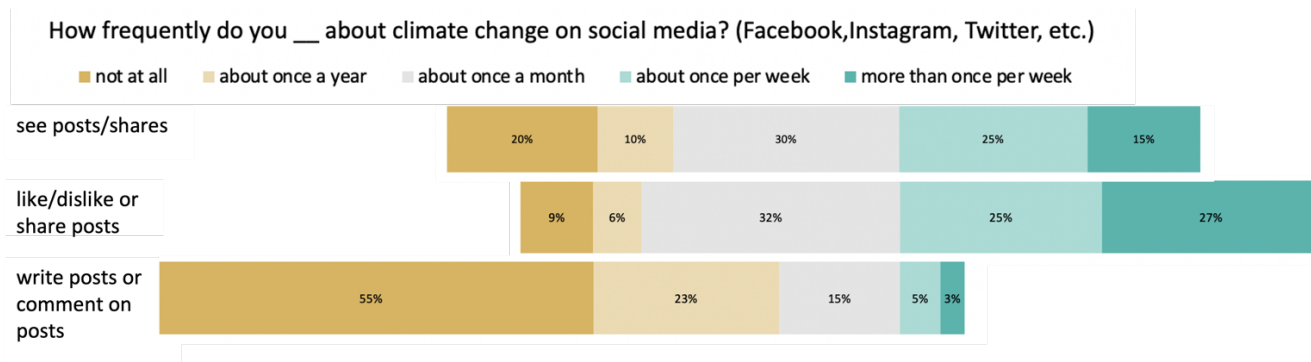

How frequently do you __ about climate change on social media? (Facebook, Instagram, Twitter, etc.)

	not at all	about once a year	about once a month	about once per week	more than once per week
see posts/shares	20%	10%	30%	25%	15%
like/dislike or share posts	9%	6%	32%	25%	27%
write posts or comment on posts	55%	23%	15%	5%	3%

Figure 4: Frequency in communication about climate change on social media

This could be because students do not feel prepared to communicate solutions, or they feel less prepared to communicate, so they are sharing other people's content instead of making their own. We will now dive deeper into those experiences through the 32 interviews.

Interviews

The final codebook consisted of 21 inductively derived codes that informed the research questions. We only kept inductive codes that were present in at least 3 interviews. There were also seven deductive codes in the rubric that were used to identify if students were using recommended strategies for communicating climate change to non-scientists. In the following sections, we present findings on the current experiences undergraduate biology students have had when communicating about climate change,

whether students are using effective communication strategies, and what training they are receiving to increase their preparation to communicate about climate change.

Finding 2: How do students describe their experiences communicating about climate change?

Students expressed learning facts or communicating about climate change from their own personal research and experiences (56%), involvement in environmental organizations (10%), and social media (47%). Students described having a limited network of people who are accepting of climate change (97%) and discussing mitigation solutions with these communities (59%). Lastly, 10% of students described feeling hopeless when communicating to people who do not accept climate change.

Organizational Involvement. Some students said that being part of pro-environmental organizations or movements on campus has made them feel more confident about communicating about climate change. For example, Sierra said that an "environmental club" she was involved in would discuss "ways we could reduce climate change or positive and negative aspects of climate change" and these discussions made her feel more confident and informed about climate change. Another student stated that she will "share posts about the environment" from an environmental club that she is a member.

Social Media. Many students said they share posts often about climate change on social media. Only one student discussed writing their own posts about climate change on social

media. For instance, Riley writes posts about ecology and species that they are passionate about like wasps because they are "treated poorly on the internet." Students described reposting specific posts based on their content. For example, some students reposted "graphs showing the change in temperature through the years" in their state, "one share equals one tree planted" posts, "infographics," "impacts in agriculture," and "deforestation and natural disasters." Another student, Andi, said this regarding communicating about climate change on social media: "I say social media is about less conversations and more about advocating and sharing information."

Limited Network. Most students described that most of their communication is limited to those within their network who are also concerned about climate change. Anne described that most of her friends were "science people," and during their conversations, everyone is "typically believing of climate change." Some students described their friends as more accepting or holding similar views on climate change as them, but their family has different views on climate change. For example, Claire's friends accept climate change whereas her family is "anti-science" and don't believe it is important for them to care about, as they "are not going to be around much longer."

Hopelessness. Some students describe feeling hopeless about the implications/current impacts of climate change when they communicate with others that are not supportive of climate change. Miranda stated that she felt "not hopeful for change" when talking to people who aren't accepting of climate change because if "they refuse to even believe it exists, then how are we going to express the urgency to improve the situation?" Another

student stated that he felt like there's "only so much we can do" and that "we can only hope they change their minds" when discussing climate change with a family member who does not accept climate change.

Mitigation Discussions. Many students say they discuss how they can mitigate climate change with their friends and family who also accept climate change. Chandni said that she and her friends "buy reusable straws and try to change the small things even if it is the larger companies' fault." James said that he and his friends discuss "ways that [their] city and the university" can improve their environmental sustainability and specifically by "promoting a greener landscape."

Finding 3a: What strategies do the students say they use?

Students described when they felt effective and ineffective at communicating. There were three themes that were expressed by students who had felt ineffective in their communication at least once (Avoid Disagreements [66%], Anger and Frustration [59%], Unknowledgeable [56%]). There were two themes in which students expressed they felt they were effective communicators about climate change at least once, which are provide facts (94%), be charismatic (56%), meet them where they are, be respectful/have an open mind, and use local evidence. The last three themes will be discussed in the next section as they align with prior literature.

Avoid Disagreement: Some students say they do not communicate with people who do not agree with them. Some students may say they feel like the person will not change their mind. One student, Jade, said that she sometimes "won't even bring it up with people who wouldn't agree with [her] just to avoid any uncomfortable feelings." Ashely stated that some people in her family aren't believers in climate change, so she mainly avoids bringing it up just because "they are kind of set in their ways." Although she did say she will bring it up "every once in a while" to try and slowly "scrape the bottom of the barrel" and educate them over time. Several students say they "stick to the facts" to avoid conflict when communicating to people who are not believing of climate change

Anger and Frustration. Many students described feeling angry or frustrated when discussing climate change with people who do not necessarily accept climate change. Students described these feelings mainly arising during conversations with family and strangers/peers about climate change. Riley described that they are sometimes quick to anger when communicating to non-scientists that may not accept climate change instead of "being an effective communicator and educating them."

Unknowledgeable. Many students felt they were ineffective in communicating when they were not knowledgeable about climate change or people's misconceptions. Jane described a conversation with a family member became ineffective when they started talking about "the non-scientific side of climate change" and she started to get caught up in the heat of the conversation as she had become increasingly frustrated during it. Another student stated that she knew the basics when discussing climate change but when

it came to specifics like "discussing renewable energy like windmills vs solar panels" she did not know enough information to feel comfortable talking about that aspect of climate change, which she felt was ineffective as renewable energy is a major solution to climate change.

Providing Facts. Almost all students said that providing evidence for or facts about climate change is an effective way to communicate about climate change. Brooke said that she tries to explain that it is a pressing issue by "backing up" the statements "with facts" because "it can help them see [her] point of view." Another student, Hari, said that "doing research and knowing the facts" is the best approach to communicating about climate change.

Charismatic. A little over half of the students expressed that being charismatic by having confidence and/or passion when communicating was effective. For example, Ruth said, "you need facts that you are confident in presenting for effective communication." Other students also stated that being "confident in your facts" and/or "stance on climate change" is necessary for effective communication. Some students also said that they felt showing that you are "passionate about climate change" or "certain areas" of climate change is effective when communicating with non-scientists and people who may not accept climate change. Another student Elizabeth said that for any type of communication it is important that you "look and feel confident" when you present your information because if not "people are less likely to believe you or listen to you in general."

Finding 3b: How do the strategies align with recommendations from prior literature?

Deductive codes were created to represent strategies recommended in the literature for effectively communicating climate change to non-scientists. It was found that students are using three strategies that are known to be effective when communicating about climate change, which are meet them where they are (59%), respect and open-minded (81%), and personal effects (81%). However, many students are not using other recommendations for effective communication, which are using the scientific consensus (0%), trusted messengers (32%), and being hopeful (13%) and engaging with others of differing opinions (19%).

Meet Them Where They Are. Many students recognized that as communicators you should meet your audience where they are in terms of vocabulary regarding climate change and general scientific topics. For example, Riley states that they have several articles that are "easily digestible for non-scientists" that they use when communicating about climate change. A student Dara had this to say about communicating effectively about climate change:

> "I think understanding the importance of the verbiage that you use in
> science is something that I hadn't noticed before working in my research

lab… Sometimes I think scientists forget that they have to explain that one little step further because it's just so ingrained in their everyday life."

Respect and Open-Minded. They also understand that going into a conversation with someone of a differing opinion, or when conversing about a controversial topic such as climate change, you must have an open mind and respect the other person's feelings and opinions. For example, l said "Well with any kind of effective communication you need people to be willing to consider the argument. Because you can't really have a good discussion if people are super closed-minded because they're not even potentially thinking about changing their mind, so they're just kind of going to knock down everything that is presented." This is in line with prior literature that shows both parties of a conversation regarding a controversial topic should have open minds to the other's opinions.

Personal Effects. Discussing the personal impacts of climate change is effective for communication by focusing the broad topic of climate change to something easier for audiences to connect to. One student Christine described when talking to farmers or people in agriculture, she tries to "relate information to what they are experiencing" and tries to discuss how "climate change is affecting agriculture and the future effects it will have on their farms."

Trusted Messengers and Consensus Messaging. Some students referenced making sure that the sources they used for facts or information about climate change came from

sources that non-scientists may recognize and/or are credible sources of information. For example, Tyler said he refrains from using sources from universities and focuses on sources that non-scientist "may be more comfortable with and recognize" like "National Geographic because it's a big name that people trust." Hari said he does not use information gathered from "social media posts because they are not trustworthy." If he uses a fact from social media, it is because he has researched it and tried to find the original source to ensure he is not spreading false information. For consensus messaging, no students mentioned using the scientific consensus on anthropogenic climate change (97% of scientists agree that humans are causing climate change; Lewandowsky, et al. 2020) for effective communication about climate change.

Engagement and Hope. Few students described engaging with people who disagree and being hopeful in those conversations as effective strategies for communicating about climate change. For example, Ruth said it's important to talk to others as "the more people we interact with the higher the chances are to meet someone with differing opinions". Another student described using solutions as an effective for communicating to non-scientists or people who are not accepting of climate change. Jade described communicating with people who only share the same opinion as you as "closing the door" on opportunities to learn different opinions and engage with people who may be "skeptical about what you are saying." For the feeling hopeful in conversations with people who do not accept climate change one student Tyler said he tried to be "less of a debbie-downer" and "keep the conversation less depressing and focus on the lighter aspects of climate change."

Finding 4: What are the students' experiences learning how to communicate about climate change?

The students reported that research and class presentations were helpful in learning how to communicate effectively to scientists and non-scientists (72%). The students were only taught facts and not communication strategies when it came to climate change (97%).

Research and Class Presentations. Some students said that having presentations in classes improved their confidence in conveying scientific material even if it is to other science students. For example, Katie said, "I think presentations in classes have helped me focus a little bit more on conveying information in an easily digestible way. There's literally nothing worse than having to sit through somebody's presentation and they lost you on the first point so none of the other stuff makes sense." One student, Miranda, said that practicing class presentations at home with her non-science family improved her presentation skills to non-scientists and scientists by allowing her to improve her descriptions of scientific results.

Taught facts not communication. Almost every single interview participant described not being taught how to effectively communicate about controversial scientific topics to non-scientists. For example, Miranda said, "Classes have definitely focused on science and nothing about communication, especially nothing about communication with non-scientists."

Additionally, Andi said, "We never really went over how to communicate about it, we just learned the material, like the facts and background, never really learned how to communicate about it."

Personal Research. Many students expressed that most of their information about climate change and climate change communication came from personal research. These students used published literature to educate themselves on the facts of climate change, watched YouTube videos, and/or viewed other infographics to gain knowledge about climate change. For example, Riley used "JSTOR" and other journal search engines to find current articles that were relatively easy to read and digest to learn facts that are good for conversations with non-scientists.

Finding 5: What do students think they need to communicate more effectively about climate change?

Students desire to be taught how to communicate effectively to non-scientists about controversial scientific topics like climate change (100%). Students believe that practice conversations (53%), learning facts (75%), and discussion groups are beneficial for learning effective communication skills (47%).

Communication Training. Students desire to learn how to communicate about climate change. For example, Ashley would have rather had a communication course than an

animal behavior course. Some students believe being taught how to communicate "without letting your emotions get the best of you" would be beneficial. Dara says to reach more audiences "it's important that students know how to effectively communicate information because sometimes scientists can be very cold and fact-driven, and some people just don't see things in that point of view." Some students believed that a course should be offered to non-scientists as a general education course or make a subunit on climate change communication in introductory biology courses. One student, Aly, said, "I think making it really accessible to all majors is important for a class about scientific communication." Another student, Shawn, said that they believed that it would have been "incredibly useful" in their education as "they're teaching us all this information, but then it's like well how do we spread the information and do that effectively, and you know actually share this knowledge without causing conflict."

Practice. Many students described that having practice conversations in the classroom would be beneficial to learn how to effectively communicate. Some students even compared learning how to communicate to non-scientists about controversial topics to learning a foreign language. For example, Tyler said that "communication training should almost be taught like an advanced foreign language course where it's more focused on speaking about it with different people who don't understand the scientific language and being able to have the ability to describe it to them."

Learning Facts. Most students say that learning more facts about climate change will help them feel more confident communicating about climate change. For example, Dan

said that "learning facts is important for communication, but I think learning the different opinions or different aspects of climate change would help me communicate more effectively"

Specific Practices. At the end of the interviews, students were asked what they thought was needed in the classroom setting to learn how to effectively communicate about climate change and other controversial scientific topics. Some of the students' recommendations were:

> James: "discussion groups would help a lot with oral communication, and I've always been a fan of research papers because it really helps my communication skills, at least in writing, and then hopefully it translates to actually relay facts."

Many students said they would prefer to have climate change communication education "integrated into biology courses that already exist". This is because as a science majors' students already have a lot of required courses, so it is hard to add in extra courses that are interesting. One student said they would prefer "a subunit on climate change communication" as its easier than trying to incorporate a new class into their already busy schedule. Some students even recommended having guest lecture events, or short lecture series on effective communication strategies instead of a course to allow students from different disciplines to attend. Several students also expressed having more interactive classroom experiences would be beneficial for learning effective communication skills.

Table 2a: Coding rubric – Inductive codes

Themes	Description	Example Quote	# of students (n=32)
Organizational involvement	Student says being part of pro-environmental organizations has improved their confidence when communicating about climate change	Samantha: "I was in an environmental science club at my high school that made me more confident in discussing climate change"	19%
Social media	Student shares posts about climate change on social media.	Riley: "Usually I post about how ecology and our public perception of certain organisms can directly influence the way we address conservation. I get some responses where people get mad, but that's the internet, thankfully most people take my posts in a positive way."	47%
Limited network	Most of the students' network is limited to people concerned about climate change	Jane: "most people I'm surrounded by definitely have similar opinions to mine."	97%
Hopelessness	Feels hopeless about the implications of climate change when discussing climate change with others who disagree	Miranda: "I feel hopeless for the change that should be made regarding the issue, because it they refuse to even believe it exists, then how are we going to express the urgency to improve the situation?"	10%
Mitigation Discussions	Student discusses with friends and family who are accepting of climate change about how they can mitigate climate change	Amy: "My family and I talk about how we can change our lifestyle to lower our carbon footprint as a family."	59%
Avoid disagreement	Does not communicate with people who do not agree with them as they may feel like the person will not change their mind.	Claire: "It's a hard conversation that I tend to avoid on a general basis. I'm the only science person in my family so it's difficult to talk to them about what I am learning."	66%
Anger/Frustration	Student feels ineffective when they get angry or frustrated while communicating about climate change	Andi: "It can be frustrating talking to my family about it because they don't see it as an important issue."	59%
Unknowledgeable	Student felt ineffective in communicating when they were not knowledgeable about climate change or people's misconceptions	Ava: "When someone has a super specific question, and I don't have an answer for them or don't understand that part of climate change I don't feel like the conversation is effective."	56%
Provide facts	Providing evidence for or facts about climate change will be effective for communication	Kyle: "Providing just the facts is effective and staying unbiased"	94%
Charismatic	Being charismatic by having confidence and passion when communicating is effective.	Nathan: "certain things about climate change I get just passionate about that would make me want to talk about it more to somebody."	56%
Meet them where they are	Using words that a lay person understands is helpful for effective communication	Elizabeth: "You want to speak. at a level where they can understand, but make sure it's not condescending either."	59%
Respect/ Understanding	Student says they approach communicating by respecting, understanding, or being nice in the conversation.	Nathan: "I've tried to come into those conversations with grace and understanding too because I'm not going to single handedly change their mind on something, but I can	81%

		at least provide the information and delivery in an understanding and loving way."	
Economic and personal	Discussing the economic and personal impacts, and local evidence of climate change will be effective for communication.	Shawn: "making something relatable to the person you are talking to is a major factor for communicating effectively."	**81%**
Research/ class presentations	Presentations for courses and/ or research labs have improved their ability to communicate complex information which has improved their confidence in communication about climate change.	Sydny: "I think in an ecology class we had a research project that we presented and one of my conclusions was spreading more awareness on climate change would help alleviate a situation. I think, my topic was forest fires and it basically it was just making sure that people are aware that climate change is one of the main factors, it helps encourage students to take initiative."	**72%**
Taught facts not communication	Student says they were taught facts about climate change but not how to communicate to non-scientists.	Lilly: "Courses have talked about the facts of climate change but not in a way where I feel competent enough to articulate it."	**97%**
Communication training	Student says they would benefit from explicit training on how to communicate climate change to non-scientists.	Ashley: "So, I think really changing the curriculum to emphasize what is going to matter more in the long run, like science communication, I think that would be a big step forward. "	**100%**
Practice	Having practice communicating about climate change would make students feel more confident communicating about climate change	Sierra: "I think having more practice to get students used to communicating about climate change."	**53%**
Learning facts	Student says learning more facts about climate change will help them feel more confident communicating about climate change	Hari: "learning facts and doing your research beforehand, I think is a good way to feel more confident."	**75%**
Specific Practices	Student describes specific practices that would be beneficial in the classroom	Dan: "Teaching people to speak objectively, is very important, especially in today's social climate"	**47%**
Personal research	Most of the student's information about climate change & climate change communication came from personal research	Chris: "This is kind of just personal research. I've never had an actual class here that talks about scientific Communication to people who are not in the field. "	**56%**
Avoid on social media	Student avoids reposting or sharing posts about climate change on social media to avoid conflict	Tyler: "I try not to talk about stuff like that on social media because I find those conversations to be unproductive. How social media works today is that either this person has this view, and this person has this view, and they yell at each other, until one blocks the other"	**6%**

Table 2b: Coding rubric- Deductive codes

Theme	Description	Quote	# of students (n=32)
Trusted messengers	Using trusted messengers that people know and are reputable may allow people to be more receptive to accepting climate change	Dan: "It's hard to refute evidence but using lots of credible sources would be effective."	32%
Consensus messaging	Stating the scientific consensus on anthropogenic climate change to climate change deniers can act as a mediator of attitudes about climate change	N/A	0%
Hope	Being hopeful when talking about climate change is beneficial for effective communication	Amy: "I think if you if you incorporate some solutions, it helps because people feel helpless. Most people want to help, but then they assume that there's nothing they can help with, because everyone kind of just thinks that their role is small and what they do, doesn't really matter."	13%
Engagement	Engage with people who disagree (people may become polarized when they do not communicate with people with differing viewpoints)	Samantha: "I have a greater knowledge base and I have talked to people that are climate change deniers... I tend to try to take a step back sort of in those conversations and try to recognize where the other person is coming from."	19%
Respect	Approaching discussions by being respectful, open minded, and ensuring you are listening allows for more effective communication about controversial topics	Ruth: "You should be civil, share your side, and listen to the other persons side to make sure they feel heard"	81%
Meet them where they are	Using words that lay people know can increase the receptiveness of climate change and other polarized scientific topics. Additionally, debunking misinformation and conspiracies help educate and reassure the public.	Katie: "I think, being able to explain everything in a way, that everybody would understand regardless of their background, interest, or focus is helpful for communication in general, but specifically for scientific communication."	59%
Local evidence	Discussing personal impacts of climate change is effective for communication by focusing the broad topic of climate change to something easier for audiences to connect to	Sydny: "I think that giving real life examples is a great way to effectively communicate because you can't argue with facts because it's something that's true and regardless of whether it appeals to them"	81%

DISCUSSION

The survey showed that students did not feel prepared to communicate accurately about the solutions to climate change. Prior research has shown that discussing solutions with people who may not accept climate change is an effective communication strategy (Shah, et al., 2022). This is because discussing the solutions can elicit a feeling of hope for the future. Students are mainly reposting or sharing others' posts not creating their own. This could be because students do not feel prepared to communicate solutions, or they feel less prepared to communicate, so they are sharing other people's content instead of making their own. This is an important finding because it's showing that the students are seeing the posts, but they are not engaging.

It was found that students only communicated with those that held similar beliefs. This is in line with the survey results that showed most students communicated about climate change with their friends. Students communicated with family around 32% of the time. In the interviews, some students expressed having conflict with family in older generations, sometimes due to the political affiliations of the family members students communicated with. Additionally, 39% of students indicated they spoke about climate change at least once per week, this could be online or in person communication. Lastly, the interviews showed that 100% of the students want to be taught how to be effective communicators about climate change and other controversial scientific topics.

One limitation of this study is that the survey likely attracted students that had a high interest in climate change, because it was a self-selecting survey, and the population was comprised of mainly undergraduate biology students. So, the survey data, as we saw, reflected the communication and preparedness of a highly accepting population of students. Future research could try to gather a more variable (different majors science and non-science)

population with a greater response rate to have a more comprehensive view of the generalized

undergraduate biology population.

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Appendix:
Undergraduate Climate Change Communication Survey

The climate is always changing and what we are currently observing is just natural fluctuation.

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

The burning of fossil fuels over the past 50 years has caused serious damage to the planet's climate.
- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

Climate change is happening because humans have increased greenhouse gasses, such as carbon dioxide, methane, and nitrous oxide, in the atmosphere.

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

Humans are too insignificant to have a substantial impact on global temperature.

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

Climate change is a process that is already underway.

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

Climate change is not happening.

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

For the following questions we are going to ask you about the frequency that you communicate with others about climate change, so we can understand undergraduate students' communication habits. There are no right or wrong answers to these questions. We are only interested in your genuine honest experiences.

How frequently do you talk about climate change with others?

- Never
- About once a year
- About once a month
- About once per week
- More than once per week

When you discuss climate change with others what **percent** of the time is it... (**percentages** must total to 100%)

- with your **family**? _____

- with your **friends**? _____

- with **neither** your **friends nor** your **family**? _____

- Total: _____

How prepared do you feel you are to communicate accurate scientific information to others about

	Not at all (1)	A little (2)	A moderate amount (3)	Completely (4)
The **effects** of climate change? (comprep1)	○	○	○	○
The **causes** of climate change? (comprep2)	○	○	○	○
The **solutions** to climate change? (comprep3)	○	○	○	○

How frequently do you see posts/shares about climate change on social media? (Facebook, Instagram, Twitter, etc.)

- Never
- About once a year
- About once a month
- About once per week
- More than once per week

How frequently do you like/dislike or share posts about climate change on social media? (Facebook, Instagram, Twitter, etc.)

- Never
- About once per year
- About once per month
- About once per week
- More than once per week

How frequently do you write posts or comment on posts about climate change on social media? (Facebook, Instagram, Twitter, etc.)

- Never
- About once per year
- About once per month
- About once per week
- More than once per week

Please indicate the extent to which you were previously taught about climate change in high school and college thus far? (including your current class)

- Not at all
- A little
- A moderate amount
- A lot
- A great deal

Please list any courses science or non-science, in which you have learned about climate change (example: BIOL1110: General Biology 1):

_____

What is your current year in college?
- First year
- Sophomore
- Junior
- Senior
- Other (please describe):

Is your major in biology? (Includes biomedical sciences, biology and society, conservation biology, genetics, neurobiology/physiology/behavior, microbiology, medical microbiology, molecular bioscience, neuroscience, biochemistry)

- Yes (please describe):
- No (please describe):
- I'm not sure (please describe):
- Decline to state

What is your intended career?

- Healthcare professional (examples: Physician, Nurse, EMT)
- Research scientist (examples: Professor, Biologist, Chemist)
- Option not available, please describe:

I most closely identify as:

- Man
- Woman
- Nonbinary
- Please describe your gender identity if the best option is not listed:

Choose the race/ethnicity with which you most closely identify. (Select all that apply.)

- Asian (East Asian, Southeast Asian, South Asian, West Asian, Middle Eastern)
- African American or Black
- Latinx or Hispanic
- American Indian, Native American, or Alaskan Native
- Native Hawaiian or Other Pacific Islander
- White
- Multiracial (please describe your multiple racial/ethnic identities)
- Option not available, please describe:
- Decline to state

Interview Questions:

1. Can you describe any experiences you have had talking about climate change with friends? Family? acquaintances, or even strangers? What about social media?

    a. For each instance, how did you feel during the conversation?

    b. If you have experienced any negative emotions during these conversations, how do you manage the negative emotions?

2. What would it look like to you to communicate effectively about climate change to someone who is not concerned about climate change?

3. Are there any instances in which you have felt like you were an effective communicator about climate change?

4. Are there any instances that you thought you communicated ineffectively? What caused you to feel it wasn't effective?

5. Are there particular ways you talk about climate change to avoid potential social conflict? Are there any experiences you have had where you used these strategies?

6. *if person is religious, does your religion influence your view points on climate change? Do you think it impacts how you communicate about climate change? Or who you communicate with?

7. In the courses you took that taught climate change did you ever discuss how to communicate about climate change with non-scientists? If so, how?

8. Do you feel confident to communicate accurately and effectively about climate change to non-scientists? Why or why not?

9. Would you like to become better at communicating about climate change to non-scientists? Why or why not?

10. If there was a class on science communication about climate change, why or why not would that be of interest to you?

11. Can you describe any experience you have had in a classroom or research setting that helped improve your confidence and skill in climate change communication? Where did you primarily get your information from?

12. From that experience, what improved your confidence and skill in scientific communication? Why do you think that improved your confidence and or skills?

13. What do you think students need from their instructors to be better at communicating about climate change?

14. Is there anything else you think is important to share with me about your communication about climate change or how to improve scientific communication training for undergraduate students?

Final Coding Rubric:

RQ1: What experiences, if any, have undergraduate biology students had learning to communicate about climate change?

- RESEARCH AND CLASS PRESENTATIONS: Students say that science presentations for courses and/ or research labs have helped improve their ability to communicate complex information which has translated to their confidence in their communication about climate change.
- TAUGHT FACTS NOT COMMUNICATION: Student says they were taught facts about the science of climate change but not how to communicate to non-scientists.

RQ2: What experiences, if any, have undergraduate biology students had when communicating climate change?

- ORGANIZATIONAL INVOLVEMENT: Student says being part of pro-environmental organizations or movements has made them feel more confident about communicating about climate change
- SOCIAL MEDIA: student says they write or share posts often about climate change on social media.
- LIMITED NETWORK: Student describes that most of their communication is limited to those within their network who are also concerned about climate change
- HOPELESSNESS: Student describes feeling hopeless about the implications/ current impacts of climate change when they communicate with others.
- MITIGATION DISCUSSIONS: Student says they talk with their friends and family who also accept climate change about how they can mitigate climate change
- PERSONAL RESEARCH: Students expressed that most of their information about climate change and climate change communication came from personal research

RQ3a: What communication strategies do undergraduate biology students use that they think is effective and ineffective when communicating about climate change?

- AVOID DISAGREEMENT: Student says they do not communicate with people who do not agree with them. Some students may say they feel like the person will not change their mind.
- AVOID ON SOCIAL MEDIA: Students describes avoiding reposting or sharing posts about climate change on social media to avoid conflict
- ANGER/FRUSTRATION: Student says they feel ineffective when they get angry or frustrated while communicating about climate change
- PROVIDING FACTS: Student says providing evidence for or facts about climate change will be effective for communication
- ECONOMIC AND PERSONAL: Student says talking about the economic and personal impacts of climate change will be effective for communication. Student may also refer to using personal stories. Students may say using local evidence is beneficial in effectively communicating about climate change.

- RESPECT/UNDERSTANDING: Student says they approach communicating by respecting, understanding, or being nice in the conversation.
- UKNOWLDEGEABLE: Student says they were ineffective in communicating when they were not knowledgeable about climate change or people's misconceptions
- CHARISMATIC: students expressed that being charismatic by having confidence and/or passion when communicating was effective.
- MEET THEM WHERE THEY ARE: students state that using words that a lay person understands is helpful for effective communication

RQ3b: Are these strategies ones that are recommended for communicating climate change effectively? DEDUCTIVE
- MEET THEM WHERE THEY ARE: Using words that lay people know can increase the receptiveness of climate change and other polarized scientific topics. Additionally, debunking misinformation and conspiracies help educate and reassure the public.
- RESPECT/OPEN MINDEDNESS: Approaching discussions by being respectful, open minded, and ensuring you are listening allows for more effective communication about controversial topics
- PERSONAL EFFECTS OR LOCAL EVIDENCE: Discussing personal impacts of climate change is effective for communication by focusing the broad topic of climate change to something easier for audiences to connect to
- TRUSTED MESSENGERS: Using trusted messengers that people know and are reputable may allow people to be more receptive to accepting climate change
- CONSENSUS MESSAGING: Stating the scientific consensus on anthropogenic climate change to climate change deniers can act as a mediator of attitudes about climate change
- HOPE: Being hopeful when talking about climate change is beneficial for effective communication
- ENGAGEMENT: Engaging with people who disagree (people may become polarized when they do not communicate with people with differing viewpoints)

RQ4: What do undergraduates think they need to effectively communicate about climate change?
- PRACTICE: Student says having practice communicating about climate change makes them or would make them feel more confident communicating about climate change
- LEARNING FACTS: Student says learning more facts about climate change will help them feel more confident communicating about climate change
- COMMUNICATION TRAINING: Student says they would benefit from explicit training on how to communicate climate change to non-scientists. Student may say they would benefit from incorporating science communication training into their existing science classes. Student may also describe science communication about climate change being beneficial in general education or lower division biology courses

- SPECIFIC PRACTICES: Student lists specific practices that would be beneficial in the classroom
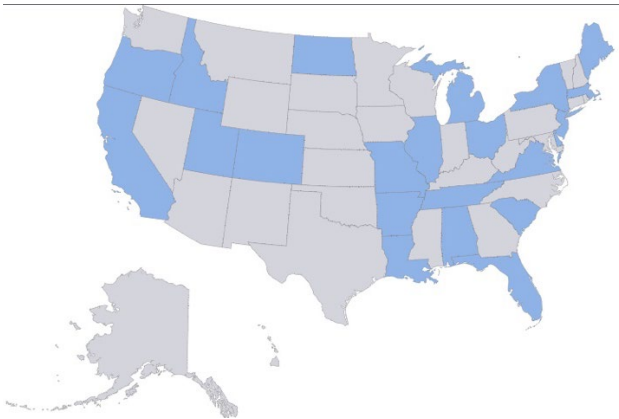
Figure 3: States in which participants reside
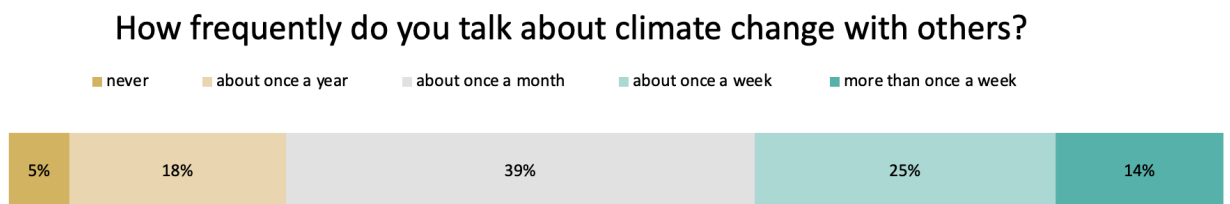

Figure 4: Frequency of communication.
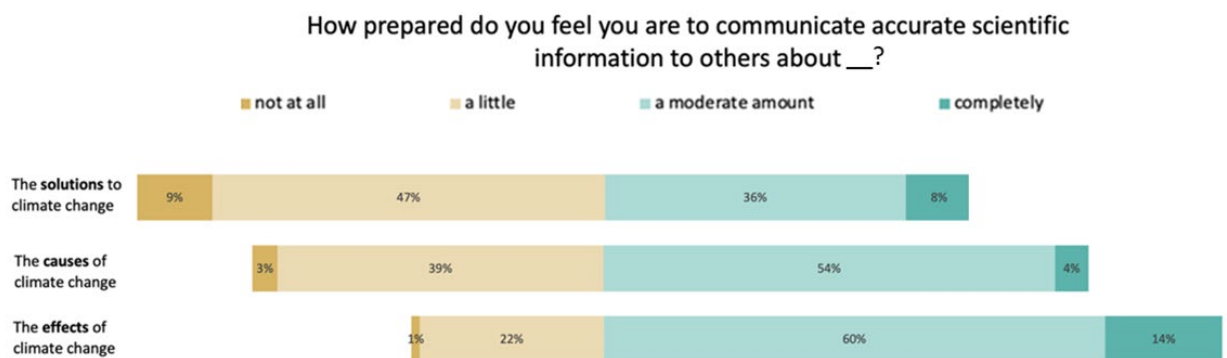
How frequently do you talk about climate change with others?

■ never ■ about once a year ■ about once a month ■ about once a week ■ more than once a week

5%	18%	39%	25%	14%

Figure 3: Preparedness to communicate about climate change

How prepared do you feel you are to communicate accurate scientific information to others about ___?

■ not at all ■ a little ■ a moderate amount ■ completely

The **solutions** to climate change	9%	47%	36%	8%
The **causes** of climate change	3%	39%	54%	4%
The **effects** of climate change	1%	22%	60%	14%

Figure 4: Frequency in communication about climate change on social media

How frequently do you __ about climate change on social media? (Facebook, Instagram, Twitter, etc.)

■ not at all   ■ about once a year   ■ about once a month   ■ about once per week   ■ more than once per week

see posts/shares	20%	10%	30%	25%	15%
like/dislike or share posts	9%	6%	32%	25%	27%
write posts or comment on posts	55%	23%	15%	5%	3%

IRB Approval Letter

Human Participant Research Proposal
IRBF001:   EXPEDITED REVIEW   REQUEST   FORM
Institutional Review Board
Middle Tennessee State University

"Expedited" versus "Full Review" Definition:
Please note "expedited" does not mean this proposal would be reviewed by a "fast track" mechanism; it merely means the proposed research study does not require a full committee review. Other than the actual review & approval, the procedures and documents requirement are mostly similar.
- *Expedited Review:* 	*https://mtsu.edu/irb/ExpeditedProcedures.php*
- *Full Committee Review:*	*https://mtsu.edu/irb/FullReviewProcedures.php*

What does this form contain?
This form separated into the following sections with added subsections to make the review process swifter. The AY-2021 form also contains space for how the PI **plans to handle potential COVID-19 exposure**.

1. Project Information	8. Informed Consent
2. VACANT	9. CITI Training and Researcher Expertise
3. VACANT	10. Mandatory Documents & Attachments
4. Expedited Approval Category	11. Investigators' Declaration and Assurance
5. Research Methods & Instruments	12. *IRB Action (Office Use)*
6. Participant Selection & Recruitment	13. *Additional Procedures APPENDICES*
7. Confidentiality	14. VACANT

Mandatory requirements
- Participant recruitment - https://mtsu.edu/irb/FAQ/Recruitment.php
- Completed informed consent form(s): https://mtsu.edu/irb/forms.php
- All of the investigators must complete all required research-specific CITI training modules - https://mtsu.edu/irb/requirements.php
- Study instruments
- Plans to minimize COVID-19 exposure if the participants will have direct physical interactions
- Other documents may be required

Instructions for document submission.
- Use Microsoft Office to complete this form; DO NOT use other apps or utilities
- Send all of documents as **separate** files but in a single email to irb_submissions@mtsu.edu
- Submit all IRB forms in their original MS Word format – DO NOT CONVERT TO PDF
- Student researcher must have the IRB documents submitted by their research advisor
- Please use fresh application templates when starting a new study; do not use older version.
- **Do not begin your Research until you have received a formal approval letter.**

Review & Timeline
- The documents will be prescreened for completeness – incomplete applications will be returned
- A reviewer will be assigned after the prescreen; the review is expected to take 2-3 weeks
- This form will be sent back to the investigators with reviewers' comments and other instructions

- The review process is iterative and it depends on how swiftly the reviewers' concerns are addressed.
- Once a final approval has been issued, a "locked" version of this form may be sent to the investigators to be used as a guideline for their study.

1. PROJECT INFORMATION

1.1 Select the type or Review Mechanism:
☒ Expedited Review   ☐ Full Committee Review

1.2 Project Title

Understanding underdraduate biology students current communication habits about climate change

1.3 Primary Investigator (PI)
Refer to <mark>https://www.mtsu.edu/irb/FAQ/ResponsibilitiesOfPI.php</mark> *for PI responsibilities.*

Name	Maryann Elizabeth Barnes ☒Faculty ☐Staff ☐Graduate ☐Undergraduate ☐Other:
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Department/Unit	Department of Biology *College* College of Basic and Applied Sciences
Office Location	*Room* #1163 *Building* SCI *Box* #060
CITI Program ID	

1.4 Faculty Advisor (FA) if the PI is a student:

1.5 Co-Investigators (list all researchers <u>other than the PI/FA</u>)

Name(s)	Madeline Aadnes
Email address(es)	mga3s@mtmail.mtsu.edu
Department/Unit/Affiliation(s)	Department of Biology
CITI Program ID(s)	9791648

1.6 Research Category *(select ALL that apply)*:
☒ Faculty research   ☐ FRCAC   ☐ Not for Publication   ☐ Class Project
☒ Thesis Dissertation ☐ URECA   ☒ Publication/Presentation ☐ Staff research
☐ Other

1.8 Miscellaneous Questions:

Project Questions	Response	Remark(s)
Expected start date	August 2021	
Anticipated completion date **The protocol will be closed on this date**	Summer 2022	
Source of funding (Funding agency, number/ID, and expiration date)	MTSU faculty start up account	

Important Information:

- Expedited and Full protocols are valid for one year; Annual Progress Report is mandatory
- For studies that require more than one year, the investigator must submit a written request for continuing review and a Progress Report (form available at www.mtsu.edu/irb and click on FORMS)
- Each protocol can be continued twice; a new application must be submitted after 3 years

Review Tracking

		IRB Comments
Protocol ID	**22-2026 7qv**	
Date Received	**08/30/2021**	The application is submitted as a PDF
Resubmission	**09/01/2021**	The application is an oldver version
Prescreen Date	**09/03/2021**	
Revision Date	**09/13/2021**	Zoom IC and CITI training for one of the students
Prescreen	**09/15/2021**	
Review Date	**09/20/2021**	
Revision Date (if applicable)	**09/27/2021**	
Approval Date	**09/28/2021**	Refer to the approval notice for more information
Expiration Date	**09/30/2022**	Refer to the approval notification for more details on how to extend this date

4   APPROVAL CATEGORY for EXPEDITED REVIEW

Select the category under which this proposal qualifies for an expedited review.   Refer to https://mtsu.edu/irb/FAQ/ExpeditedCategories.php for more details on each of these categories and make your selection after you have familiarized with the categories.

	Category Description	Select	Subcategory
7	Research of individual or group characteristics or behavior	☐	**N/A**

Check the box(es) corresponding to the category under which your study qualifies for an expedited review. Enter the sub-category (https://mtsu.edu/irb/FAQ/ExpeditedCategories.php).

5 RESEARCH METHODS & INSTRUMENTS

5.1 HYPOTHESIS:
Provide the research questions being addressed in this study. Also describe if the study design. (e.g., qualitative, correlation, factorial, etc)

What experiences have undergraduate biology students had in college in which they learned how to communicate about climate change? What experiences have undergraduate biology students actually had communicating climate change? What communication strategies do undergraduate biology students use that they think is effective and ineffective when communicating about climate change? Are the strategies and experiences students report when communicating about climate change in line with expert recommendations? What do undergraduates think they need to effectively communicate about climate change?

5.2 BACKGROUND:
Describe relevant research that has been done previously. Include citations as well as a brief description of relevant methods and important findings. You may limit this section to a sample of the most relevant research.

Climate change has already caused widespread damage to the world's ecosystems and has greatly impacted humans (IPCC, 2014), but only 42% of Americans know that scientists agree that climate change is happening (Leiserowitz, et al. 2014). This is partly due to the difficulty scientists have effectively communicating climate change. People often reject climate change due to political affiliation. Democrats are more likely than Republicans to believe in human-caused climate change and support public policy (Hart & Nisbet, 2011). Since climate change is highly politicized this also makes it difficult for scientists to communicate about it effectively (Kahan, 2015) because avoiding or mitigating the political divide when communicating about climate change can be difficult (Hart & Nisbet, 2011). There is little research about teaching scientific communication skills to undergraduate students outside of lab reports and CURES (Parker, 2018; Peter and Skorupa, 2021). Thus, we wanted to understand the current potential needs for undergraduate student training on communicating about climate change.

5.3 PROTOCOL SUMMARY:
Provide a **short** summary of this proposed study and detailed descriptions can be presented in other segments of this application.

We will recruit junior and senior undergraduate bology students at research intensive universities in the Southeast, where climate change skepticism is high. We will email biology department chairs to forward our recruitment email to any junior and senior biology student listservs that they have. We will use a survey to identify students pursuing careers in which they are more likely to communicate about climate change (researcher, professor, K-12 teacher, etc.) for interviews about their experiences. The survey will inform us of the participants that agreed to participating in an interview, these students will then receive an additional recruitment email to set up the interview. To analyze our data we will look at descriptive statistics for the frequency of students' communication and how prepared they feel to communicate accurately. Additionally, we will deductively and inductively code interview transcripts. Transcripts will be coded

deductively for communication strategies recommended by national organizations (Lewandowsky, 2020; FrameWorks Institute, 2015):.

NOTE: although many of the steps, such as, recruitment, informed consent, data collection, debriefing, are also elaborated elsewhere, it is crucial to provide a chronological account of the study in this section to allow the reviewer to get a full picture of all of the methods in context.

5.4 DATA DESCRIPTION:

5.4.1 Primary mode of data collection
Select ALL applicable options and complete appropriate Appendix sections:

5.4.1.1 Select type of interaction
☒ Virtual or online interaction with NO direct physical contact with the participant
☐ Direct physical interaction with the participant: Complete Appendix COVID-19
☐ Participant-to-participant direct contacts - Complete Appendix COVID-19

5.4.1.2 Non-physical interventions/interactions
☒ Social & Behavioral   ☐ Educational   Complete **Section 5.4.2**
☐ Existing Data – Analysis including investigation of audio/video   Complete **5.4.2 & Appendix L**
☐ Biospecimen – Analysis of previously collected biological samples   Complete **Appendix F**)

If you selected one of the above, then provide a simple definition of what you mean by "data" in this research: The data from the surveys will be the answers selected or given within the survey platform. The questions asked will be about the participants knowledge/acceptance of climate change, the frequency in which they discuss climate change, and demographics including religion and political affiliation.
Please describe the data not the mode of data collection. Provide a short description of the information collected in the survey.

5.4.1.3 Other Intervention/interactions   ☒ **NONE**

5.4.2 Data Acquisition
Complete this section for all types of Social/Behavioral and Education studies:

Select all that apply

☒ **5.4.2.1 Survey**[8]   *Submit Survey either as PDF or as MS Word document*
   ☒ Qualtrics Survey[10]   *Visit https://mtsu.edu/irb/FAQ/OnlineDataCollection.php for more information*
   Qualtrics Link(s): https://mtsu.ca1.qualtrics.com/jfe/form/SV_eQH6Zw7Gb4BOBa6

☒ 5.4.2.2 **Interview**[8]   *Submit interview script/topics as a PDF or as a MS Word document*
   ☒ Internet-based Virtual Interview (Zoom)   ☐ Social Media Interaction

☐ 5.4.2.3 **Observation**[9]
   Explain and describe the instruments

☐ **5.4.2.4 Focus Group(s)**[9]
   Explain and describe the instruments:

☐ **5.4.2.5 Other**
Explain and describe the instruments

Prescreen:

<mark>**Are the participants taking the survey different from the ones participating in the interviews? Please provide a short descrption of how the participants are related:**</mark>

Pi Response: All participants take the same survey, at the end of the survey the participants will be asked if they would like to participate in an interview, if they say yes to an interview they will be asked provide an email. The interveiw participants will be contacted by the email provided in the survey.

<mark>Review:</mark>
<mark>Please submit a script for the invitation to be sent for the interview request. Please submit a copy of the Qualtrics survey and the interview questions for IRB records.</mark>

Notes:

[8] *Attach a list of survey/interview questions with the application*

[9] *Describe the instruments to be used in the observational study or to be used during focus groups*

[10] All of the investigators MUST *complete "Internet Based Research" module under CITI SBR course*

5.5 DATA ANALYSIS: What is your plan for analyzing the data**? Include how any personal data, voice recordings, images and other types of identifiable artifacts collected from the participants will be used in the analysis.**

The survey data will be analyzed using SPSS software and the interviews will be coded using inductive and deductive coding.

5.6 How will this design allow you to address the research question?

By sending out the survey we created we will be able to obtain statistics to analyze for frequency and preparedness of communication about climate change. The interviews will allow us to dive deeper and gather specific data about the participants experiences communicating about climate change..

5.7 RESERVED – No response is needed

5.8 **DEBRIEFING:** Describe how the participants will be debriefed; attach copies of debriefing statements

The participants will be fully aware of the purpose of the study from the recruitment communications and consent form. The interview participants will receive an additional debriefing statement before the interviews begin.

NOTE: In addition to any debriefing materials, an electronic copy of the informed consent must be provided to the subjects if the study is conducted over the internet.

5.9 RISKS: List the potential risks and discomforts to the participants

The extent of the anticipated risk for this survey is the possible anxieties that some participants may feel when discussing climate change.

Risk Estimation:

☒ **Minimal Risk –** *the probability and magnitude of harm or discomfort anticipated in the research are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests.*

☐ **More than minimal** – a slight increase in risk compared to the definition of minimal risk

☐ **Risk** – the subjects may experience reasonably foreseeable **risks** or discomforts
*Definition: If evaluating a particular **risk** of research associated with a standard of care is a purpose of the research, then in general **OHRP** considers that particular **risk** to be "reasonably foreseeable (45 CFR 46.116(a)(2)).*

5.10   BENEFITS: List prospective benefits of conducting this research. Include direct benefits for participants, science, and society

Participants will be able to observe and express their own opinions of climate change. This freedom of expression in a scientific manner will provide educators and fellow researchers with the data necessary to better communicate, promote increased understanding and learning of climate change among undergraduate students. Additionally, the data may help educators understand the current level of climate change communication and determine what can be done to increase undergraduate students' communication skills. This will be important if we want to start to bridge the divide between the scientific consensus and the general public's view of climate change.

5.11 RISK to BENEFIT RATIO: Evaluate the level of risk relative to the potential benefits.

The minor risk of slight emotional discomfort (depending on the experience of the participant) is outweighed by the benefit this information will have to the science education community in promoting the education or cliamte change to students and the general population.

6. PARTICIPANT DESCRIPTION and RECRUITMENT

6.1 Sample Size (maximum number of participants):   600

6.2 Participant Age (minimum and maximum age group): 18-60

6.3 Description: Provide a simple description of who your ideal participant(s) would be:
Our study is aimed at undergraduate students enrolled in a biology course at research intensive
          universities in the southeast.

6.3 Targeting more than one type of participants: NONE

6.3 Participant population (Select ALL that apply):

Healthy Adults (18 years or older)	☒	Minors (less than 18 years old)	☐
Adults (not included above)	☐	Prisoners (COMPLETE APPENDIX A)	☐
MTSU Psychology Research Pool	☐	Pregnant Women	☐
(complete section 6.7)		Mentally Handicapped	☐
Amazon Turk Workers	☐	Mentally Disabled	☐
Qualtrics panel	☐	Physically Ill	☐
Senior Citizens (65 years or old	☐	Disabled	☐

6.4 Recruitment Scripts & Methods

Please visit https://mtsu.edu/irb/FAQ/Recruitment.php for more information on participant recruitment.
Select the type(s) of recruitment method to be used:
          ☐IRB Flyer
          ☒IRB Recruitment Email[14]
          ☐Word of mouth[14]
          ☐Telephone[14]
          ☐Regular
          ☐Web posting
          ☐Social media

          Review: the initial recruitment email script is provided for review but the QUalitrics link is
                    not shown. Moreover, the followup invitation to attend the Zoom interview is not
                    provided. Please submit follow up scripts for IRB review and records.

6.5 How will participants be recruited and selected for this research? Describe the recruitment steps starting from the initial contacts. Include compensation (inducement) to participants. Recruitment script(s) must be submitted with this application.
Refer: https://www.mtsu.edu/irb/FAQ/Recruitment.php
Describe the recruitment steps: We will recruit junior and senior biology students at research intensive universities in the southeast. This will be done by emailing biology department chairs to forward our recruitment email to any junior and senior biology student listservs that they have.

Students that agree to be interviewed will receive an additional email with a link to select a time for a possible zoom interview.

NOTE: If the participants are to be drawn from an institution or organization (e.g., hospital, social service agency, prison, school, etc.) which has the responsibility for the participants, then documentation of permission from that institution must be submitted before final approval can be given (https://www.mtsu.edu/irb/FAQ/PermissionLetters.php).

6.6 Inclusion/Exclusion: Provide a list of inclusion/exclusion criteria for the proposed research and justify any demographics (e.g. sex, race, economic status, sexual orientation) that have been excluded.

Inclusions: Junior and Senior students enrolled in an undergraduate bioogy course at research intensive universitites in the southeast.
Exclusions: Students not enrolled in an undergraduate biology course at a research intensive university.

6.7 Inducement and Compensation:
Explain inducement plan for compensating the participants. Examples are: extra credit, cash, gift card, meals and etc. The inducement has to be fair and should not unfairly influence the decision of the participants. Provide a clear description of the mode of disbursement of the compensation and the requirements for when the compensation would be denied.

☒Monetary Compensation (complete Appendix J)   ☐ Compensation has no monetary value

Undergraduate students who complete the survey will be entered into a drawing to win one of five 50$ amazon gift cards. The interview participants will be offered a 25$ gift card as compensation for participating.

NOTE: most types of monetary compensation used for inducement will require proper documentation for records keeping and IRS accounting.

6.8 Recruit Psychology Research Pool (SONA):   ☒ NOT Applicable
Refer: (http://mtsu.sona-systems.com/)

6.9 Recruiting Amazon Mechanical Turk workers   ☒ NOT Applicable
  Complete   MTurk   Additional   information   Page   Form   F023 (https://mtsu.edu/irb/forms.php)

6.10   Enrolling Qualtrics Panel members as participants   ☒ NOT Applicable
  Complete Qualtrics Panel Additional information Page Form F023b from the IRB Forms page (https://mtsu.edu/irb/forms.php)

7   CONFIDENTIALITY

7.1 Personal Information: Select ALL those apply from the following list of identifying information (but not limited to) that will be recorded from your research participants.

    ☒ E-mail address

The above personal information are collected as research data	☐ Yes	☒ No
The above personal information are collected for administrative purposes	☒ Yes	☐ No

Provide additional explanation if needed:

<mark>**Review:**
Video/audio recording is disclosed in the revised Zoom interview informed consent script. But in the protocol these interactions were not selected during the submission. Please clarify below if Video/audio recording are being done. In addition, please enter a justification for capturing the recording in Section 7.2. If the purpose of the recording is to transcribe the interview for later, then video may not be necessary. So, please ensure video recording is necessary for data analysis.</mark>

PI: Response:

7.2 JUSTIFICATION - Provide a justification for why each type of information listed above is necessary for this study and also explain how that information will be protected/destroyed

The email address of the participant is necessary to distribute the gift cards for compensation. All data will be password protected on a computer in the primary investigator's faculty office. Only audio recording will be done in order to accurately transcribe the interviews for analysis.

7.3 DATA STORAGE - Where will research materials be stored? If anywhere other than an MTSU faculty researcher's office, please describe why the faculty researcher's office is not secure; include an address where data will be stored.

Data collected will be stored on a password protected computer located in the primary investigator's facutly office.

Mandatory Data Storage Requirements:
- All Study related records (documentation of informed consent, surveys, study notes, data records, and all correspondence) be stored securely for **at least 3 years** after data collection ends.
- Additionally, the Tennessee State data retention requirement may apply (*refer MTSU Policy 129:* https://www.mtsu.edu/policies/general/129.php).
- Records must be stored securely in a faculty member's office on campus for 3 years. (Or another secure location if there is reason to believe the faculty member's office is not secure. These arrangements must be approved).
- Subsequently, the data may be destroyed in a manner that maintains confidentiality and anonymity of the research subjects.

7.4 List anyone other than the Investigators mentioned in page 1 who will have direct access to the research participants or their primary data. Consider research assistants, transcribers, statisticians, and others who may be present during the research or have access to the data records. These individuals must also submit Human Subjects Training Certificates.

Only the investigators will have access to the survey and interview data.

8   INFORMED CONSENT
- Adult participants only; Use Appendix B for describing the consent process involving minors
- Refer https://www.mtsu.edu/irb/FAQ/ConsentAndAssent.php for more information

8.1 Will informed consent be obtained from the participants?
☒ Yes

Consent waiver is permitted only in rare conditions.

8.2 Will you collect signed consent forms?
☒ NO   complete Appendix G with justification for why signature is not collected

Each participant must be provided with a copy of the informed consent signed by the PI/FA regardless if participant signatures are collected or not.

8.3 Will you obtain consent verbally?
☒ Yes   complete Appendix G with justification for verbal consent   (Select this because it is true for Zoom)
☐ NO

Each participant must be provided with a copy of the informed consent signed by the PI/FA regardless if participant signatures are collected or not.

8.4 Will you administer the informed consent by VIRTUAL/ONLINE methods?
☐ NONE
☒ Virtual (Zoom): Complete Appendix G (Section G.6) (Select This)
☐ Telephone Interview: Complete Appendix G (Section G.6)
☒ Online using Qualtrics: **minimal risk studies only:** Complete Appendix G (Section G.5)
    with explanation

>   ***Paste the Qualtrics link for the proposed online study here:***
>   https://mtsu.ca1.qualtrics.com/jfe/form/SV_eQH6Zw7Gb4BOBa6
>   Refer https://mtsu.edu/irb/FAQ/OnlineDataCollection.php for more information.

8.5 Will the participants receive compensation/inducement for enrolling?
☒ Yes   Explain: **The undergraduate students will be entered into a drawing to win one of five 50$ amazon gift cards. Interview participants will receive a 25$ gift card in compensation for their time.**
☒The compensation has monetary value – Complete Appendix J
.

8.6 Give a description of your consent "process". Include who is administering the consent information, where is it obtained, how is it administered and etc.?

The consent form will be accessed via the given Qualtrics link. The link will be provided to the participant's by the research team. The investigators will distribute the Qualtrics link to the students. Upon entering the qualtrics survey platform, the informed consent will open and participants will be asked to confirm that they are 18 or older, that they understand the surveys purpose and any potential risks. Finally, the participant will need o check the box that says "Yes, I consent" or "No, I do not consent." If the latter is chosen, they will not enter the survey section.

Use Section 5.6 to describe the consent process when involving ADULT participants. When enrolling **minors**, use **Appendix B** for explaining **parental consent and child assent**.

Prescreen:
This study uses two different methods of data collection. Please provide a description of informed consent will be administered for the two methods:

Online Survey: Consent will be gathered through a Qualtrics survey sent to the participants in the recruitment email. The consent form will be accessed via the given Qualtrics link. Upon entering the Qualtrics survey platform, the informed consent will open and students will be asked to confirm that they are 18 or older, that they understand the survey purpose and any potential risks. Finally, the student will need to check the box that says "Yes, I consent" or "No, I do not consent." If the latter is chosen, they will be directed to the end of the survey. Please test the Qualtrics survey and enter the name of the person who tested in Appendix G

Zoom Interview: The participants will be sent a copy of the informed consent document that they need to sign before the interview.

If audio/video will be conducted during the Zoom interviews, then a separate Zoom interview informed consent template needs to be completed and submitted for review. In addition, please complete the Zoom interview section in Appendix G.

Review:
The Qualtrics survey was tested. The does not comply with the instructions provided in Appendix G. Plesae use the attached informed consent text to be displayed in the first page of the survey. The survey may not begin unless the participant consents. Make any necessary changes to the informed consent script as needed. If the informed consent script is alterered, then submit the revised informed consent with the revised files.

8.7 MANDATORY Informed Consent Elements Check List:
Select "yes" if the element appears in your consent document, if it does not check "no". If you check no to any item you must complete the request for waiver of consent. See Appendix G.

A statement that the study involves research and the true purpose of the research (If using deceit, check no and justify in Appendix G).	Yes ☒ NO ☐
A description of all the procedures in detail to be followed and the expected duration	Yes ☒ NO ☐
Foreseeable risks or discomforts to the participant	Yes ☒ NO ☐
Benefits to the participant or others (NOT COMPENSATION)	Yes ☒ NO ☐
Disclosure of appropriate alternative procedures or courses of treatment N/A ☒	Yes ☐ NO ☐

A statement describing the extent of confidentiality of records identifying the subject will be maintained	Yes ☒ NO ☐
Explanation for compensation (inducement) for participation (not listed under the benefits section) along with any requirements and qualifications for receiving the proposed compensation	Yes ☒ NO ☐
A statement regarding compensation to participants in case of injury	Yes ☒ NO ☐
Contact information for the researcher and the Compliance Officer	Yes ☒ NO ☐
A statement that participation is voluntary, there are no penalties for refusal to participate, and participation can be discontinued at will without loss of benefits.	Yes ☒ NO ☐

9 TRAINING and EXPERTISE
This application WILL NOT be reviewed if training is incomplete

9.1 Will this research involve specialized procedures or methods that will require specific training or expertise?

☒ NO
☐ YES   Explain:

9.2 Provide a list of qualifications possessed by the investigating team to address any potential challenges during this study.

All members of the investigating team are familiar with the Department of Biology at MTSU and have participated in the appropriate CITI training

9.3 CITI Training *The following CITI course(s) and modules are mandatory. Review your CITI training certificate and check boxes for all those modules that have been completed by the entire research team.*

- The entire investigating team must complete "Social and Behavioral Research" basic course
- Students must also complete "Students in Research" module in addition
- Study-specific and participant-specific modules/training must also be completed
- **Click here or visit http://www.mtsu.edu/irb/requirements.php to learn more**

☒ Social & Behavioral Research (SBR)	
Modules for All Researchers	Modules required based on researcher status and the study
☒ Belmont Report and CITI … (ID: 1127) ☒ History and Ethical Principles - SBE (ID: 490) ☒ Defining Research ….. - SBE (ID: 491) ☒ The Federal Regulations - SBE (ID: 502) ☒ Assessing Risk - SBE (ID: 503) ☒ Informed Consent - SBE (ID: 504) ☒ Privacy and Confidentiality - SBE (ID: 505) ☒ Conflicts of Interest in …. (ID: 488) ☒ MTSU Module DEMO (ID 1073)	☒ Students in Research (ID 1321) **MANDATORY FOR STUDENTS** ☐ Research with Prisoners – SBE (ID: 506) ☐ Research with children – SBE (ID 507) ☐ Research in Public ….. Schools – SBE (ID 508) ☐ International Research – SBE (ID 509) ☐ International Studies (ID 971) ☒ Internet-based research – SBE (ID 510) ☐ Research and HIPAA …. (ID 14) ☐ Research on Workers/Employees (ID 483) ☐ Hot Topics (ID 487) ☐ IRB Member module (ID 816) ☐ IRB Administrators …. (ID 13813)

10 APPLICATION CHECKLIST

10.1 Check List: To be completed by the PI Please <u>READ</u> and <u>INITIAL</u> each item.
Incomplete applications will NOT be prescreened.

☒ The application is complete
☐ Faculty Advisor information and signature included if the PI is a student
☒ CITI certificates attached
☒ Participant information and methods to enroll is provided
☒ Recruitment materials/scripts for enrolling participants is/are attached
☐ Signup information for Psychology Department Research Pool (if applicable) is
   provided
☒ Consent template(s) for all types of proposed data collection methods is/are
   included
☒ Alteration to consent process or changes to the standard consent template are
   justified
☒ Surveys, questionnaires, tests, interview forms/scripts attached – include a PDF of
   the entire survey if the study is being administered via Qualtrics
☒ Qualtrics link(s) for studies conducted online is/are provided
☒ Appendix section(s) for additional methods are completed
☐ Permission letters on official letterhead for conducting research at non-MTSU sites
☐ Other:

10.2 Additional Procedural Information
Indicate below whether this study involves additional procedures listed below. Be sure to complete the selected appendices below the signature section

Appendix	Additional Procedure Information
☐ COVID-19	Risk for COVID-19 infection
☐ A	Risk
☐ B	Minors as Participants
☐ C	Psychological Intervention
☐ D	Deception
☐ E	Physiological Intervention
☐ F	Biomedical Procedures & Biospecimen
☒ G	Changes to Informed Consent
☒ J	Monetary compensation for participation
☐ K	Physical interaction (intervention/assessment & other)
☐ L	Analysis of existing data not eligible for exemption

11 DECLARATION

Sign by entering your name in the fields below. Student PI's MUST enter their name by logging into their MTSU account. Although not mandatory, faculty researchers and advisors are encouraged to enter their name by logging to their MTSU account.

11.1   PI Signature:
I certify by entering my name below that:

1) the information provided for this project is accurate;
2) no other procedures will be used in this project;
3) any modifications in this project will be submitted for approval prior to use; AND
4) I have read and fully understand my responsibilities as the PI (https://www.mtsu.edu/irb/FAQ/ResponsibilitiesOfPI.php)

Maryann Elizabeth Barnes	09/24/2021
*Name of the Investigator (PI)	**Date**

Enter your full name

APPENDIX SECTION – ADDITIONAL PROCEDURAL INFORMATION

APPENDIX G
REQUEST FOR ALTERNATIVE CONSENT PROCESS

Starting from AY 2021, this appendix will be used to provide additional details on various types of consent processes and their documentation. Please complete this appendix if you do not plan to obtain traditional in person informed consent with participant signature.

Under 45 CFR 46.116(d) the IRB may waive the requirement for obtaining informed consent or approve a consent procedure that leaves out or alters some or all of the elements of informed consent, provided that the IRB finds and documents that all of the following four criteria are met:
 a) the research involves no more than minimal risk to the subjects;
 b) the waiver or alteration will not adversely affect the rights and welfare of the subjects;
 c) the research could not practicably be carried out without the waiver or alteration;
 d) whenever appropriate, the subjects will be provided with additional pertinent information after participation.

G.0 Type of changes to informed consent:
☒ Web-based informed consent using Qualtrics – Complete G.5
☐ Informed Consent rhough Zoom or Telephone – Complete G.6
☐ Other – Continue to G.1

G.1 Are you requesting a waiver of obtaining informed consent? (i.e., you will not obtain informed consent at all. e.g., observational study and informing participants that they are in a research study would make the research impossible.)
☐ Yes   ☒ NO
Explain if Yes:

G.2 Are you requesting that physically signed consent forms are not obtained? (e.g., you are conducting research online and cannot obtain signatures; you wish to not obtain signatures to protect the participants, etc)
☒ Yes   ☐ NO
Explain if Yes: The research will be completed remotely, via Qualtrics and Zoom. .Therefore it is not possible to have physical signatures.

G.3 Are you requesting approval to alter the consent form such that not all the required elements of consent are included? (i.e., you checked "no" to some elements in the checkbox for informed consent)
☐ Yes   ☒ NO
Which elements from the informed consent are you seeking to alter or remove?

G.4 If you answered yes to G.1 through G.3, then complete this link:

a. How does the research involve no more than minimal risk?
All questions are asked remotely and the entire survey is voluntary. Emails are gathered only to allow for approriate compensation.

b. How will a waiver of informed consent not adversely affect the rights and welfare of the participants?
Names are not part of the data analysis and will not be considered as part of the results.

c. Why could the research not practicably be carried out without the waiver or alteration?
The participants will be recruited from research universitites from the southeast. Therefore, the distance between schools in and out of the state would not be feasible for the investigators to compelete in-person consentn forms.This and the need to social-distance makes it necessary to provide an online survey and consent document.

d. If appropriate, how will subjects be provided with additional pertinent information after participation?
Additional pertinent information will be distributed via email.

G.5 Online informed consent:

Refer https://mtsu.edu/irb/FAQ/OnlineDataCollection.php
Describe the process administering informed consent starting with how the participants will access the Qualtrics: The consent form will be accessed via the given Qualtrics link. The link will be provided to the participant's by the research team. The investigators will distribute the Qualtrics link to the students. Upon entering the qualtrics survey platform, the informed consent will open and participants will be asked to confirm that they are 18 or older, that they understand the surveys purpose and any potential risks. Finally, the participant will need o check the box that says "Yes, I consent" or "No, I do not consent." If the latter is chosen, they will not enter the survey section.

Qualtrics data collection – Mandatory consent requirements:
- *All exclusion inclusion criteria must be clearly disclosed prior to the consent*
- *The first page of the study must be the informed consent form*
- *Consent to participate must be explicitly asked and separate responses must be entertained by clearly indicated boxes to accept or deny*
- *An age-verification question with an active response must be added*
- *The text for informed consent should be provided to the participant as part of debriefing or a follow up email whichever is approved by the IRB*

Visit www.mtsu.edu/irb and click on IRB Forms to download one of the informed consent templates meant for online administration. Based on your which form you downloaded, make a selection below:

☒ Locked online consent template is used
☐ Unlocked free format online consent template is used

The Qualtrics link for administering informed consent provided for IRB review AFTER the link has been tested by the PI. Use the following check list to test the Q

Test the online consent before completing this check list

☒ Yes	The protocol ID, study title, name of PI and faculty advisor (if applicable) and space for approval/expiration dates are provided legibly.
☒ Yes	All inclusion and exclusion requirements are clearly stated and additional click box items are added if necessary
☒ Yes ☐ N/A	Compensation information and adequate disclosure for eligibility are clearly stated and additional click boxes are inserted if necessary
☒ Yes	Contact details for the researchers and the office compliance are provided
☒ Yes	Consent to participant is entertained by two distinct responses
☒ Yes	Age verification of the participant is also done as in the consent question above
☒ Yes	The survey will not begin unless all necessary boxes are clicked

☒ Yes	If a participant fails to consent or ignores one or more of the clickable boxes, then one of the following action is done:
	  ☒ The survey ends and the participant is directed to a "Thank You" page
	  ☐ A good faith reminder is given and the survey will move to debriefing if the participant continues to not click the mandatory boxes

☒ Yes	The survey administered to someone who is not familiar with the study (enter name: Laine Matthews) and the time duration for completing the entire survey is compatible with what is displayed in the consent script.
☒ Yes	The consent script displayed online is identical to the consent document submitted for IRB review (minor formatting/font changes are allowed)

G.6 Interview by Telephone or Zoom:

Instruction:

a. *Zoom Interview:*
Currently, virtual interviews can only be done via Zoom for IRB purposes. Other platforms will be allowed if the PI can demonstrate that the participants are protected adequately. The participants will receive a copy of the informed consent via email. S/he will physically sign and send a scan of the signed page back to the investigator. Alternatively, the participant will simply write a response text indicating s/he is interested in the study. The PI will go ahead and arrange the zoom meeting. Prior to the interview, the PI will refresh the participant with the important steps of the study and ensure the participant read the informed consent script sent by email. The PI will then document the informed consent process and store in his/her records.

The PI or his/her designee MUST NOT video/audio record the informed consent process unless or otherwise explicitly approved by the IRB.

b. Telephone Interview:
Not Applicable

Description:

i. Have you read and understand the instructions above?
Yes

ii. Do you plan to make any changes to the informed consent process and documentation from what is described above?
No

iii. Do you understand that the informed consent process must not be video/audio recorded unless you have explicit approval from the IRB?
Yes

iv. How will a consent through Zoom or a telephone call not adversely affect the rights and welfare of the participants?
Getting consent through zoom allows for any possible COVID19 exposure to be minimized

v. If appropriate, how will subjects be provided with additional pertinent information after participation?
If necessary the participant will be contacted via email with any additional pertinent information after participating in the interview.

---------- End of Appendix G (Informed Consent) ----------

APPENDIX J
MONETARY COMPENSATION

MTSU Business Office (BO) requires that all MTSU funds are adequately accounted to comply federal and state finance laws. But the researchers are also required to protect participant anonymity. Since both federal/state laws must be followed, the MTSU IRB and the BO have an arrangement to document monetary disbursement of funds without compromising participant identity.

Mandatory Compensation Disclosures:
- *All of the eligibility requirements to receive the compensation must be clearly disclosed in the informed consent as well as in the recruitment script*
- *The participants must be awarded the promised compensation or a portion of once they enroll; they are not required to complete the tasks to the satisfaction of the investigators*
- *If funds for the compensation are disbursed through the MTSU Business Office, then documentation requirement for receipt of compensation, such as obtaining W9 forms. This must also be clearly disclosed in the informed consent as well as the recruitment scripts*

J.1 Inducement Details

1. MTSU funds disbursed by MTSU Business Office are used OR this project is being funded by an agency/entity that requires the participants to produce a receipt for reporting purposes:
   ☐ NO – Jump to Section J.5
   ☒ Yes- Continue to step 2 below
2. Total compensation per participant for the entire study: 25-50$
3. Compensation for each trial per participant: 25$
4. Disbursement method:

☒Gift card   ☐Check   ☐Cash   ☐Direct Deposit
☐Other Explain:

J.2 Record keeping & Reporting

Make selections below to evaluate what type of record keeping is necessary:
(i)   The inducement per trial (line 2 above) is less than $70   ☒Yes   ☐NO
(ii)   The inducement per year (line 1 above) is less than $600   ☒Yes   ☐NO

> A. If selected YES for (i) AND (ii), then document the following:
>   o   Gift card/Check or other Transaction Number
>   o   Date of Issue
>   o   Amount disbursed
>   o   Participant Signature

B. If selected NO for (i) and YES for (ii), then document the following:
   o   All of the particulars from A above
   o   Full name (if the IRB approval notice clearly allows this)

C. If selected NO to (ii), then document the following for each participant.
   o   All of the particulars from A and B above.
   o   Obtain participant's W9 form

- **The compensation dispatch record must not contain any other identification on the protocol in which the participant enrolled.**
- **Do not make copies of the records. Store the records in a safe place and deliver them to the Business Office in a timely manner.**

J.4 Acknowledgement

By entering my name below, I acknowledge that I have read these instructions listed above and I will maintain records of the inducement in a manner such that the participant anonymity is maintained.

PI: Maryann Elizabeth Barnes
Date: 9/1/2021

Please skip J.5 if you completed rest of the sections above (J.1 through J.4)

J.5 Documentation Waiver
Complete this if MTSU funds will NOT be used to pay for the participant compensation

By entering my name below, I affirm that MTSU funds are not used to pay for research compensation. I am aware that no records of participants must be retained and any identifiable information must be destroyed.

PI:	Faculty Advisor:
Date:	Date:

---------- End of Appendix J (Participant Compensation) ----------