ENGAGING DIVERSE HIGH SCHOOL STUDENTS IN MISSOURI THROUGH A
DELIBERATIVE CLIMATE CHANGE FORUM

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By

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The undersigned, appointed by the dean of the Graduate School, have examined

the thesis entitled

ENGAGING DIVERSE HIGH SCHOOL STUDENTS IN MISSOURI THROUGH A

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a candidate for the degree of Master of Science,

and hereby certify that, in their opinion, it is worthy of acceptance.

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To my hero and inspiration—my mother. Her tireless efforts have brought me here, to the other

side of the world, where I continue fighting for my dreams. This achievement is more yours than

mine. Your strength, guidance, and perseverance paved the way for me. Thank you for being my

light in the pursuit of my aspirations. This thesis is not only a product of my academic journey,

but also a testament to your unconditional belief in my potential. It is dedicated to you, Mom,

with all the gratitude and love.

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ABSTRACT

Climate change is the most pressing environmental issue in the 21st century. Its effects increase in severity due to human actions that negatively impact natural resources. This produces risks to human health, food security, water supply, and the global economy. In order to address climate change, it is crucial to recognize it as a social-environmental issue. Formal and non-formal education plays an important role in fostering knowledge, attitudes, values, and behavior among students. Thus, it is essential to prioritize education and research that explores differences in knowledge and attitudes toward climate change among diverse high school populations. For that reason, this study aims to engage diverse high school students in Missouri through a deliberative climate change forum.

This study was conducted using a mixed-methods approach with students from 2 different Missouri high schools (n=22). The quantitative approach included pre and post-test instruments, while the qualitative procedure was a focus group using the Climate Choices Issue Guide created by the North American Association for Environmental Education (NAAEE). The deliberative climate change forum was divided into five sections: recognition, reduction, adaptation, innovation, and conclusion, with 17 questions in total.

Paired-sample tests showed a statistically significant increase in knowledge ($t(21)=-2.806$, $p=0.005$), awareness ($t(21)=-6.21$, $p<0.001$), and hope ($t(21)=-3.65$, $p<0.001$) after the forum. The students were able to identify what are the causes, and consequences of global warming, and got a better understanding of climate systems. Additionally, participants provided strategies that they considered the most effective ways to address climate change. This suggests that climate change education and deliberative forums can foster awareness about environmental issues and promote positive values and attitudes towards climate change.

I. INTRODUCTION

Climate change has been one of the foremost environmental concerns in the twenty-first century. Its effects have been rapidly increasing in severity due to the use of the environment as a platform for human expansion. These actions have negatively impacted the natural resources producing risks to human health, food security, a decrease in water supply and the economy (Reimers, F. 2021). Climate change has been recognized as a global concern; however, some sectors are still unbelieving about the harm that this issue might produce to the environment and society (Reimers, F. 2021).

Polar bears floating on melting ice is the most popular environmental image used to increase awareness in the world to show how climate change impacts the environment and natural resources. However, it's important to highlight that humans are also vulnerable to the effects of this environmental issue. According to The International Panel on Climate Change (IPCC), if we continue with the current economic model, the temperature is projected to increase by 1.5 ºC between 2030 and 2052, posing risks to human health, food security, water supply, and economic growth (IPCC, 2021).

Different studies have demonstrated that climate change impacts regions and communities throughout the world (Hsiang et al., 2017; United Nations, 2019; Diffenbaugh & Burke, 2019). For example, due to abrupt changes in the weather and variations in precipitation patterns. Coastal areas, and arid regions are susceptible to the increase in sea levels producing flooding, erosion, and water scarcity (UN, 2019). In addition, in countries whose economies are agricultural-based, climate change produces a negative impact on agriculture, generating food insecurity and economic instability (Hsiang et al., 2017).

Education is crucial at all stages of people's life since can provide them with the

necessary knowledge and skills to address different problems (Reimers, 2021). Empowering people by fostering awareness, prompt reflection, and influencing their behavior regarding different issues is the key to improving their lives. Additionally, education allows individuals to address problems by increasing their knowledge and understanding. As a result, people can take action to mitigate and adapt to the effects of this impact and propose sustainable actions (Fien et al., 2000). Through the evaluation of existing knowledge, results can illustrate to what extent people can adopt new attitudes toward a more sustainable lifestyle (Haker-Schuch & Bugge-Henriksen, 2013).

Youth generation face multiples challenges regarding climate change. Children and adolescents present risk of adverse health effects of climate change, ranging from physical illness due to severe weather events to psychological distress related to climate-related disasters (Sanson et al., 2019). On the other hand, young people are increasingly being recognized as important agents of change, who with the appropriate knowledge are able to promote climate action initiatives (Flora et al., 2014). Youth have been conformed activists group who are significantly contributed to the global climate movement, bringing unique perspectives, and advocating for substantial policy changes (Lee et al., 2020).

To promote individuals to adopt sustainable practices it is essential to deliver education that equips them with the necessary tools and skills supported by an academic framework. Quality education not only enhances individuals' knowledge and innovation but also fosters better relationships with the world by improving their social skills (Reimers, 2021). As a result, students can transfer what they have learned in educational settings to their peers (Weissberg & O'Brien, 2004; Lawson et al., 2019).

Deliberative forum is a method used to engage participants in an informed and respectful

discussion about a particular issue (Li et al., 2021). This process involves a diverse group of participants with different viewpoints and social-economic backgrounds who gather to deliberate on a specific topic, share their perspectives, and explore potential solutions (Fishkin, 2018). Deliberative forums have been used at schools to engage students in in-depth conversations about different social issues, where finding mutual solutions may be no easy such as climate change. These forums provide an opportunity for students to learn from each other, develop critical thinking skills, and gain a better understanding from different perspectives (Hoffman, 2021).

Deliberative forums are an important method that should be included in climate education. As Gastil (2005) noted, these forums encourage active learning, foster critical thinking, and create an environment for respectful and productive discussions on complex issues like climate change. The implementation of deliberative forums allows educators to promote civic engagement and create safe spaces for students to voice their opinions and concerns about climate change. Furthermore, research has demonstrated that deliberative forums can help to reduce polarization and increase trust among participants, which is crucial in the promotion of constructive dialogue and collaborative decision-making (Nabatchi, 2014).

The Climate Choice Issue Guide was published by the North American Association for Environmental Education and National Issues Forums in 2016. This guide is proposed for use in both formal and non-formal educational settings and aims to promote informed deliberation on climate change as a global issue. *Engaging Diverse High School Students in Missouri Through a Deliberative Climate Change Forum* is a study created to promote the discussion among high school students to share their thoughts, opinions, and concerns about climate change. This forum used the Climate Choices Issue Guide as a resource for leading the discussion. This study

emerged in response to a request made by students from St. Clair and Metro High Schools in Missouri, who desired to participate in constructive conversations about the environment and climate change solutions led by environmental professionals. Both schools have students from different social backgrounds, which made the sample study a diverse group that incorporated diverse perspectives during the discussion. Consequently, a deliberative climate change forum was proposed as an approach to engaging high school students with differing viewpoints. St. Clair High School is situated in St. Clair City, Franklin County, MO, while Metro High School is located in St. Louis, MO. This study utilized a mixed-methods approach, involving both quantitative and qualitative data collection and analysis. The application of pre and post-test, analysis of open-ended questions, and focus group ensure the robustness and reliability of the results (Creswell and Plano Clark's, 2018)

Finally, this study aims to align with the principles from the Theory of Planned Behavior (Ajzen, 1991) and Bandura's Social Learning Theory (Bandura, 1977), emphasizing collective action's role in shaping individual attitudes and the learning environment in shaping sustainable behaviors. Incorporating those theories in this study is crucial, since they contribute to a deep analysis of the results, explaining why the interaction between different individuals at the same place can enhance the understanding about climate change, acquiring new knowledge, and promote sustainable behaviors between each other. The literature review within this study provides an important theoretical framework, illustrating the theories and concepts that support the development of this research.

II. LITERATURE REVIEW

This literature review explores the foundational theories and concepts that support the present study, focusing primarily on the engagement of the youth demographic in climate change initiatives. With young people at the heart of this research, it becomes crucial to comprehend the multitude of ways in which climate change impacts their physical and psychological health. This review highlights the importance of climate change education in youth empowerment, and the engagement in sustainable measures to address this global issue. Moreover, examines the current strategies, programs, and methodologies that are employed globally to deliver high-quality and effective climate change education to young people. Psychological theories such as the Theory of Planned Behavior and Bandura's Social Cognitive Theory, are key in understanding the dynamics of youth interaction with environmental issues. These frameworks offer insights into the driving forces behind behavior change and the interaction between individual and societal influence. Thus, this review examines how these theories contribute to our understanding of youth engagement in climate change mitigation and adaptation efforts.

Youth Health and Engagement

Numerous scientific articles have documented the negative impacts that climate change has on ecosystems and natural resources. However, it is equally important to consider how this environmental issue will harm future generations and how we, as a society, can protect and empower our youth to face the effects of climate change. Climate change's repercussions extend beyond the environment, posing severe risks to the physical and mental health of children, who are often more vulnerable to its effects than adults (Sanson et al., 2019). For example, children and young people can experience heat-related illnesses, exposure to environmental toxins, and

infections triggered by parasites resilient to warmer temperatures (Sheffield & Landrigan, 2010; Sanson et al., 2019)

In terms of mental health, climate change can contribute to post-traumatic stress disorder (PTSD), depression, anxiety, and sleep problems in children and teenagers (Garcia & Sheehan, 2016; Majeed & Lee, 2017; Sanson et al., 2019). Young people who comprehend the dimension of climate change and its impacts may start to experience feelings of worry, fear, sadness, anger, and frustration, reflecting their understanding of its potential harm (Ojala, 2015; UNICEF UK, 2013; Sanson et al., 2019).

Some adults, due to a lack of awareness or even deliberate denial, fail in taking appropriate action against climate change. Thus, this is a significant opportunity for younger generations to become actively involved in advocating for and implementing sustainable practices. Their future is directly shaped by the decisions we make today, and they are in a powerful position to influence these decisions (Bandura & Cherry, 2020).

It's noteworthy that decision-making processes that impact the youth's future are usually dominated by adults, despite the direct implications for young people. The Convention of the Rights of the Child mandates the inclusion of children in decision-making processes related to their interests (United Nations General Assembly, 1989). Therefore, it's essential to acknowledge young people as thoughtful individuals capable of contributing valuable insights and arguments to matters of their concern. Furthermore, children's active participation in societal processes offers multiple opportunities and psychological benefits, including increased hope, self-esteem, and confidence (Hart, Fisher, & Kimiagar, 2014; Sanson et al., 2019).

Young generations possess leadership qualities such as enthusiasm, intelligence, and dynamism, which equip them to play a significant role in protecting the earth and conserving

natural resources (Flora et al., 2014). In addition, they have access to important digital platforms like social media, which makes spreading their voices easier. In the 21st century, youth have begun to raise their voices and express their concerns. A notable example is young Swedish climate activist Greta Thunberg, who in 2018 established a campaign called "Youth for Climate". This initiative incentivized thousands of young people from over 100 countries to demand their governments take action against climate change (Lee et al., 2020). This movement promptly received significant support from academics and scientists (Hagedorn et al., 2019; Scientists for Future, 2019). As a result, environmental education has emerged as a pivotal tool to inform children about their impact, develop their environmental attitudes, nurture beliefs, create hope, and stimulate concerns about climate change (Sanson et al., 2019).

Multiple studies have shown the significant psychological benefits produced by the engagement of youth in environmental programs. Usually, youth feel empowered after participating in an educational program, having a sense of being able to address any social issues, such as climate change, and experiencing enhanced self-efficacy, a psychological attribute associated with improved mental health and well-being (Zimmerman, 2000). Moreover, environmental engagement can help to create personal objectives and guide their lives toward a healthy style, which are fundamental factors of psychological well-being (Steger et al,. 2006). These findings suggest that by conducting climate education and engaging youth in those programs, we are addressing the environmental crisis and contributing to their psychological development and welfare.

Intergenerational justice focuses on the importance to engage youth in climate education and environmental programs. In addition, this concept argues that adults have the duty to leave a habitable, healthy, and sustainable planet where future generations can live (Gosseries & Meyer,

2009). The involvement of youth in environmental programs aligns with two of the seven principles of intergenerational justice which are the principles of participation and responsibility. The principle of participation argues that both present and future generations should have the right to participate in decisions making processes that may impact them. On the other hand, the principle of responsibility holds that each generation acts as a custodian of the Earth and has the responsibility to take care of future generations by minimizing negative environmental impacts (Gosseries & Meyer, 2009).

Engaging youth in environmental programs is strategic. Young people are the leaders and decision-makers of the future; therefore, their early engagement in climate change initiatives is key to ensuring long-term, sustainable solutions (Flora et al., 2014). Youth are not only affected by decisions about the environment, but they are also key actors in the ongoing effort to mitigate climate change. Thus, the importance of youth engagement in climate change cannot be overstated.

Climate Change Education

Academia and policymakers agree that education is essential for boosting knowledge and fostering sustainable behavior (Bofferding & Kloser 2014). Understanding climate change is important for addressing this environmental issue. The role of education in this process is crucial, however, integrating climate change topics into the scholarly curriculum sometimes is challenging for educators due to several constraints that they may face (Monroe et al., 2017). At present, there are multiple academic sources that offer abundant information about climate change. Nevertheless, this information can occasionally be contradictory (Holthuis et al., 2014), leading to misconceptions among students and opening the gap in knowledge. Furthermore, the

complex nature of climate change complicates the delivery of quality educational programs on the subject, making some educators propagate misconceptions about the basic facts of climate change (Monroe et al., 2017). This situation may be intensified if they lack a comprehensive understanding of climate change issues, negatively affecting their teaching effectiveness.

On the other hand, institutional constraints often obstacles to the delivery of climate change education. School curricula provide the basis for how children and youth learn about environmental issues, but these programs sometimes lack the necessary depth and breadth to provide adequate knowledge. The context of standardization leaves little room for flexibility and can further limit the inclusion of new topics such as climate change (Sanson et al, 2019). It's often observed that discussions about climate change in classrooms are reduced to generic discourses about pollution, neglecting specific aspects such as the greenhouse gases involved and their sources (Koulaidis & Christidou, 1999; Lee et al, 2020). As a result, teachers may hesitate to integrate climate change topics.

Another significant constraint is the politicization of climate change. This happens when the political affiliations of the individuals often shape their beliefs about this environmental issue. Consequently, socio-ideological aspects may hold more influence than the tangible environmental and health impacts of climate change (Lawson et al., 2019). In this political situation, teenagers are involuntarily dragged into ideological conflicts, their environmental values and personal identities being defined without their active participation or choice.

Given these constraints, there is an urgent need to develop and implement strategies that facilitate youth understanding of climate change and promote their active involvement in addressing its impacts. To close the gaps in knowledge, scholars and social scientists should conduct research and develop environmental education programs aimed at teaching youth about

the issue (Puttick et al., 2015). It's essential to recognize that the delivery of impactful climate education requires more than just being a competent teacher. Therefore, the use of teaching strategies such as experiential, inquiry-based, and constructivist approaches becomes essential in environmental education.

These strategies, which include field trips, flipped classrooms, simulations, worksheets, data collection, role plays, and community action projects, promote engagement with diverse audiences and improve the quality of programs, contributing to more comprehensive climate education (Monroe et al., 2017). Lastly, youth due to their innocence and vulnerability, are more susceptible to misinformation than teenagers or adults, creating the need for effective climate change education (Moutier et al., 2006; Lee et al, 2020). All these considerations make clear the importance of proactive, innovative, and sensitive approaches to climate change education, which would ultimately equip future generations to address this environmental crisis.

Building critical thinking skills and empowering youth with knowledge are among the most valuable outcomes of climate change education. By engaging students in dialogue and exchange of ideas, they are enabled to conduct in-depth analyses and create strategies to address climate change from their unique perspectives (Monroe et al., 2017). Research findings have demonstrated that an active interaction between and student and a facilitator during a climate change education session significantly improves students' knowledge (Holthuis et al., 2014).

This engagement helps students broaden their understanding by introducing them to new perspectives and concepts. Additionally, after participating in these educational sessions, students are more willing to engage in environmental school programs and make sustainable personal actions (Flora et al., 2014). It is important to highlight that a homogenous group of participants may not represent the entire range of diverse perspectives or underrepresented

opinions. For that reason, it is crucial to compose and integrate a diverse group into the discussion to capture a variety range of responses possible (Monroe et al., 2017).

Deliberation, and Environmental Issues Forums

In his rhetoric, Aristotle argues that the deliberation process is one of three fundamental genres of civic discourse that promotes discussion (Hoffman, 2021). Furthermore, deliberation serves as a valuable approach, aiming to communicate environmental issues such as climate change to the youth (Li et al., 2021). The power of this process enables individuals to actively participate in decision-making or discussions to improve their lives. Indeed, any decisions made here will significantly impact their lives (Hoffman, 2021).

Deliberation processes are social spaces where different individuals involve themselves and express their insights about social issues (Li et al., 2021; Manosevitch, 2019). According to Hoffman (2021), a deliberation forum, like those organized by the National Issues Forums Institute (NIFI), for instance, involves gathering one or more groups of 6 to 12 participants who actively engage in discussions on specific issues. These discussions are led by a facilitator using a NIFI issue guide pertinent to the topic and can span anywhere from forty minutes to two hours. Remarkably, the forums are versatile, capable of addressing a multitude of issues, and can be implemented in various settings such as civic associations, local governments, and high school or college classrooms. In the context of these forums, the NIFI issue guide serves as an informative document that can be adapted to any topic. Maintaining a consistent structure, it is divided into three sections, each about 20 pages long, and is rich in graphics and images. Each section presents a unique approach to problem-solving, exploring its advantages, disadvantages, and associated trade-offs.

Environmental Issue Forum is a tool that creates a space for deliberation to promote and improve communication about climate change (Li et al., 2021). The communication process not only consists of the delivery of a message but also involves tasks such as integrating individuals with different social characteristics in the same place for discussion, brainstorming, and knowledge sharing, which results in a greater understanding of the discussed topic (Li et al., 2021; Dietz, 2013).

However, there are several technical and social barriers to delivering programs that communicate climate change and its effects (Li et al., 2021). Factors such as social norms, political affiliations, and topic complexities often impede communication about environmental issues (Axon et al, 2018; Li et al., 2021). In contrast to these challenges, creating a communication link with young people is often easier than with adults since teenagers are more concerned about climate change (Bell et al., 2021; Li et al., 2021). Social media emerges as an important platform that young people use frequently which allows them to stay informed about current issues (Bandura & Cherry, 2020; Li et al., 2021). In fact, engaging youth in educational programs is easier since their identity is still under construction, which means they are less skeptical about new and controversial topics (Arnett, 2006; Li et al., 2021).

From this perspective, public deliberation is an approach that integrates stakeholders to address a particular issue and find mutually agreed-upon solutions (National Issue Forums, 2020; Li et al., 2021). As a result, the integration of young people in climate change discussions promotes the opportunity to enhance their knowledge about this environmental issue (Li et al., 2021; Hara et al., 2016). In support of this approach, research demonstrates that public deliberation is an excellent method to foster climate change concerns (Li et al., 2021; Monroe et al., 2017). According to the National Issue Forums Institute (NIFI) model (Li et al., 2021;

Hoffman, 2021), the deliberative forum is a strategy used to inquire into social topics and

provide a series of possible solutions (Li et al., 2021). Deliberation is more than just gathering

the public and discussing a topic; it's a process that has been shown to increase knowledge

(Gastil, 2004). Moreover, Deliberative Civic Education indirectly promotes participants'

willingness to engage in future deliberation spaces (Gastil, 2004).

Several studies highlight the importance of engaging youth in environmental education

programs to address climate change. This need is due to the constant environmental threats

produced by climate change, which directly affects youth in a physical and mental way, as well

as their future (Sanson et al., 2019). It is important to note that young people are not only

vulnerable subjects, since they have the leadership skills, passion, and access to different digital

platforms, they must be seen as agents of change capable of fostering sustainable decisions and

actions (Bandura & Cherry, 2020; Flora et al., 2014). Youth engagement in environmental

programs has psychological benefits, one of them is the alignment with the principles of

intergenerational justice and the enhancement of their psychological well-being (Zimmerman,

2000; Steger et al., 2006). Moreover, according to the Theory of Planned Behavior, the

engagement process has the potential to impact attitudes toward pro-environmental behaviors,

subjective norms, and perceived behavioral control, contributing to a more sustainable future

(Ajzen, 1991).

In this context, climate education plays a fundamental role. Despite the challenges faced

by educators in integrating climate change education into the curriculum, studies have shown

that strategies such as experiential, inquiry-based, and constructivist approaches can enhance its

effectiveness and contribute to developing a better generation equipped to handle this

environmental crisis (Monroe et al., 2017).

It's clear that the engagement of youth in deliberative forums such as Environmental Issues Forums offers an educational platform that helps foster climate change awareness, promotes safe debates, and encourages active participation (Li et al., 2021). These forums provide a space for discussion and exchange of ideas, leading to a better understanding of the complexities of climate change and the proposal of potential strategies to address this environmental issue. Despite the challenges and constraints, the creation of deliberative spaces for youth can lead to increased climate change knowledge and more importantly, motivate them to engage further in similar initiatives (Gastil, 2004).

Social Cognitive Theory, and Theory of Planned Behavior

The principles of the social cognitive theory are crucial in the context of climate change education. Specially, the process of social learning, where behaviors are constructed through the interaction with the society, the observation of how others individuals behave, and the influence of sociological aspects (Bandura, 1977). During a deliberative forum, students observe their peers sharing their perspectives and ideas, which facilitate the learning and adoption of sustainable behaviors. In addition, by actively participating in the discussion, students are also engaged in a form of direct learning, where they gain first-hand experience of the implications of their actions. Thus, these experiences can contribute to enhancing their self-efficacy in dealing with climate change issues.

The interaction between individual, behavior, and the environment is denominated reciprocal determinism, which is a crucial component in behavioral change (Bandura, 1977). This interaction is vital in the devolvement of deliberative forums, where students (individual) discuss climate change issues (behavior) in an educational setting (environment). This relation

provides the opportunity for students to understand the impact of their behaviors on the environment, and fostering the adoption of sustainable practices (Bandura, 1977).

The social cognitive theory's focus on self-efficacy, which is the individual's belief in their ability to succeed in specific situations is also of great relevance. In the context of this study, fostering a sense of self-efficacy among students could empower them to believe that they can make a difference, prompting them to take sustainable actions in their daily lives and become proactive agents of change in their communities (Bandura, A., & Locke, E. A., 2003). Therefore, aligning this study with the Social Cognitive Theory not only provides a robust theoretical basis for the implementation of the deliberative forums but also ensures that the approach can effectively foster a change in students' attitudes and behaviors towards climate change. This alignment highlights the potential of this study to make a meaningful contribution to climate education and, by long term, to the objective of mitigating the effects of climate change (Bandura, A., 1977).

Climate education and environmental programs can potentially influence all three aspects of the Theory of Planned Behavior, fostering an increased intention to engage in pro-environmental behaviors and, subsequently, actual engagement in those behaviors. The Theory of Planned Behavior, proposed by Icek Ajzen (1991), argues that an individual's intention to engage in a behavior (in this case, environmental behavior) is determined by three factors: attitude towards the behavior, subjective norms, and perceived behavioral control.

Attitude Toward Behavior refers to the assessment of the behavior that an individual makes. For instance, when youth are involved in environmental activities, they can develop a positive attitude towards pro-environmental or sustainable behaviors, such as recycling or re-using water, since they understand their importance and see the tangible outcomes of their

actions (Ajzen, 1991; Kollmuss & Agyeman, 2002). Subjective norms represent an individual's perception of societal expectations regarding their behavior. The social aspect of environmental programs can foster supportive subjective norms, as youth see their peers and mentors engaging in and valuing environmental behaviors (Fielding, McDonald, & Louis, 2008). Perceived behavioral control encompasses the person's belief in their ability to perform the behavior. Participating in environmental programs can increase youth's sense of self-efficacy in relation to environmental behaviors, thereby enhancing their perceived behavioral control (Hungerford & Volk, 1990; Bogner & Wiseman, 2006).

This literature review make emphasis in the significance of youth engagement in climate change initiatives, and provides a comprehensive exploration of the theories, strategies, and methodologies that support the objectives of the present study. Furthermore, the Theory of Planned Behavior, and Bandura's Social Cognitive Theory explained the interaction of youth with their environment and provide effective strategies for fostering knowledge and behavioral change. The relation between individual, society, and environmental factors, as well as the ways in which these elements shape youth values, knowledge, attitudes, and behaviors towards climate change, constitute the focus of this study. This literature review highlights the relevance of this research, additionally, sets the foundation for exploring the ways in which youth, through education and active engagement, can be powerful agents of change in addressing the climate crisis. With this, we can move forward to the subsequent stages of this study, which were firmly grounded in the insights and guidance provided by the existing literature.

The Significance of the Study

Engaging Diverse High School Students in Missouri through a Deliberative Climate Change Forum has significant importance in both academic and practical areas. This research is based on studies by different researchers on the importance of interactive, deliberative, and engaging spaces in fostering climate education and promoting environmental responsibility among young people (Corner et al., 2015). The methodological approaches applied in this study enhanced the validity and reliability of the results. Integrating mixed-methods design, the pre- and post-questionnaires, and the focus group contribute to a more robust and nuanced understanding of students' responses to climate change education (Creswell & Plano Clark, 2018; Morse, 2015).

This study makes several contributions to practitioners since the research findings might be useful for teachers and policymakers by offering them reliable suggestions on how to incorporate deliberative forums into high schools focused on climate change. Additionally, by the identification of the strengths and weaknesses of the deliberative forum, this study provides valuable feedback that could be used to refine the format and content of similar environmental education programs, similar to the continual improvement strategies recommended (Babbie, 2016).

Finally, this study confirms the crucial power of climate change education, demonstrating that climate change is a concern for all youth, regardless of their backgrounds or circumstances (Corner et al., 2015). This inclusive approach to climate education is essential in fostering a collective, global response to the climate crisis.

III. OBJECTIVES

The purpose of this study is to determine the impact of the deliberation climate change forum among diverse high school students in Missouri. To accomplish this purpose, the following objectives were constructed:

1. Measure the students' knowledge, awareness, and hope regarding climate change and global warming, before and after participating in the deliberative climate change forum.

2. Describe the students' perceptions towards climate change before, during, and after participating in the deliberative climate change forum.

3. Examine the students' perceptions regarding the impact of participating in the deliberative climate change forum.

IV. METHODS

The Institutional Review Board (IRB) of the University of Missouri has granted approval

for this study, affirming its adherence to ethical guidelines and protocols. The approval is

registered under IRB Project Number 2091823. This acknowledgment validates the research

methods and procedures and confirms the commitment to responsible and ethical research

conduct.

This study utilized a mixed-methods approach and was conducted in the spring of 2022 at

St. Clair High School located in St. Clair Missouri. The sample consisted of 22 participants, with

(n=16) students from St. Clair High School, and (n=6) from Metro High School. The session

began with a pre-questionnaire, followed by a 10-minute video explaining some facts regarding

climate change, then a deliberative climate change forum using the Climate Choices Issue Guide,

and concluded with a post-test questionnaire. Data collection took place on the same day, with

students from both schools convening in a shared space.

Quantitative Approach

This study utilized a pre-and post-test instrument to determine the impact of the

deliberative climate change forum. The pre-test consisted of 10 items, including one closed-

ended question, two open-ended questions, and seven Likert scale questions. After the forum, a

post-test was provided to assess the impact of the discussion, which consisted of two closed-

ended questions, four open-ended questions, and eight Likert scale questions. The utilization of

pre and post-instruments assessed the impact of the deliberative climate change forum and

helped to identify areas where further improvement was needed (Babbie, 2016). Thus, these

instruments measured the effectiveness of the forum by capturing changes in participant

understanding of climate change, attitudes toward the issue, and awareness. Additionally,

integrating Likert scales and open-ended questions provided an improvement in the data analysis that allowed a better understanding of student perceptions toward climate change (Creswell & Plano Clark, 2018). This approach facilitated the researchers in triangulating data from different sources, ensuring the validity and reliability of the findings (Morse, 2015).

Qualitative approach

A focus group approach was used during the deliberative climate change forum to facilitate data collection. Discussion followed the Climate Choices Issue Guide. The focus group protocol consisted of 17 questions categorized into five sections, recognition, reduction, adaptation, innovation, and conclusion. This qualitative technique aimed to capture the perceptions of students on different aspects of climate change, such as their understanding of its causes and effects, their willingness to adopt behavior to mitigate its impacts, and their ideas on innovative strategies and policies to address the issue.

The recognition section acquired information on initial knowledge and perceptions of students regarding climate change. Four questions identified the mode of transportation that students used, their understanding of climate change, and to what extent they can relate the carbon footprint as one of the causes of this environmental issue. The reduction section focused on existing strategies for the reduction of the effects of climate change through efficiency. Three questions were designed to gather information on to what extent the students are willing to adopt different behaviors that could mitigate the effects of climate change. The adaptation section was designed to obtain information on how the students will prepare themselves and their communities to protect against the effects of climate change. Three questions were used to get responses on the students' adaptation strategies to adapt to the effect of this environmental issue. In the innovation section, three questions were formulated to determine which technologies,

strategies, and policies have been implemented in their community to reduce the effects of climate change. Finally, the conclusion section consisted of four questions asking for comments, suggestions, and insights about the workshop.

Data Analysis

Quantitative data analysis was conducted using the IBM SPSS Statistics Data Editor. Descriptive statistics were calculated to determine the frequency, means, standard deviations, and percentages of the data. Inferential statistics were also used to conduct a paired sample test. To measure the impact of the deliberative forum, six variables were defined. These included 'Global Warming' and 'Future Generations,' assessed through open-ended questions and a 5-point Likert scale question. The variable 'Taking Action as a Community' was evaluated through an open-ended question. 'Knowledge Towards Global Warming', 'Awareness Towards Climate Change', and 'Hope Towards Climate Change' was assessed using 5-point Likert Scale questions and further analyzed through a paired sample test. Lastly, 'Consideration of New Aspects' was assessed through a combination of closed-ended and open-ended questions.

Manual Coding was used for analyzing the responses to open-ended questions. This involved reading through the responses and categorizing them into different themes, and codes (Boyatzis, 1998; Hsieh & Shannon, 2005). This process provided a more nuanced analysis of the data since theme identification was not pre-determined (Guest, MacQueen, & Namey, 2011). Manual coding is a valuable method for analyzing open-ended question answers and can provide rich insights into participants' experiences and perceptions (Guest et al., 2011). However, this method can be time-consuming and requires well training team to ensure consistency and reliability of the coding (Mayring, 2000).

Qualitative data analysis was conducted to process the information from the deliberative climate change forum. Since the participants were minors, the forum was recorded with the consent of their parents. The transcription of the intervention was done manually to manage and organize the data. Emergent ideas generated during the transcription process were defined as memos, which helped to get immersed in-depth in the context of the interview (Creswell & Poth, 2018). Coding is a crucial aspect of data analysis because allows the proper management and organization of the data and ensure reliable textual incomes (Basit, 2010). By creating codes and themes, content analysis can be enhanced, and the results can be applied to the data to create categories and classify the information (Blair, 2015). It is important to highlight that a team of coders was conformed, which included one undergraduate student and one lab natural resources intern. This diverse team composition allowed for enhanced confirmability and dependability in this study. The inclusion of different educational levels in the team contributed to a broader perspective, ensuring that the coding process was thorough, unbiased, and reliable (Elo et al., 2014).

V. RESULTS

The findings will be presented in alignment with each objective that was formulated to fulfill the main purpose of this study. Presenting the results in this format facilitates a direct comparison between the research objectives and the findings. In addition, provides a better understanding of the extent to which this study has achieved its objectives.

Social Demographic Information

The demographic characteristics of the participants can be seen in Table 1, which includes information on gender, area of residence, age, ethnicity, and race.

Table 1 Social-demographic Information of the Participants

Gender	*N*	*%*
Male	7	31.80
Female	14	63.60
Preferred not to say	1	4.50
Area		
Rural	11	50
Urban	9	40.9
Suburban	2	9.1
Age		
17	8	36.4
18	10	45.5
19	3	13.6
21	1	4.5
Ethnicity		
Hispanic	3	13.6
Not-Hispanic	19	86.4
Race		
African American or Black	1	4.5
White	17	77.3
Two or more races	2	9.1
Other	1	4.5
No response	1	4.5

Objective No.1. Measure the students' knowledge, awareness, and hope regarding climate change and global warming, before and after participating in the deliberative climate change forum

Knowledge Towards Global Warming

Before and after the deliberative climate change forum, students were asked to respond to questions about their understanding of global warming. The results revealed that was a significant increase in knowledge toward global warming (t = -2.806, df = 21, p = 0.005). Before the deliberative climate change forum, the mean and standard deviation scores were (M= 4.45, SD= 0.59). After participating in the forum results indicated (M= 3.31, SD= 0.33). (See Table 2).

Awareness Towards Climate Change

Results of the paired sample test indicated that there was a significant increase in student awareness of climate change and global warming after the deliberative climate change forum (t = -6.21, df = 21, p = < 0.001). The t-value suggests that there was a significant increase between the knowledge scores before and after the program. Prior to the deliberative climate change forum, the mean and standard deviation scores were (M= 2.79, SD= 0.51), whereas after participating in the forum results indicated (M= 4.72, SD= 0.45). (See Table 2).

Hope Towards Climate Change

Results indicated that there was a significant increase in students' hope regarding climate change after the deliberative climate change forum (t = -3.65, df = 21, p = < 0.001). The t-value suggests that there was a significant increase between the hope scores before and after the program. Prior to the deliberative climate change forum, the mean and standard deviation scores were (M= 4.93, SD= 0.93), whereas after participating in the forum results indicated (M= 5.43, SD= 0.91). (See Table 2).

Table 2 *Effectiveness of Deliberative Climate Change Forum on Students' Knowledge, Awareness, and Hope Toward Climate Change*

Items	Pre-Test		Post-Test				
	M	SD	M	SD	t	Df	P
Knowledge	4.45	0.59	4.72	0.45	-2.806	21	0.005
Awareness ($\alpha = 0.73$)	2.79	0.51	3.31	0.33	-6.21	21	< 0.001
Hope ($\alpha = 0.86$)	4.93	0.93	5.43	0.91	-3.65	21	< 0.001

Objective 2. Describe the students' perceptions towards climate change before, during, and after participating in the deliberative climate change forum

Global Warming and Future Generations

Two questions were used to measure perceptions toward global warming. The first question was presented in a 5-point Likert scale format, designed to assess the perception of the students about the impact of global warming on future generations. The second question was presented in an open-ended format, asking students to elaborate on their response to the Likert scale question by explaining their reasons for holding that perception. Based on the responses prior to the forum, themes such as *Natural Resources*, *Human Concern*, and *Indifference* emerged (See Table 3). However, after participating in the forum, the themes that emerged were *Alertness*, *Human Concern*, and *Indifference* (See Table 4).

Table 3 *Student Perceptions on Global Warming Before the Deliberative Climate Change Forum*

Theme	Code	Phrases	%	Feelings
Natural Resources	Impact the Natural Resources and wildlife. Habitat ending.	It's dangerous enough to affect the entire planet to some effects are still unknown. There are a lot of variables	50	Great Deal

Human Concern	Unconcern People. Future Generations. People depending on natural resources.	There are many people living in poorer communities that are more dependent on the state or the environment than I am. For example, people dependent of farming.	22.7	Great Deal
Indifference	It is nothing to do with me. Religion. Slower than the people said	I know that it is real, and it will affect generations, but I don't know if it's as big of a deal as they say. I believe that is natural and god will come before it gets to terribly bad	22.7	A moderate amount Only a little
No Response			4.6	

Table 4 Effect of Deliberative Climate Change Forum on Students' Perceptions of Global Warming

Theme	Code	Phrases	%	Feelings
Alarm	Worse that I thought. Faster that I thought. Getting worse. Selfishness. Not enough action	After the discussion, I care about it more. There are things I can be doing, and Climate Change is affecting us now. Because we grow up with it, so we are used to it but its only gonna get worse.	54.5	Great Deal A moderate amount

Human Concern	Unconcern People. Future Generations. People depending on natural resources	The way we as humans are existing and living off the planet resources is not sustainable and is harming the wildlife/natural resources in a way that will negatively impact us now and future generations and it is our responsibility to do what we can to help that.	22.7	Great Deal
Indifference	Political and natural	I feel that it is political and natural	4.5	Not at all
No response			18.1	

Taking Action as a Community

Before participating in the forum, students were asked to list actions that communities could take to address the effects of climate change. The themes that emerged during the analysis were Sustainable Sources, Education, Sustainable Actions, Social Movement, Income, and Effectiveness (See Table 5). After participating in the forum, the themes shifted resulting in Education, Sustainable Sources, Sustainable Actions, and Social Movement being the key themes that emerged (See Table 6).

Table 5 Student-Proposed Actions to Address Climate Change Before the Deliberative Climate Change Forum

Theme	Code	Phrases	%
Sustainable Sources	Electrical and Hybrid Cars. Lessen the use of fossil fuels. Incentive the use of renewable power sources. Solar Panels and Batteries Pack.	Combustion engines for everyday drives are a large factor. More hybrid electric cars on the road could help if the electrical grid could support it	31.8
Education	Environmental Education Program. Promote the discussion, conversation and meetings withing the communities. Raise awareness	The topic should be discussed more in the community, and we should be taught ways to prevent global warming. I think change first starts by having conversations and meetings such as this. Followed by actions withing our community. I believe is needed to start locally.	27.2

Sustainable Actions	Recycling and Reusing. Food Waste. Carpooling.	Recycling in St. Louis has stopped. There are many small businesses throwing away so much cornbread and plastic that could be reuse. Food waste is very normalized in America when it should not be.	22.7
Social movement	Protest	I think that organizing and attending protests could be an amazing step toward slowing climate change	4.5
Income	People with higher income should contribute more to address this issue.	Those who are able to contribute more to the community to participate, the people who can afford	4.5
Effectiveness	Small scale operations don't work to address climate change	Personally, I think small scale operations to prevent climate change are ineffective	4.5
No Response			4.5

Table 6 Student-Proposed Actions to Address Climate Change After the Deliberative Climate Change Forum

Theme	Code	Phrases	%
Education	Environmental Education Program. Promote the discussion. Raise awareness	Awareness and education are determinants to prevention as we have seen historically	31.8
Sustainable Sources	Electric and Hybrid Cars. Lessen the use of fossil fuels. Incentive the use of renewable power sources. Solar Energy	Try to use less carbon emission. I think we could innovate more	27.2
Sustainable Actions	Recycling and Reusing. Planting trees.	Being more energy conscious, reusing, recycling, carpooling	22.7
No Response			13.6
Social movement	Protest	I think that organizing and attending protests could be an amazing step toward slowing climate change	4.5

Focus Group Findings

A codebook was designed for organizing and interpreting the data. This codebook contains a list of codes which are labels applied to a specific section of the responses that represent the themes (See Table 7). In addition, the use of a codebook allowed an organized and comprehensive analysis of the data, ensuring that all relevant information was captured.

Table 7 Coding Structure for Analysis of Students' Perceptions Toward Climate Change

Theme	Code
Recognition	Mode of transportation, and freedom
Reduction	Transportation
	Industries
	Government Support
	Individual Efforts
Adaptation	Farming Techniques
	Social Support
Innovation	School Initiatives
	Local Initiatives

Recognition. During the forum, participants discussed the preferred modes of transportation they used for commuting back and forth to school. The majority reported using their own cars, primarily due to the considerable distance between their homes and the school. Some participants mentioned that they often carpool, not only to benefit the environment but also to assist peers who lack transportation options. Additionally, students expressed that driving cars provided them with a sense of freedom since they have the flexibility to come and go at their convenience.

For example, one participant stated:

I like having my freedom. I got other obligations to go to or may have to go to church later that night. And it's just more convenient.

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Reduction through Transportation. In this section, students shared their ideas on mitigating the impacts of climate change. Most participants suggested that the fastest way to improve air quality was transitioning from traditional vehicles to electric and hybrid cars. However, some pointed out that this solution might not be easy to achieve due to the challenges in making it affordable or suitable for people from various regions and economic sectors. The primary concern among participants was that the transition to new technology is costly and could discriminate against those with lower incomes.

Based on the student discussion, they identified farmers and truck drivers as communities that could be significantly impacted by the technology transition, given their reliance on vehicles as a primary source of income. Students acknowledged that trucks and tractors emit significant amounts of carbon dioxide, and currently, there isn't a substantial market for replacing these types of vehicles. Consequently, they suggested that the transition to sustainable transportation needs to include more affordable and accessible options for consumers. Therefore, to inclusively benefit local economies and achieve greater environmental benefits, sustainable transport must become more standardized.

Reduction through Individual Efforts and Industries. The discussion also revealed that it is important, but difficult to address individual behavioral related to climate change. Consequently, participants noted that individual changes might not be significant, since industries are contributing more to pollution. For this reason, they argued that industries should be the ones to transition their practices to more sustainable methods. Additionally, participants indicated that whichever sector is the primary contributor to carbon emissions must establish strategies to reduce their carbon footprint and mitigate the effects of climate change.

Reduction through Government Support. Some students expressed that it is unrealistic to expect people to change their behaviors drastically, especially when it comes to transportation. They expressed that individual consumers alone cannot fix the problem of climate change. This indicates that students consider legislation should target companies that produce large amounts of emissions. Furthermore, students considered that legislation might require industries to make significant changes. Even if all consumers were to switch to electric cars, it wouldn't make as much of a difference as directing efforts toward the major sectors at the top, which are contributing the most to these issues. These sectors should be compelled to implement clean energies in their processes and change behaviors on a larger scale.

Adaptation through Farming Techniques and Social Support. Students exchanged ideas about the strategies that society must adopt to adapt to the effects of climate change during the forum. Since Missouri is predominately a farming state, most of them considered that farmers should implement techniques to make their crops resistant to extreme weather conditions. Additionally, students argued that climate change adaptation strategies must focus on strengthening the farming sector because people's survival depends on food security. They further explained that abrupt changes in weather could severely impact the food supply, potentially resulting in significant loss of life. Lastly, they suggested that the government and society must provide support, in the form of food and shelter, to those who are vulnerable to inclement weather such as homeless people.

The discussion led to a brainstorming session where students suggested ideas about how the farms could adapt to the effects of climate change. Participants agreed that farming should explore new techniques for food production that do not require extensive space. For example, the local food production sector might implement hydroponic farming, which uses fish and growing

plants vertically. This farming technique allows indoor cultivation and producing the same amount of food as traditional farming methods on large tracts of land.

Additionally, students discussed that individuals from high- and middle-income have more resources to adapt to the effects of climate change. Therefore, they should extend support to low-income communities, who are more vulnerable and consequently bear the brunt of this environmental issue. For instance, people from higher-income groups are able to afford homes equipped with adequate HVAC systems (Heating, Ventilation, and Air Conditioning), robust water supply systems, and facilities for food and medical storage. Meanwhile, those from low-income groups often lack these privileges. For this reason, participants expressed that it's our collective responsibility as a society to care for and show empathy toward those who are disproportionately affected.

Innovation Through School Initiatives. In this session, students were encouraged to consider what innovative strategies the city and the school could adopt to address the effects of climate change. Participants agreed that neither St. Louis City nor St. Clair and Metro High Schools have implemented innovative strategies. However, they began brainstorming about what strategies they could create for the school. The idea of an environmental club was proposed by St. Clair students during the brainstorming session, although they expressed concern that others might not be as passionate or knowledgeable about it. Consequently, students from Metro High School provided ideas on how to create and maintain the club. They had successfully promoted their club by offering hikes, cleanup events, and other environmental-based fun activities, thereby engaging their peers. They emphasized that the success of any educational club is to keep it functional, dynamic, and overall fun.

Regarding recycling programs, students acknowledged that in order to engage people, they need to raise awareness about climate change and environmental issues within the school community, clarifying misconceptions and providing accurate information. They recognized that their opinions might be skewed due to environmental inexperience, and thus sought support from parents and local organizations to gain a better understanding of environmental terms and policies. This, they believed, would provide them with the knowledge and tools necessary to sustain environmental education programs.

Objective No. 3 Examine the students' perceptions regarding the impact of participating in the deliberative climate change forum

Consideration of New Aspects

After the forum, students were asked to identify aspects of climate change that were new to them and had not been previously considered. 50 % of participants reported that they had learned about new topics related to climate change. A coding process was conducted on the responses, revealing several emerging themes such as *Farming Aspects, Electric Cars, and People's Opinions* (See Table 8).

Table 8 Newly Identified Aspects of Climate Change by Students after the Deliberative Climate Change Forum

Answer	Themes	Phrases	%
Yes	Everything that was told was new to me. Farming aspects. Electrics Cars. People opinions. Government and big businesses helping	How resolving climate change could be different in the city/country. The discussion brought light to many topics and points that I haven't thought about. People's opinions on electric cars	50
No	I already knew about what you taught. I took environmental class		31.8
No response			18.1

VI. DISCUSSION

The findings from this study reveal that the deliberative climate change forum was instrumental in enhancing high school students' knowledge towards global warming, as well as their awareness and hope towards climate change. Results from the quantitative analysis demonstrated that the program significantly enhanced student understanding of the causes of global warming. This outcome aligns with the assertions made by Monroe et al. (2017). The data revealed a significant improvement in student ability to identify these causes after participating in the deliberative climate change forum, this finding is also supported by Holthuis et al. (2014).

Furthermore, the findings suggested that the program not only increased students' knowledge about climate change but also fostered a sense of hope regarding this issue. Finally, these results pair with Flora et al. (2014) findings, since confirmed that climate change education is successful in providing new information to the participants, indicating its efficacy in promoting active learning and knowledge gaining. In addition to improving students' knowledge, awareness, and hope regarding this environmental issue, this study also had a significant impact on their perceptions of global warming's effects on future generations.

Before the forum, students expressed concerns primarily related to "Natural Resources", and "Human Concerns", and showed some "Indifference" (See Table 3). The most common theme was "Natural Resources", with 50% of students expressing a "great deal" concern about the impact of global warming on the natural environment and wildlife. Additionally, 22.7% of students expressed "Human Concerns", specifically regarding poorer communities, and people who depend on natural resources as an income source. These findings align with research by Dietz (2013), and Fishkin (2008) who found that student perceptions of climate change can often be mixed, reflecting various sociological influences.

After participating in the forum, responses had a significant shift in students' perceptions, with the emergence of "Alarm" as a new theme (See Table 4). 54.5% of the students expressed an enormous concern about how global warming is getting worse, and the lack of action taken to mitigate it. This suggests that the forum successfully shifted students' perspectives, fostering awareness and concern toward climate change and global warming (Bofferding & Kloser 2014; Flora et al., 2014; Holthuis et al., 2014; Monroe et al., 2017).

After the forum, "Human Concern" remained as a theme, with the same percentage (22.7%) of students expressing it. However, the theme "Indifference" reduced to only 4.5% of students, suggesting that the forum also helps in reducing unconcern towards the environmental issue. This finding aligns with the study of Haker-Schuch & Bugge-Henriksen (2013), who found that education could be a powerful tool in combating indifference toward climate change.

The analysis of the open-ended questions revealed that students recognized the power of environmental education and forums in addressing complex issues such as climate change (Monroe et al., 2017; Li et al., 2021). Prior to the forum, most of the participants indicated that the use of sustainable sources, such as electric cars, and the reduction of fossil fuels were the primary ways to address the effects of climate change. However, after participating in the deliberative climate change forum, students shifted their perspective considering that education is a key factor in addressing climate change (Sanson et al., 2019). These findings are related to the Theory of Planned Behavior (Ajzen, 1991) since suggest that the deliberative climate change forum not only improved students' knowledge and awareness but also influenced their attitudes and beliefs toward climate change.

Qualitative results also showed that high school students were deeply concerned about the impact of climate change and hold a strong sense of hope for the future. They considered that

mitigating the effects of climate change is a shared responsibility of all humans and that individual actions alone are insufficient. In addition, students expressed a need for government policies, incentives, and subsidies to promote the integration of green technologies in society and industries. Moreover, they expressed willingness to use alternative modes of transportation, such as bicycles, but noted that the lack of designated roads and sidewalks in their local area makes difficult the use of these alternative ways of transportation. Thus, to promote sustainable transportation options, such as bicycles, skateboards, or walking, it is essential to create the necessary infrastructure.

Furthermore, one of the schools shared with the other ideas about environmental projects that they could implement, such as an environmental club, a recycling program, building a greenhouse, and composting (Steger et al., 2006). This deliberative climate change forum helped students to understand that environmental issues are all connected and the need to work as a community to solve them (Flora et al., 2014). It was encouraging to see how students proposed actions toward more sustainable and effective strategies after participating in the forum. These findings suggest that education and public engagement can be effective tools for promoting positive action toward mitigating the effects of climate change (Bofferding & Kloser 2014; Houlthuis et al., 2014; Monroe et al., 2017). In conclusion, these results suggest that educational programs and public forums like this one can help raise awareness about important environmental issues and promote positive action toward mitigating the effects of climate change.

VII. LIMITATIONS

The most significant limitations of this study were time, resources, and staff, which prevented personal interviews. This technique would have provided a more in-depth understanding of each participant's perceptions and attitudes toward climate change (Creswell & Poth, 2018). Thus, the lack of personal interviews leaves a gap in the analysis of how a new knowledge acquisition can directly influence individual attitudes. Another significant limitation was the place where the focus group was conducted. In such a setting, not all participants may feel comfortable or encouraged to share their thoughts and feelings (Krueger & Casey, 2014). This could be due to different reasons, such as the shyness of some students, or the dominance of certain students with stronger personalities or more speaking skills.

Consequently, the perspectives and insights of quieter students may have been overlooked, leading to some bias in the qualitative data collected. These unheard voices represent a significant loss, as they could have provided valuable insights that could enhance the richness and diversity of the study's findings (Creswell & Poth, 2018). Future research should address these methodological challenges, and to ensure the collection of more comprehensive and representative data, thereby strengthening the validity and generalizability of the research outcomes (Babbie, 2016).

VIII. FUTURE RESEARCH

For further studies, it is recommended to consider including in the pre and post-questionnaire prompts aiming to measure the behavior of participants. This addition will ensure a better analysis of participants' attitudes, beliefs, and most importantly, their behaviors in relation to climate change. Regarding the qualitative approach, it is suggested that the focus group protocol be revised to incorporate personal interviews. This methodological modification will provide a deeper insight into how a newly acquired knowledge of climate change can influence individual behaviors.

Moreover, future research could be improved by conducting deliberative climate change forums with specific demographic groups. Taking into account variables such as rural versus urban populations, immigrant populations versus native-born American residents, and contrasting age groups such as youth versus adults can potentially uncover nuanced perspectives and responses to climate change. Those comparisons will not only allow for a more detailed understanding of the diverse attitudes and behaviors towards climate change but might also reveal unique challenges and opportunities for climate change education and action within these specific demographic groups. By implementing strategies that consider these demographic differences, we can progress toward more effective and inclusive climate change solutions.

IX. CONCLUSION

Climate change is an undeniable environmental issue that is currently affecting our planet. To address this problem, it is crucial to develop and implement effective environmental education programs and environmental issues forums that engage communities from all backgrounds and age groups. These programs should not only focus on providing information but also promote dialogue and allow the participants to express their ideas and concerns without fear of judgment. The creation of safe spaces for participation encourages critical thinking, fosters creativity, and generates innovative solutions to address climate change.

The deliberative climate change forum provides to the students a platform to engage in reflective discussions, respectful debates, and effective brainstorming sessions about environmental issues. One of the most valuable results of this forum is the interchangeability of ideas among participants. By sharing their perspectives, insights, and experiences, students increase each other's knowledge and understanding of the causes and effects of climate change. Attitudes, perceptions, and beliefs towards climate change vary depending on individuals' sociological and psychological aspects, and bringing together participants from different social demographic backgrounds enhances the process of ideas exchanges.

This forum contributes to the development of participants' knowledge and awareness, enabling them to take informed action toward mitigating the effects of climate change by promoting the interchange of ideas. This process is crucial because requires extensive knowledge and awareness to understand the causes and effects of climate change and the ways to mitigate and adapt to them, which can be achieved through educational programs and forums.

In conclusion, the deliberative climate change forum is an essential approach to engage students in meaningful discussion and exchange of ideas, increasing their knowledge and

awareness regarding environmental issues and promoting positive action towards mitigating the effects of climate change. For that reason, the deliberative climate change forum served as a co-curricular activity that equipped students with the necessary strategies to mitigate and adapt to climate change. After participating in this forum, the participants felt empowered and developed a sense of ownership and responsibility for environmental issues among individuals, communities, and society at large. This new awareness can lead to sustained and effective actions to mitigate the effects of climate change.

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APPENDIX A - Climate Change Forum Pre-Questionnaire

Q1. Recently, you may have noticed that climate change has been getting some attention in the news. Climate change refers to the idea that the world's average temperature has been increasing over the past 150 years, may be increasing more in the future, and that the world's climate may change as a result. What do you think? Do you think that climate change is happening?

Yes
No
Don't know enough to say

Q2. Assuming climate change is happening, do you think it is…

Caused mostly by human activities
Caused by both human activities and natural changes
Caused mostly by natural changes in the environment
None of the above because climate change isn't happening
Other
Don't know

Q3. Personally, how well informed do you feel you are about …

	Not at all informed	Not very well informed	Fairly well informed	Very well informed
How the Earth's "climate system" works	1	2	3	4
The different causes of climate change	1	2	3	4
The different consequences of climatechange	1	2	3	4
Ways in which we can reduce climatechange	1	2	3	4

Q4. How important is the issue of global warming to you personally?

Extremely important
Very important
Somewhat important
Not too important
Not at all important

Q5. How much worried are you about climate change?

Very worried
Somewhat worried
Not very worried
Not at all worried

Q6. How much do you think global warming will harm you personally?

A great deal
A moderate amount
Only a little
Not at all
Don't know

Q7. How much do you think global warming will harm future generations of people?

A great deal
A moderate amount
Only a little
Not at all
Don't know

Q8. Why do you feel this way?

Q9. How much do you disagree or agree with the following statements?

(1=strongly disagree; 2= disagree; 3=slightly disagree; 4=neutral; 5=slightly agree;6= agree; 7 strongly agree)

I am hopeful about resolving climate change because more people are taking climate change seriously.	1	2	3	4	5	6	7
I know that there are a number of things that I can do to contribute to climate change solutions.	1	2	3	4	5	6	7
I am hopeful about climate change because I can think of many ways to resolve this problem.	1	2	3	4	5	6	7
I am willing to take actions to help solve problems caused by climate change.	1	2	3	4	5	6	7

Q10. What actions do you think that we could take in our community to lessen and adaptto climate change? Please explain the reason in a couple sentences.

Now that you've had chance to participate in a forum on climate change, we'dlike to know what you are thinking. Your perspective along with those who participated the talk will be part of a report to inform the design of future education and outreach events on this issue. Thank you!

Q1. Recently, you may have noticed that climate change has been getting some attention in the news. Climate change refers to the idea that the world's average temperature has been increasing over the past 150 years, may be increasing more in the future, and that the world's climate may change as a result. What do you think? Do you think that climatechange is happening?

Yes
No
Still not enough information

Q2. Assuming climate change is happening, do you think it is…

Caused mostly by human activities
Caused by both human activities and natural changes
Caused mostly by natural changes in the environment
None of the above because climate change isn't happening
Other
Don't know

Q3. Personally, how well informed do you feel you are about …

	Not at all informed	Not very well informed	Fairly well informed	Very well informed
How the Earth's "climate system" works	1	2	3	4
The different causes of climate change	1	2	3	4
The different consequences of climatechange	1	2	3	4
Ways in which we can reduce climatechange	1	2	3	4

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Q7. How much do you think global warming will harm future generations of people?

A great deal
A moderate amount
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Q8. Why do you feel this way?

Q9. How much do you disagree or agree with the following statements?

(1=strongly disagree; 2= disagree; 3=slightly disagree; 4=neutral; 5=slightly agree;6= agree; 7 strongly agree)

I am hopeful about resolving climate change because more people are taking climate change seriously.	1	2	3	4	5	6	7
I know that there are a number of things that I can do to contribute to climate change solutions.	1	2	3	4	5	6	7
I am hopeful about climate change because I can think of many ways to resolve this problem.	1	2	3	4	5	6	7
I am willing to take actions to help solve problems caused by climate change.	1	2	3	4	5	6	7

Q10. What actions do you think that we could take in our community to lessen and adaptto climate change? Please explain the reason in a couple sentences.

Q11. How much do you disagree or agree with the following statements?

(1=strongly disagree; 2= disagree; 3=slightly disagree; 4=neutral; 5=slightly agree;6= agree; 7 strongly agree)

	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
Schools should teach children about the causes, consequences, and potential solutions to global warming					
Climate change will cause damaging changes for me and my community in my life time.					
Since the US is one of the world's largest greenhouse gas producers, it shouldtaked the lead in reducing emissions of Co2					

Q12. Do you hear any aspects of climate change you hadn't considered before? Is yes, what were they?
Q13. Are you thinking differently about climate change now that you have participated inthe forum?

Yes
No
If yes, please explain:

Q14. Any other comments about the forum?

Demographics
Please tell me something about yourself…

I am: ☐ Male   ☐ Female   ☐ Preferred not to say

I am: ☐ Hispanic/Latino   ☐ Not Hispanic/Latino

What best describes the area that you live in?   ☐ Rural   ☐ Urban   ☐ Suburban

What is your race?
American Indian or Alaskan native
Asian or Pacific Islander
African American or Black
White
Two or more races
Other (Please specify) _____

Thank you!

APPENDIX C

FOCUS GROUP PROTOCOL

Thank you so much for participating in this workshop and forum discussion, however, I would like to know more about you and your concerns about Climate Change and Carbon Footprint. That information would be very helpful and give valuable material to develop my research. For that reason, very respectfully I will ask the next questions:

Recognition
1. Please what is your current position at the St. Clair High School?
2. How do you go to school every day? and why?
3. According to the forum, what do you understand about Climate Change and which activities can produce it?
4. What do you understand about Carbon Footprint and how is related to the effects of Climate Change?

Mitigation
5. What do you think is the best way to reduce emissions of CO2 or other greenhouse gases in the United States? Why?
6. As a personal goal, would you be willing to change your lifestyle, eat differently, ride a bike or take public transportation more often, or lower your home thermostat in order to reduce carbon emissions? and why.
7. What kind of activities the people and industries can implement to reduce the effects of Climate Change?

Adaptation
8. How the effects of Climate Change can harm you and future generations?
9. How society can adapt to the effects of Climate Change?
10. What actions we should take to protect our community from the effect of Climate Change. (high/low precipitation, high/low temperatures, snowstorm)

Innovation
11. What initiatives or policies have the St. Clair High School taken to reduce the effects of climate change?
12. What options do you know of sustainable transport offered in St Louis City?
13. What do you think about the implementation of new technologies in order to reduce the effects of carbon emissions and climate change?

Conclusion
14. What do you think about this environmental forum?
15. What were your favorite aspects of this forum?
16. How can we improve it?
17. What was the most important thing that you have learned today?

Climate Choices: How Should We Meet the Challenges of aWarming Planet?