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Climate Change and Infrastructural Damage

Macey VanSavage

ABSTRACT

With the assistance of ENGL 231C students at Old Dominion University, Dr. Daniel Richards and Mrs. Megan McKittrick led this study testing the usability of Climate Central's *Risk Finder* tool. The study was conducted as a client-based, service learning project for a Technical and Scientific writing course, serving client Dan Rizza at Climate Central, a non-profit research organization. The study serves as a way for local collegiate students to be able to gain knowledge about the execution of faculty-level research. The *Risk Finder* tool allows users to view the potential effects of sea level rise on their area. The tool also shows predictions of how flooding from storms could affect users' lifestyles. The *Risk Finder* tool's collection of data from various organizations provides users with a wealth of information customized to their specific interests. Citizens of Hampton Roads, Virginia prove crucial to this experiment; citizens' responses to Climate Central's most recent technology will show researchers how the tool's information affects the residents and how they handle negative predictions. The usability testing will require a sufficient sample size of approximately 8-10 users from the area. The users will be requested to disclose their name, contact information, availability, and length of time spent in the Hampton Roads region. The participants will use the *Risk Finder* tool under observation and participate in interviews. If more than 10 users volunteer for the study, a representative sample will be compiled for participation in interviews and exploration of the *Risk Finder* tool. Informing residents of high-risk areas, like Hampton Roads, about climate change is crucial to the safety of these areas. Increasing the usage and popularity of a tool like *Risk Finder* could potentially decrease environmental and infrastructural damage due to climate change and sea level rise.

Climate change and sea level rise affect the lives of people around the world, especially in coastal areas. Structural damage to homes, roads, and the surrounding environment are effects of this unnatural change in the atmosphere. Previous research studies demonstrate what can be done to help societies dealing with the issues of climate change and sea level rise. Research led by Mrs. Megan McKittrick and Dr. Daniel Richards tests the usability of Climate Central's *Risk Finder* tool for client Dan Rizza at Climate Central.

LITERATURE REVIEW

Impacts on Developed Areas and Environmental Systems

A research study by A. Linhoss, G. Kiker, M. Shirley, and K. Frank provides insight into how sea level rise and climate change affect Florida as a result of its extensive oceanic exposure (2015). Possible inundation of infrastructure and environmental ecosystems during sea level rise shifts natural and man-made habitats, placing them at risk (Linhoss et al., 2015). The study exemplifies the effects of

severe sea level rise based on the vulnerabilities of communities and ecology (Linhoss et al., 2015). A model analyzing surface cover and land use was used to assess potential resulting damages to various locations, including salt and freshwater wetlands, urban areas, and less developed expanses (Linhoss et al., 2015). The model used three different sea level rise scenarios that produced various simulations of how flooding would affect certain areas (Linhoss et al., 2015). Predictions included millions of dollars in property damage and the migration of wetlands to areas that would not be suitable to sustain them (Linhoss et al., 2015). The study only examines a coastal area and does not show the effects of climate change on wetlands in midland areas.

Adaptation to Climate Change

Adapting to climate change is essential to managing its many effects and impacts. A study by F. Davis and E. Chornesky resided in California, an important area for raising the environmental awareness of the general public (2014). Flooding is nationally the

most common concern regarding climate change. However, in other areas like California, droughts can prove to be a greater concern (Davis & Chornesky, 2014). Heat waves brought on by droughts and dryness threaten the area's billion-dollar agricultural sector (Davis & Chornesky, 2014). Droughts also put California's multiple endangered species of plants and animals at risk by potentially causing drastic environmental change to their natural habitats (Davis & Chornesky, 2014). To address the risks posed by droughts, Californian political officials used communication to raise awareness among residents and made improvements to the state's water management system (Davis & Chornesky, 2014). These crucial steps of communication and action help develop knowledge about the underlying need for crisis communication while moving towards solutions (Davis & Chornesky, 2014).

The research study also shows how direct effects of sea level rise are initially manageable but become more hazardous as levels rise disproportionately (Davis & Chornesky, 2014). Land will

eventually become severely uneven, preventing convenient construction, but this is not predicted to happen for quite some time (Davis & Chornesky, 2014). Although this research shows California's progression towards adapting to climate change, it still does not provide evidence that indicates a source (Davis & Chornesky, 2014). Further research in this field could result in more effective solutions.

Effects on Tourism

Initially, tourism might not come to mind when the topic of climate change or sea level rise is discussed. However, for tropical developing countries that rely on tourism for profit, it is a major concern (Mycoo, 2014). Sea level rise not only affects beaches directly but also the facilities that are used as the main attractions to draw visitors to these countries (Mycoo, 2014). Major flooding can destroy infrastructure, and less fortunate areas may not be able to afford to rebuild (Mycoo, 2014). A case study by Mycoo shows how Barbados handles adapting to the unpredictability of the weather

(Mycoo, 2014). The study exemplifies ways for the nation to take precautions and put pre-emptive policies in place to minimize the effects that sea level rise and climate change can have on the area (Mycoo, 2014). Improvements for coral reefs, flooding retreat strategies, and planning policies are being explored to handle potential negative situations (Mycoo, 2014). The trend of climate change affecting certain species significantly is also present in Barbados (Mycoo, 2014). Barbados' coral reefs are deeply affected by the rise and fall of the sea; changes caused by sea level rise place them at risk (Mycoo, 2014). Coral reef protection has become an urgent need and must be implemented to keep local sea life healthy (Mycoo, 2014). The research study presents many strategies, but some are only in the developmental phases (Mycoo, 2014); these strategies cannot benefit the nation until they are put into action.

Climate Change Evaluation

Impacts of climate change and sea level rise can be extremely severe if precautions are not taken. Adapting to the inconsistency of

flooding and climate change has developed into a trend as a result of adaptation becoming increasingly more necessary (Goharnejad, Shamsai, & Hosseini, 2013). A study by Goharnejad, Shamsai, and Hosseini highlights how southern Iran evaluates the effects of climate change on its coast (2013). A model that simulates different variables produced by climate change and sea level rise was used to conduct research on how to evaluate vulnerability even further (Goharnejad et al., 2013). Although not correct in all cases, models prove to be a proficient way to predict scenarios.

Models and Methods

Many methods of prediction have been used to evaluate the potential harm that can be caused by climate change and sea level rise. An article by Bosello and De Cian shows how different methodologies have been approached and adapted towards the cause (2014). Positives and negatives exist for almost every method, but based on various assessments regarding economics and technologies, some methods can be more effective than others,

depending on use (Bosello & De Cian, 2014). A survey was conducted to determine the direction for the future, which tends to involve combining the areas of risk analysis and evaluations based on the economy (Bosello & De Cian, 2014). One seemingly cost-effective strategy that would significantly decrease risk is the bettering of coastal protection (Bosello & De Cian, 2014). Adaptation is also addressed in this research; methods and strategies for retreating from considerable sea level rise could be beneficial because of the negative effects of flooding (Bosello & De Cian, 2014). In times of extreme events, retreat not only provides safety if an area is undergoing inundation, but also allows for residents of high risk areas to prepare for the worst, reducing damage (Bosello & De Cian, 2014). Further research will lead to better analysis tactics and growth in this field.

Effects on Infrastructure

Flooding as a result of climate change negatively affects infrastructure in vulnerable areas. A new system described by

Schweikert, Chinowsky, Kwiatkowski, and Espinet plans to incorporate better ways of planning and managing the effects of flooding on infrastructure (2014). The system pieces together both qualitative and quantitative data analyses to develop an approximate fiscal cost (Schweikert et al., 2014). It has started to be implemented in many countries in hopes of focusing on the impact of road construction on societies (Schweikert et al., 2014). The system proves to be progressive towards new ways of trying to protect infrastructure against the elements.

Most of these research area groups require further investigation for better solutions. Current research accomplishments emphasize the big picture of crisis communication. All research area groups show how adapting to climate change and sea level rise is crucial for better-developed societies. Areas of concern that are not as frequently associated with climate change can also be affected. The more the issues of climate

change and sea level rise are communicated internationally, the more prepared the world will be for future changes.

METHODS

To make sure that the usability testing for this study was organized and efficient, it was divided into three tasks. Initially, participants needed to be identified and gathered for the usability testing to be conducted. Next, data collection from each individual interview was recorded and transcribed. Last, all information taken was analyzed to be able to receive results from the testing. Each of these processes proved necessary to be able to complete the testing in an organized and efficient manner.

Initially, a call for action was sent out to numerous households throughout the Hampton Roads area. These households were chosen through systematic sampling, which included the randomization of various addresses and allowed for an unbiased view of choosing participants. Four participants responded and contributed to this “productive” type of usability testing. The

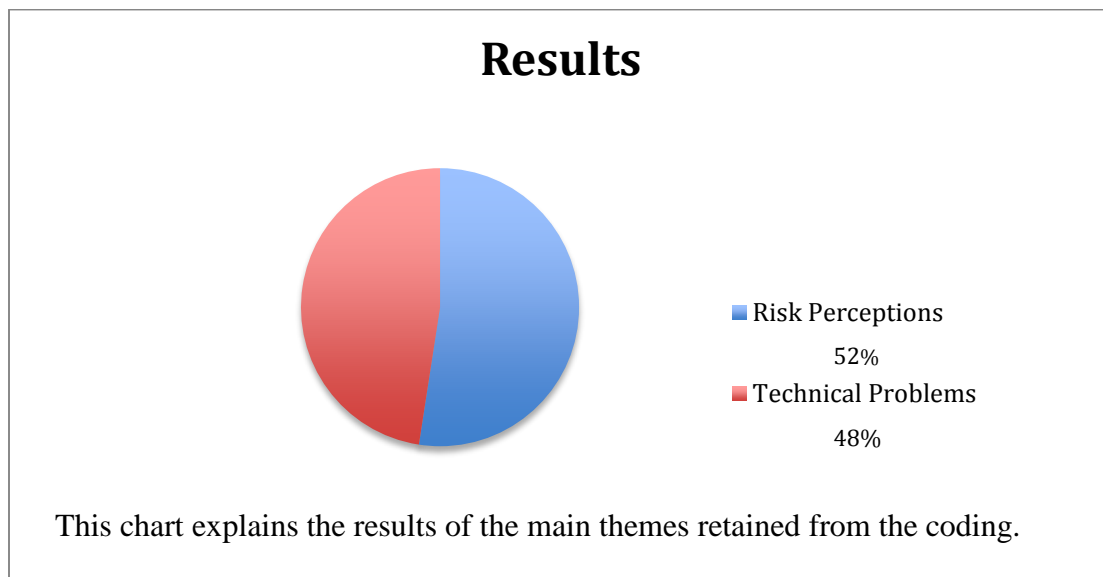
participants served as a small sample from the Hampton Roads area and aided the testing by collectively giving four hours of data. All participants were willing to provide help towards the cause of improving risk communication.

All four participants were interviewed, observed, recorded, and asked to perform tasks regarding the *Risk Finder* tool. The participants were asked about the Hampton Roads area to establish a connection to the topic. Participants were briefly introduced to the tool before a pre-test interview was conducted. They were then observed for approximately twenty minutes while they used the tool. A post-test interview was conducted at the end.

All of the data from the interviews was collected and analyzed. Audio recordings and field notes were transcribed. These audio transcriptions were broken down between observers and transcribed for clarification. Transcriptions were carefully organized for the results of the research. The data was carefully considered for solutions.

RESULTS

The transcriptions revealed that participants were interested in topics of transportation and infrastructure. Flooding was a common concern, as well as views on climate change. Ages varied between the participants in forms of decades, so they brought complex and unique perspectives between their ideas. Also, all of the participants showed prominent concerns for their residential area and the future. The overall results can be viewed in the pie chart below.



DISCUSSION

Our data points to some important questions. The first of these remaining questions deals with the type of work that citizens wish to do while using the *Risk Finder* tool. Most of the participants had difficulty navigating the interface; they wanted it to be simpler to use without having background knowledge about the tool. Technical difficulty was one of the most common themes in the transcription. An advantage of the study's methods was that participants were given ample opportunity to search the tool freely; the allotted time dedicated to the exploration of the tool during the usability testing did not hinder or force opinions on participants.

The second question needing further exploration is in regard to how perceptions of risk and vulnerability affect the use of the tool. Each of the participants showed unique and specific interests that resulted in differing search aspects associated with personal connections. Prior concerns and ideas that have been previously instilled through experience affect how someone uses the tool.

However, the study's small population cannot act as an accurate sample for all of the Hampton Roads area. Further data would need to be collected to achieve a more accurate solution statement.

The final question regards speculation about whether the use of the *Risk Finder* tool brings about any observable change in risk perception and vulnerability. The tool is meant to bring light to risk perceptions, climate change, and flooding. However, the limitation of our sample size hindered this research question. With only four participants, it proves difficult to be able to make a statement about an observable change in their perceptions of the risk and vulnerability of the area. The participants did react well to some of the tool's features, such as the gauge where sea level rise could be manipulated to view impacts. The sea level rise gauge seemed to further open participants' eyes to the vulnerability of the area in which they live.

The four participants displayed both similarities and differences. Despite the advantages of the employed methods, some

limitations were still present due to sample population and time constraints. The findings will help Climate Central make their *Risk Finder* tool more user-friendly and widely known. The research will benefit the client, Climate Central, by providing data to be surveyed and used to make changes to their tool.

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