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## **Engaging in Online Environmental Discussion: Experiences and Reflections of Students in an Undergraduate Science Course**

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### Abstract

Environmental and sustainability-focused education plays an integral role in positively influencing students' levels of environmental awareness, competencies, and adoption of sustainable decision making and behavioral practices. Media and information technology have been identified as possible factors influential in shaping the youths' level of environmental literacy and perceptions of environmental issues. Yet, due to format and scope of coverage and lack of emphasis on the importance of the environment and consequences of human action, the role of mass media may at times be inadequate or unsuitable, leading to eco-anxiety. The literature on the connection of students' media and information literacy (MIL) and environmental literacy (EL), especially in college settings, remains scarce. This mixed-method study explored the experiences of students in an introductory college science course with a weekly discussion forum designed to engage them in learning about environmental issues through various media platforms and participation in peer discussions. This study examined the types of environmental topics students focused on and students' experiences and reflections as they engaged in environmentally focused media content and peer discussion. The findings indicated that students obtained mainly national and international news stories from major mainstream news media outlets, followed by online science or environment-focused news outlets. They gained awareness of environmental concerns in various geographical locations, the negative impact of human activity on the environment, as well as various means of positive human impact through ecological footprint reduction solutions and actions.

*Keywords:* environmental education, environmental literacy, discussion, undergraduate science education

### Introduction

The global community faces myriad environmental, social, and economic challenges including, but not limited to, climate change, water shortage and pollution, loss of biodiversity, food scarcity, depletion of resources, and industrial pollution and health hazards. These challenges are often interlinked, grounded in science and

technology, and intricately connected to issues of equity and justice (Amirshokoohi & Kazempour, 2022). Addressing these complex and interwoven issues and navigating an uncertain future pose critical implications for education. There exists a growing recognition of the significance of environmental and sustainability-focused education in dealing with issues of such magnitude and complexity. According to the *Environmental Literacy in the United States: An Agenda for Leadership in the 21st Century* publication (NEEF, 2015), “Environmental educators have an unprecedented opportunity to create a more environmentally literate citizenry — a citizenry equipped with the knowledge, skills, and motivation to tackle the environmental, social, and economic challenges that we face today and, in the future” (p. 7). Preparing and inspiring today’s students, who are future consumers, decision-makers, and global citizens, and instilling in them the necessary knowledge, skills, and dispositions, will be key to contributing to a more sustainable and humane world. Accomplishing this requires that all levels of formal and informal education, including higher education, embrace and integrate environmental literacy and social responsibility as a fundamental curricular focus.

### **Literature Review**

The review of the literature will begin with a discussion of environmental literacy, in terms of what it entails, its significance, as well as the current state of environmental literacy. The next section will focus on environmental education and its role on environmental literacy, particularly with respect to younger people, and the role those educational institutions, including higher education play in incorporating environmental education as a key focus. The final section of the literature review will concentrate on media and information literacy and the role that various forms of media play in engaging people, especially the youth, in various aspects of environmental concerns.

### **Environmental Literacy**

One of the earliest definitions of environmental literacy originates from the Belgrade Charter (UNESCO, 1976) which established that the goal of environmental education is to create an environmental literate population “that is aware of, and concerned about the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones” (p. 1). Subsequently, the Tbilisi Declaration (UNESCO 1978), further defined the goals of environmental education to include the following:

*To foster a clear awareness of, and concern about, economic, social, political and ecological interdependence in urban and rural areas; to provide every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment; and to create new patterns of behavior of individuals, groups, and society as a whole towards the environment. (p. 2)*

The North American Association for Environmental Education's (NAAEE) publication, *Developing a Framework for Assessing Environmental Literacy* (Hollweg et al., 2011), echoed the earlier definitions by describing an environmentally literate individual "as someone who, both individually and together with others, makes informed decisions concerning the environment; is willing to act on these decisions to improve the well-being of other individuals, societies, and the global environment; and participates in civic life" (p. 2). The authors of this publication reiterated earlier definitions of environmentally literate individuals as those who possess:

*The knowledge and understanding of a wide range of environmental concepts, problems, and issues; a set of cognitive and affective dispositions; a set of cognitive skills and abilities; and the appropriate behavioral strategies to apply such knowledge and understanding in order to make sound and effective decisions in a range of environmental contexts. (p.13)*

The above mentioned definitions of environmental literacy illustrate the significance of knowledge, skills, dispositions, and decision making and behavioral strategies in dealing with social and environmental issues. The cognitive, affective, and behavioral elements of environmental literacy have been shown to be highly interconnected, in a complex, non-linear, and often context-based manner (Dietz, Fitzgerald, & Shwom, 2005; Heasley, Iliško, & Lindner, 2024) thus, knowledge, and more importantly, possessing an understanding of issues, have been shown to impact individuals' attitudes, opinions, behaviors, and ability to participate in making decisions about and finding solutions for such issues (Dahm et al., 2009; Gardner & Stern, 1996). Some studies (e.g. Amirshokohi, 2016; McMillan, Wright & Beazley, 2004) have shown that enhancing environmental knowledge through environmental education can lead to more positive attitudes toward the environment while other studies (e.g. Hsu, 2004; Salite, et al., 2024.) have illustrated the positive impact on more responsible environmental action and behavior. Yet, other research findings indicate that environmental behavior and decision making are not necessarily influenced solely by knowledge (Bamberg and Möser, 2007; Heeren et al., 2016; Ehret et al., 2019), and that deeply held beliefs and perspectives (Kahan et al., 2012), ways in which environmental issues are framed and presented (Nisbet, 2009; Maibach et al., 2010; Corner and Groves, 2014), individual environmental skills, competencies, past experiences, as well as environmental attitudes and personal and societal norms, identity values, are all necessary for motivating responsible environmental action.

Although environmental education has been an ongoing endeavor for the past several decades, Americans' level of environmental knowledge, attitude toward environmental issues, and inclination to take environmentally focused actions has fluctuated at times and remains relatively low or average. According to the NEEF Benchmark Survey (2015), about one-third of the U.S. adult population report being actively engaged in environmental issues, two-third report taking some level of action dealing with such issues, and half are willing to learn more, understand possible actions, and adopt environmentally supportive behaviors.

During the years 2000-2012, in what appeared to be an increasing perception of Americans' perception of an improvement in environmental conditions accompanied by the economic recession, the level of environmental concern, particularly about certain issues, such as air and water pollution, declined while economic concerns rose (Pew Research Center, 2012). These numbers began to shift in the next decade, and

particularly during years of political and economic uncertainties and challenges to environmental well-being as a national priority.

Over the years, the results of various studies and reports about environmental knowledge have not been promising. The Yale Project on Climate Change (Leiserowitz, Smith, & Marlon, 2010) reported that the climate knowledge score of about half of the population (52%) was found to be equivalent to an F and another 40% fell in the C and D range scores with only 8% of the population earning a score equivalent to an A. On a more positive note, recent Pew Research Center surveys indicate that the younger generations of American, mainly Millennials and adults in Generation Z, are more highly engaged with, speak about, take action, and demand action on issues such as climate change.

Interestingly, individuals in the younger generations, especially those most actively engaged with related social media content, are also reportedly more likely to express anxiety about environmental issues, particularly climate change. The Pew Survey (2012) reported 69% of Gen Zers and 59% of Millennials expressed anxiety the last time they encountered social media content on climate change. The sense of fear, distress, and hopelessness is not uncommon among today's youth which increasingly feels lacking control over finding solutions to environmental problems that the older generations have created and to which they are reluctant to find solutions. This sense of anxiety and helplessness in the face of environmental problems is not a recent phenomenon and was alluded to by Rowe (2002) who described that "many students feel the problems are so large and complex they can't do anything about it." On a positive note, "practical eco-anxiety" (Kurth & Pihkala, 2022), one which prompts more pronounced reflection on the possible negative impacts of actions, may encourage greater level of planning and positive changes in individual and communal environmental and sustainable practices. According to the 2021 Pew Research Center survey, although many in the younger generations express frustration over the lack of action on climate change, they also report a sense of motivation to learn more and confidence in the ability to decrease the impact of climate change.

### **Environmental Education Defined**

Over the past several decades, educators, scientists, community leaders, and policy makers have increasingly promoted and emphasized the significance of quality transformative education and its critical role in addressing the ongoing global environmental challenges such as environmental justice, biodiversity loss, and of course climate change (e.g. Amirshokoohi & Kazempour, 2022; UNESCO, 2022). In one of the earliest calls for extensive formal environmental education, the Tbilisi Declaration (UNESCO-UNEP, 1978), described the need for environmental education to "be integrated into the whole system of formal education at all levels to provide the necessary knowledge, understanding, values and skills needed by the general public and many occupational groups, for their participation in devising solutions to environmental questions" (p. 4). Carvalho (2002) suggested that all levels and forms of education must consist of an environmental dimension for the learning processes to be meaningful and sustain continued human existence.

Institutions of higher education have an especially critical responsibility to prepare and educate an environmentally literate global citizenry equipped with the knowledge, skills, and mindset necessary to be effective and heedful environmental and sustainability-focused consumers, leaders, experts, decision-makers, entrepreneurs,

and policy-makers in the future (Cortese, 2003; Lozano, 2006; Waas, Verbruggen, & Wright, 2010; Zilahy & Huisingsh, 2009). Higher education plays an integral role in positively influencing students' levels of environmental awareness, competencies such as critical thinking problem solving, and inquiry as well as adopting sustainable decision making and behavior (Adomssent et al., 2014; Barth & Rieckmann, 2012).

An increasing number of higher education institutions are incorporating environmental and sustainability focused courses as part of their general education requirements or encourage students to enroll in such courses. In fact, ranking systems such as the American Association for the Advancement of Sustainability in Higher Education (AASHE) Sustainability Tracking Assessment Rating System (STARS) evaluate, rank, and reward colleges and universities for their environmental and sustainability related course offerings as well as including such courses as part of their general education (Bullock & Wilder, 2016; Findler et al., 2019).

In order for any environmental education program, including in higher education, to be effective, it should refrain from focusing on an environmental doomsday narrative which may create further anxiety and fear, especially among the youth. Instead, it should address the key components of environmental literacy (NAAEE, 2011) including:

- (1) contexts-awareness of local, regional, or global situations that involve the environment;
- (2) competencies-abilities to identify and analyze environmental issues, evaluate potential solutions to environmental issues, and propose and justify actions to address environmental issues;
- (3) environmental knowledge-knowledge of physical ecological system, environmental issues, sociopolitical systems, strategies for addressing environmental issues;
- (4) dispositions toward the environment-interest, sensitivity, locus of control, responsibility, intention to act.

### **Media and Environmental Literacy**

Several factors, including media and information technology, have been identified as influential in shaping young people's level of environmental literacy and perceptions of environmental issues (Hamid, et. al., 2017). Media, including entertainment and news media, may be sub-divided into two categories of mass media consisting of books, radio, television, films, and the Internet versus social media that has become increasingly more popular in the past few decades. Traditional mass media tends to be monodirectional, meaning communication from one source and reaching a wide audience, while social media consist of a more complex web of content sharing, interaction, and access by and for many (Fotopoulos, 2023).

News or other communications by media, regardless of whether in print or digital form, tend to not only influence individual's awareness of issues, but also their attitude toward and perceptions of the significance or urgency of the issues (Keinonen, Palmberg, Kukkonen, Yli-Panula, Persson, & Vilkonis, 2016) as well as their actions, behaviors, and participation in public policy (de Sousa Carvalho, Sevilla-Pavón, & Seiz-Ortiz, 2012). Media tools such as documentaries, films, and videos can provide educational and informative content to educate the public about environmental issues, such as climate change, and human impact on the issues.

Similarly, the media can serve as a powerful tool to enhance students' sense of environmental awareness and subsequent willingness to take action and advocate for environmental protection.

Although most of the public's knowledge about the environment and environmental issues comes from mass media, it is worth noting that concerns have been raised about the type and accuracy of information shared via mass media and the scope and degree of the impact on the public, particularly the youth (Riffe, Lacey & Reimold, 2007). Alexander (2002) suggested that the role of mass media may be inadequate or unsuitable due to the scope and format of the coverage which often lacks emphasis on the importance of the environment and consequences of human action. There is also concern about the failure of mass media to bring to public attention a consistent and thorough examination of the interrelationships and aggregate impact of environmental problems. According to Alexander (2002), "for this job to be done right, it can't be piecemeal. Links among stories must be made abundantly clear to readers, viewers, and listeners to emphasize the interrelationships and totality of the threat." (p.47)

There are further concerns that the intensification of media attention on environmental issues, such as climate change, does not necessarily equate alterations in attitude or actions (Shanahan et al, 97) or that it may result in unintended consequences such as an increased sense of fear and anxiety with respect to these issues, referred to as eco-anxiety. According to Hibberd and Nguyen (2013), messages about climate change in mass media, and particularly social media platforms, have resulted in young people developing a strong sense of behavioral inefficacy about this issue. There is increasing evidence of developing climate anxiety and reduced climate efficacy as a result of increased indirect exposure to content and information presented to them through social media coverage of such issues. Indirect, scattered, and sporadic coverage of such issues through mass media, especially social media platforms such as TikTok, Instagram, Facebook, or YouTube, can "elicit negative emotional responses including anger, sadness, despair, fear, and guilt" (Maran & Begotti, 2021, p.1) and ultimately climate or eco-anxiety.

Consequently, in the age of constant fast-paced, yet piecemeal, mass media coverage, it is necessary to develop skills and competency to decipher and analyze the saturated body of information in a more critical and meaningful manner. The critical missing piece is environmental education, particularly as part of formal K-16 education, as well as focus on developing media and information literacy (MIL) which has been described as a precursor to environmental and scientific literacy (Lopez, 2015). Individuals equipped with environmental literacy and MIL have less tendency to accept disinformation and greater inclination to accept research and other reputable information about environmental issues as well as take necessary actions to educate others or alleviate the issue (Mansoor, 2024).

The literature on the connection of students' MIL and environmental literacy, especially in college settings, remains scarce. The purpose of this study was to explore the experiences of students in an introductory college science course with a weekly discussion forum designed to engage them in learning about environmental issues through various media platforms and participation in peer discussions. This mixed-method study focused on examining: (1) the types of environmental topics students focused on and (2) students' experiences and reflections as they immersed themselves in examining and communicating about environmentally focused media content and engaged in peer discussion.

## **Methodology**

Studies focusing on college students' MIL and environmental literacy are scant, particularly in terms of the connection between the two constructs and the possible interrelationships with college course experiences and educational opportunities. Furthermore, the majority of existing studies in this area mainly focus on college students' current MIL and EL and do so utilizing quantitative research methods. In the current study, a mixed-methods content analysis approach, which consists of both quantitative (Krippendorff, 2004; Neuendorf, 2002) and qualitative methodology (Berg, 2001; Burnard, 1991), was employed to allow for a systematic evaluation and thorough exploration of the abovementioned research foci. The quantitative component consisted of content analysis of the textual data and expressing and summarizing the analyzed material as frequencies of particular categories (Krippendorff, 2004; Neuendorf, 2002). A qualitative content analysis was undertaken to address the other research foci by analyzing and inferring from and presenting the textual data in the form of themes.

The study focused on the weekly discussion forum component of an introductory environmental science course at a mid-sized branch campus of a major northeastern university in the United States. The course is one of the options for fulfilling the general science requirement necessary for different degrees, particularly non-science majors. More than 75% of the students enrolled in the course are first- and second-year students, and all are non-science majors including education, engineering, business, communication, criminal justice, and psychology majors and those who may be undecided.

The goal of this course is to enhance students' understanding of environmental concepts and issues, the connection among these issues and concepts, and the underlying causes and consequences of human actions. The course instruction is based on the constructivist model and consists of active student engagement through activities, discussions, projects, as well as a weekly discussion forum. Each week, students are tasked with finding an environmentally related news story and writing a post on the discussion forum including a summary of their news story and their own reaction or reflection. The weekly discussion forum opens Monday morning and closes on Sunday before midnight. After posting their own news summary and reflection, students will gain access to their peers' posts and are tasked with reading and responding to three peers' posts. During the latter part of the semester, the forum structure is slightly modified, and students are provided with specific resources, including environmental or sustainability related documentary films accessible through the university library's free streaming service, for them to write a post about.

## **Data Collection and Analysis**

The textual data gathered and analyzed for this mixed method content analysis consisted of discussion forum entries for three consecutive years and students' mid-semester and final course reflection assignments discussing their learning experience and factors deemed influential in their learning. The quantitative content analysis consisted of examining the discussion entries to determine the presence of themes or ideas related to the issues focused on in the posts and quantifying and summarizing the occurrences as frequencies. For each semester, 10 weekly forums were analyzed for a total of 60 weekly forums over the three-year period (six semesters). Since the forum

is open to students in all sections of the course each semester, there were approximately 150 students participating in the weekly forum each year. The qualitative content analysis utilized for examining the other research questions involved utilizing the MAXQDA software to evaluate and infer from the discussion entries and the reflections and present the data in the form of themes and related descriptions.

## Results

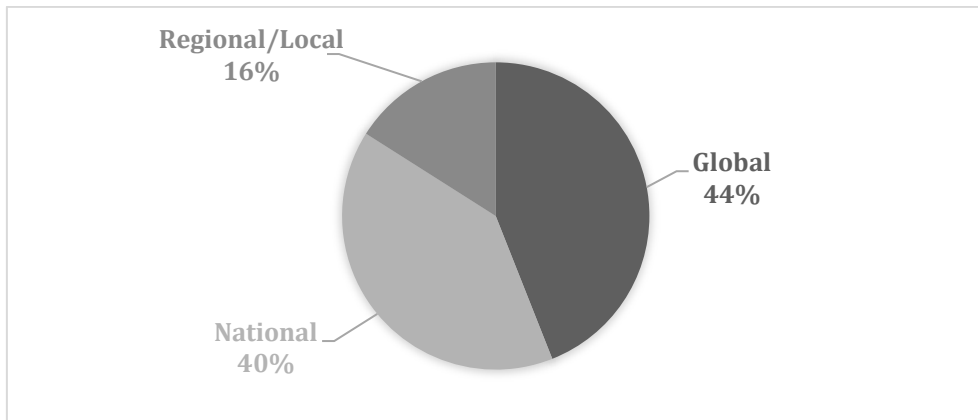
The study's findings will be discussed in two main sections: 1) the types of environmental news topics students focused on, media resources used, scope of the news stories, and the focus of the news stories, as well as 2) students' experiences and reflections as they immersed themselves in examining and communicating about environmentally focused media content and engaged in peer discussion.

### Environmental News Topics

The quantitative content analysis of the discussion entries focusing on student selected news indicated that students discussed a spectrum of local, national, and global news stories. As depicted in Figure 1, an approximately equal fraction (~40-44%) of the posts focused on environmental or sustainability related news occurring within the United States and globally. Only a small fraction of the news stories (~16%) focused on news occurring within the county, region, or state where the university is located.

**Figure 1**

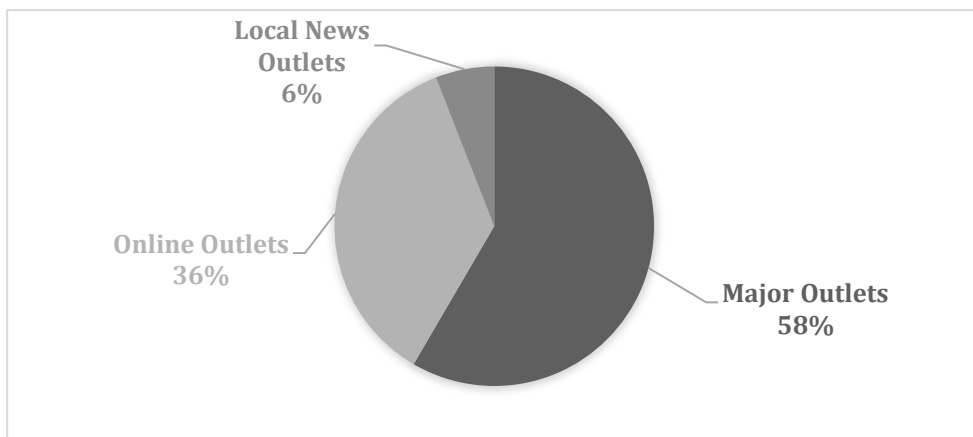
*The Geographical Scope of Environmental News Stories*



The greater focus on national and global issues as opposed to local ones may in part be due to the selection of media outlets and news sources students examined when searching for news stories. As depicted in Figure 2, the sources for the majority of the shared news stories consisted of the mainstream news outlets including ABC, CBS, or NBC News, CNN News, The Guardian, BBC, Wall Street Journal, Associated Press, and Reuters. Approximately 36% of the posts included citations from online environmental or science focused news or journalism outlets such as Science Daily, Science News,

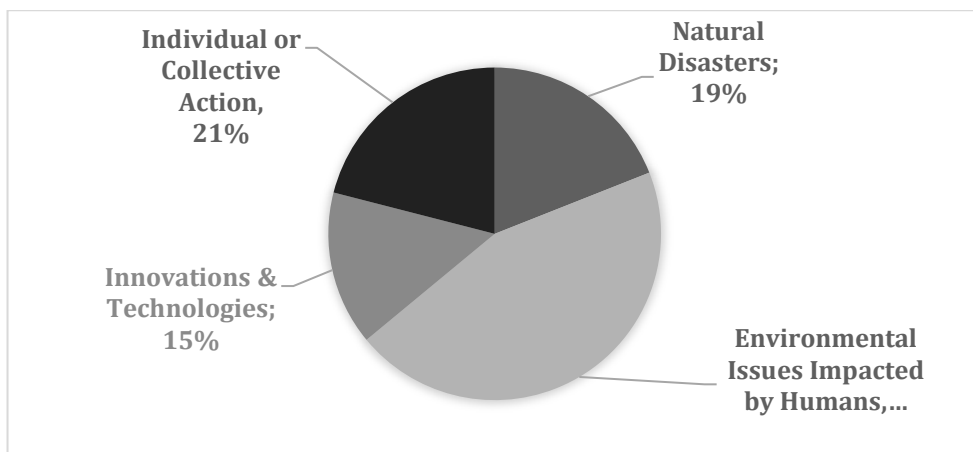
Earth.Org, and Scientific American. Conversely, only 6% of the news posts were obtained from local and state-wide news sources.

**Figure 2**  
*Media Outlets and News Sources Utilized for News Story Selection*



The analysis revealed that the news stories selected by students may be classified under two umbrella categories of positive and negative themed topics (Figure 3).

**Figure 3**  
*Focus of Environmental News Stories Discussion Posts*



Approximately two thirds (66%) of the posts concentrated on news stories addressing a negative phenomenon or issue such as those listed in Table 1. A small percentage of the posts (21%) focused on natural events such as floods, storms, wildfires, snow or winter storms, and occasional stories such as cicada outbreaks in some states or news that hit closer to home and they had more direct experience with, as with our region's severely depleted air quality due to the Canadian wildfires.

Interestingly, although these posts focused on natural occurrences, student reactions and summaries, as illustrated in the excerpts below, often highlighted the indirect connection with human activity as well as the immediate and longstanding impacts on biotic and abiotic components, including humans.

*Excerpt 1: Since I live in this area, the wildfire affected us as well. The air quality was terrible. It really felt like covid-19 all over again. There were a lot of days I couldn't go outside because of my asthma and how that would affect me. It was interesting to find out from this article that, in Canada this was a normal thing but this time it was dangerous.*

*Excerpt 2:*

*The wildfires in Canada are a severe problem. For many people living in this area, we got to see secondhand how bad the fires are. For many weeks this past summer our air quality was affected by these fires, and you could see a thick layer of smoke that looked like fog. It is obvious that the fires in Canada are a result of the rising temperatures and as explained in the article, these types of events are becoming more frequent. I think the best thing we can do at this point is to better prepare for these types of events and set up infrastructure to deal with them. It doesn't seem that there is a way to reverse the damage of climate change so at this point the best thing we can do is minimize the damage from the results of climate change.*

**Table 1**

*News Topics Focusing on Negative Environmental Impacts*

<b>News Topic Category</b>	<b>Sample News Topics</b>
Natural Phenomena	<ul style="list-style-type: none"> <li>• Flooding</li> <li>• Tornado &amp; hurricane</li> <li>• Earthquake</li> <li>• Wildfires (due to heat)</li> </ul>
Human Activity	<ul style="list-style-type: none"> <li>• Climate change               <ul style="list-style-type: none"> <li>○ Impact on biodiversity (birds, bees, trees.)</li> <li>○ Impact on glaciers &amp; weather patterns (increased floods, droughts, heat waves, warmer winters)</li> </ul> </li> <li>• Water scarcity (west coast &amp; globally)</li> <li>• Water pollution (plastic pollution, agricultural runoff,</li> <li>• Fracking, oil/gas pipelines, oil spills</li> <li>• Pesticide/insecticide harms (environmental &amp; health)</li> <li>• Mercury and lead contamination</li> <li>• Invasive species (bark beetles, lanternflies)</li> <li>• Biodiversity loss (endangered species, coral reef destruction,</li> <li>• bee &amp; butterfly population decline, overfishing, oyster overharvesting, poaching)</li> <li>• Watershed threats</li> <li>• COVID related increase in waste</li> </ul>

The remainder of the news stories in the ‘negative’ category focused on a variety of non-natural environmental issues such as climate change, water scarcity, endangered species, loss of biodiversity, depletion of non-renewable resources, and various forms of pollution which have been either created or exacerbated as a consequence of human activity. Posts in this sub-category focused on the extent or severity of the issue and the societal, behavioral, political, and economic factors contributing to the worsening of the issues, as well as the reciprocal impact of these issues on the environment, society, and the economy. One news story discussed the surprising impact of extreme heat from climate change on human behavior, including anger and decreased work productivity. Others noted examples of environmental injustice and the disproportionate impact of environmental problems in traditionally marginalized and indigenous communities.

Conversely, some posts focused on more encouraging and promising environmental news stories and the positive impact of human action on the environment (Table 2). These stories included news about innovative approaches or technologies developed to deal with environmental issues. Multiple stories focused on the use of renewable energy sources, technologies for improving water quality or addressing water scarcity, innovative methods and techniques to reverse coral reef destruction, and even innovative approaches to examine the past to garner ideas to be implemented now or in the future.

**Table 2**

*News Topics Focusing on Positive Environmental Impacts*

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<b>News Topic Category</b>	<b>Sample News Topics</b>
Innovations & Technology	<ul style="list-style-type: none"><li>• EV cars</li><li>• Alternative energy &amp; biofuel</li><li>• Eco-friendly fashion</li><li>• Ecological farming</li><li>• Climate resilient agriculture techniques</li><li>• Banana peel for water purification</li><li>• Plastic eating microbes</li><li>• Engineered bacteria</li></ul>
Individual & Collective Human Action	<ul style="list-style-type: none"><li>• Urban gardens</li><li>• Oyster restoration</li><li>• Watershed restoration</li><li>• Multi-level bans and regulations (toxic material, plastic bags, waste, powerplant emissions,</li><li>• Climate or environmental regulation protests and lawsuits</li><li>• Zero waste initiatives (city recycling, reusing landfill waste,</li><li>• Higher education efforts (plastic free initiatives, decarbonization, zero waste initiatives, energy efficient buildings)</li></ul>

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*Excerpt: "In Peru, Bolivia, and Chile, people who live in foggy areas use mesh nets to catch droplets of water. A few hundred liters of water can be collected this way which they will then use for drinking, cooking, and washing, but atmospheric pollution can cause hazardous substances to be absorbed as well into the mesh. In cities the air pollution can be so high that the water droplets caught are not suitable for drinking or cooking. Researchers have developed a way of using a close mesh lattice of metal wire coated with a mixture of polymers and titanium dioxide to purify the fog by breaking down molecules of any harmful pollutants that may be in the droplets. Technology involving photocatalytic memory requires minimal maintenance once properly installed. The technology is extremely efficient, requiring only a small dose of UV to regenerate the catalyst allowing these populations to have access to clean water."*

Other positive news stories focused on individual or collective actions by people, communities, organizations, and governments with encouraging environmental results. These actions included tree planting, pollinator garden development, proposal for EV car tax credit, and additional governmental or international protection of natural habitats and wildlife.

### **Experiences and Reflections**

This study also focused on the students' experiences and reflections as they engaged in the weekly discussion. The analysis involved examining the 'reaction' section of students' individual weekly posts and responses to peer posts as well as students' comments on the mid and end of the semester reflection assignments about possible factors responsible for perceived changes in their knowledge, attitude, confidence, and willingness to take action. Several themes emerged with respect to the scope and extent of student engagement in discussions, students' thoughts about the encountered environmental content, and their perceived environmental attitudes, beliefs, skills, and confidence.

### ***Engagement in Discourse***

The weekly discussion forum engaged the students in productive discourse by providing an opportunity for them to respond to the comments made by their peers or the ideas and perspectives communicated by the author(s) of the original news story. Most of the student posts received at least one or two peer responses and those about topics that appeared to be more engaging, unique, surprising, or perhaps somewhat more controversial received more peer responses. The examination of the reactions included in each individual post revealed that students unhesitatingly expressed their opinions and perspectives on the news story shared or the documentary films viewed. They communicated their agreement or disagreement with the sentiments expressed in the shared news story or documentary and provided justification for their views. Many of the sentiments were in agreement with what was expressed, but there were instances when students would make a counter argument, disagree, or even question the claim made in the original source. Interestingly, in each case, students described their rationale and supporting arguments as opposed to simply voicing their disagreement. Students would at times disagree with articles that appeared to support economic development and money saving measures over environmental protection

measures such as banning plastic bags, regulating fossil fuel extraction, and investing in renewable energy as opposed to fossil fuel industries. Similarly, although peer response comments most often were affirmative and supportive in nature, students would occasionally oppose their peers' arguments or opinions, typically over matters dealing with the environment versus economy perspectives. The tone of these responses was never antagonistic or hostile and students corresponded to their peers in a respectful and congenial manner.

### ***Knowledge and Skills***

A key purpose of the weekly discussion forum is to enhance students' understanding and awareness of the state of the environment. The analysis of the individual posts and peer responses, as well as the two reflection assignments, revealed evidence that students either lacked or possessed minimal and superficial pre-existing knowledge of many of the common environmental issues they encountered in the news or documentaries. Many discussed learning about most of the issues for the first time or not having extensive prior knowledge about them.

*Excerpt: "It makes me consider how even the smallest components of ecosystems could be impacted by our activities, such as wasting resources or failing to protect the environment. Interesting to see how climate change has an effect on virtually all aspects of life on Earth. I wouldn't immediately think the ocean would be so affected by climate change as the focus is typically on land flora and fauna and well as human health. However, thinking about it more now, it makes sense that the ocean, which makes up the majority of the earth's surface, would be affected as well as crucial in supporting life everywhere."*

Students occasionally expressed shock and disbelief in response to recognizing the extent and gravity of environmental issues they were previously unacquainted with or possessed minimal understanding about. Sample excerpts from student posts are included below.

*Excerpt 1: I did not know that air pollution was a big issue in America. I knew about how bad New York's air quality can be with the smog and traffic but did not know the whole United States was suffering from this issue. The most shocking statistic was that more than 100 million people live in counties where there is an ozone smog grade of 'F'. This means that every time someone steps outside in one of these counties, bad air is entering your lungs with health risks. Also, things like wildfires are making the air quality even worse as well, especially in the west of California. What I found so interesting about this article is the problem with particle pollution. The reason it is such a problem is that it is so tiny. The article describes it as '1/20th of the width of a human hair- that it can travel past your body's usual defenses'. These particles can get stuck in your lungs and even go into your bloodstream creating huge health risks, which is so shocking to know that such a little particle.*

*Excerpt 2: From a young age I was always aware of the ongoing list of endangered plants and species, but the affects natural disasters could have on said species rarely crossed my mind. The percentage of endangered species in*

*Hawaii is mindboggling and quite concerning. Our environments rely on species to continue; we all work together to remain a healthy, stable Earth. With the effects of these fires, environments and biomes in Hawaii are going to face struggles not just with rebuilding, but being able to do so while maintaining the safest version of an environment possible while the restoration takes place. The long lasting effects the wildfires are creating will require extreme amounts of assistance and patience while the state and country try to assess the damage and begin to rebuild.*

The discussion posts also elucidated students' newly gained awareness of issues that are normally more rarely focused on in the news, media, or school such as light or noise pollution and the classification of social media as environmental toxins. In sharing and discussing environmental issues and current environmental circumstances, students also exhibited increased understanding of the underlying science content and discussed the connection of some of the news stories or documentaries to the concepts discussed during the in-class sessions such as biogeochemical cycles, population dynamics, interactions among organisms, keystone species, and energy flow through the food web.

*Excerpt 1: I can remember one of the environmental news shares I had read about dealt with a python affecting the food chains of certain species, because it was brought into an environment where it had never been before and interrupted existing interactions such as competition.*

*Excerpt 2: It becomes pretty mind-blowing when looking at articles like these. Because so many companies and factories often have chemicals that they use an excessive amount, there will be runoff into rivers and surrounding areas that damage the environment. Although there are new regulations that are being created and others that are becoming stricter, change is not happening quick enough. This leads to increase in the number of animals, including humans, that are being affected. The thought about this had never occurred to me about the specific chemicals impact on the watershed and damage to the environment like this although it is something that we grew up learning about.*

The majority of student posts alluded to their newly gained recognition of the adverse impact of human activity on the environment, beyond what they had previously imagined.

*While I am aware that human influence has greatly impacted the world flora and fauna, I severely underestimated the extent of the issue. I was under the false impression that while we affect the world on a vast scale the underlying microecosystems were safe due to their almost insignificant size. Their small size and immeasurable impact on the world make microorganisms the most important type of life on the planet, their significance cannot be understated and it is worrisome to see that human actions may not only cause the extinction of current life on the planet but may force the planet to become a barren wasteland if the organisms are affected too much and the environment becomes unsustainable for life at the non-visible scale.*

Furthermore, since students had witnessed the course emphasis and focus on the interdisciplinary nature of environmental science, they discussed and elaborated on the interconnections of the environment with the economy, technology, society, history, and geopolitics in their news share responses and the two final reflections.

*Excerpt 1: Although it is common knowledge that the combustion of fossil fuels leads to respiratory illnesses and is generally bad for the environment I was unaware of how necessary it may be to people and their survival. The economic situation is driving people with very little into making decisions that are extremely difficult since their choices may only be to burn coal or freeze in the winter.*

*Excerpt 2: I was fully aware that droughts all over the world were becoming a serious threat, however, I was not aware of how severely they affected our global trade system. Global trade is how we get all of our goods from outside the U.S, I find it crazy how nothing is still being done about trying to help reverse and heal our environmental damage. Goods won't be able to be transported anywhere if the droughts keep getting more severe. At the end of the article, Somini mentions that the global trade industry has agreed to neutralize their emissions by 2050, and how climate activists everywhere don't believe them. I also do not believe them, global trade, or at least the people who run it are just worried about making more money. I feel that if they were actually serious about helping the planet they would not set their goal date so far into the future. If things need to be done about reversing the effects of climate change, they must happen now, not thirty years from now.*

*Excerpt 3: As someone who comes from a city with a large population, and a high amount of pollution as well, I feel that this technology is highly beneficial. Along with that there have also been issues with drinking, and running water that is able to be used for consumption and cooking, it makes it very difficult in general. I think that this would be very useful in countries that are currently having issues with having clean water for consumption, such as India. Although one concern that I do have for this innovation is that it would be quite costly and it would be worth a lot of money to install, which is already not in favor of those countries that are considered to be 3rd world countries.*

Finally, in their two reflection assignments, students often described the significance of the weekly discussion forum in expanding their awareness of environmental issues they were previously partially or completely oblivious about. They also emphasized the importance of the discussion forum in strengthening their communication and argumentation skills by allowing for dialogue with their peers beyond the walls of the classroom and in a context and setting where they may feel more comfortable partaking in discussion and sharing their ideas and views. Finally, many students described not previously paying attention to environmental news or issues or general news and how the discussion forum allowed them an opportunity to engage with the news or watching documentaries focusing on real-life topics that cut across disciplines and deal with the environment, society, and global economy. As a consequence of completing the weekly discussion forum, a number of students

discussed experiencing an enduring impact of adopting a habit of increased attention to social environmental or sustainability news and coverage on social media.

### ***Perceptions and Perspectives***

Students' reactions to their own selected news stories or documentary films as well as their responses to their peers' posts illustrated various emotions, perceptions, and attitudes. In discussing and responding to news stories or documentaries about the scope, dangers, and implications of environmental issues such as climate change, water pollution, or loss of biodiversity, students shared myriad feelings such as a sense of loss, uncertainty, and powerlessness. Some student reactions and peer responses to this category of news or documentaries displayed a dearth of optimism or sense of confidence in the ability to embark on individual and societal action necessary to deal with the existing and lingering issues.

*Excerpt 1: I think that this article does good reporting on a very important topic of these modern times, microplastics. I think that microplastics are going to be found very toxic to humans. I enjoy eating a credit card worth of plastic a week as much as the next person, but I think that if nothing is done about the microplastic problem, a lot of things are going to go wrong for us in the future. The scariest thing I thought about this article was how the residents of the lake used the water for drinking, without even knowing how bad the water was for them. If water considered to be near-pristine could be so contaminated, it makes me wonder what the water I could be drinking is like and no one seems to be taking any action.*

*Excerpt 2: I'm left with a mixture of despair, urgency, and deep concern for the future of our world after reading the article on the unprecedented breeding failure among emperor penguin colonies in Antarctica as a result of complete loss of sea ice. It is very sad to learn that these famous animals, who have long survived in one of the toughest settings on Earth, are now in such desperate situations because of human-caused climate change. The explanation of how these penguins' breeding cycle, from egg laying in the winter to baby fledging in the summer, depends on stable sea ice emphasizes just how complex and sensitive their ecology is. A strong wake-up call is provided by the unusual failure of entire colonies to reproduce. It is difficult to believe that we have altered the environment to the point that creatures that have evolved over thousands of years are now finding it difficult to cope with these quick changes.*

Others discussed a sense of frustration and resentment toward businesses and industries responsible for creating the various environmental issues and lack of government action to alleviate such problems by creating or reinforcing environmental protection policies.

*Excerpt 1: This (story about Kenyan plastic waste issue) is a tragedy to me because the world already has a whole lot of trash everywhere and we never think of what it's doing to the planet. This causes pollution to get in the air and the water and impact our everyday life. In Kenya, they live literally next to a garbage dump that keeps on growing from all the plastic we use and don't recycle. The*

waste and pollution affect children's growth and health and the environment. And to have this management law in place to say reduce your pollution and environmental impact on the earth really is a huge step for us to take. However, this makes me mad because there are several thousand companies all around the world and over 1,000 companies in Kenya that won't sign the paper and the ones who do is only about 13 or 14 of them which go to show how little they care about their own home. They never stop to think like this is our home where we're making a mess of it because with all that money it's not going to matter if the home you live in is gone.

*Excerpt 2: This article was initially frustrating to read, mainly due to the Japanese government's lack of transparency and initial, spontaneous decision. I have also never considered how impactful this may be for an area dependent on its environment for financial stability, and to no fault of their own. I found this article interesting as someone familiar with threats to watershed, it goes to show how much greater of an impact we have as individuals on conservation, but is also discouraging to see how quickly a government can undo years of careful, environmentally conscious decisions.*

Some students responded by focusing on the sense of concern and urgency about the many issues they encountered in the news and which they associated with human activity but also communicated the urgent need for collaboration and personal and collective action.

*Excerpt 1: I think one of the ways we can help at least slow down this climate change is by stop burning so much fossil fuels that basically air pollution and to our atmosphere because that alone is causing droughts to happen all over the world which greatly affects our global trade because whatever comes from the air goes into the water the land and it greatly affects our resources causing not just living things to be greatly affected and also affects us because half of our stuff comes from different countries That's how we survive but the only way to continue staying alive is to cut back on all the negative input we have on the earth so we can at least try and help save our planet.*

*Excerpt 2: The article gave me a lot to think about how we are mistreating the resources we have on this planet. The ocean is a big part of how we get more clean oxygen in the air and it's also where we get our food from so reading that it's become too hot for the animals to live in their own home because we are causing the ocean to heat up is worrisome for the future. We are also causing the ice glaciers to melt faster which more animals live on causing them to lose their lives and if the ice glaciers keep melting as fast as they are the more the sea level arise which might eventually cause more floods than ever causing even more millions to lose their lives. As human beings who live on this earth, we have to be more mindful of what the earth is giving to us because this is our home we have no other place to go if it's gone.*

*Excerpt 3: As bad as this is, there's always a way for humans to help out, and hopefully prevent this from happening. Obviously, if humans are responsible for a contributing factor to this problem (pollution), we can certainly stop it. I also*

*didn't know that only 3% of the world's water is freshwater, which, of course, makes pollution a lot worse. I believe people should look into this more and take the time to read through the articles and take them into consideration (i.e. don't ignore them). I appreciate all of the great writers and volunteers who devote their time to making the environment a lot better for humans and animals. We have people (like WWF) who understand the severity of water shortages (and what causes them). The only problem is, who will listen?*

The sentiments about the importance of individual and social responsibility were especially evident when discussing the category of news stories or documentaries focusing on positive actions or innovations which provoked a sense of hope, excitement, optimism, and encouragement. As one student noted in response to a news story about indigenous voices or collaboration among various groups to instigate action: "I think reading about these stories sparked a lot of emotions in the class, including a sense of encouragement and empowerment, and this was helpful in persuading us to do more because we can also potentially make changes through our actions."

### **Discussion**

This study is unique in its focus on students' interaction with media and discourse focused on environmental issues as discussed in news media outlets. It shed light on the types of environmental news students focused on, their scope of understanding about environmental issues, the extent of engagement in discussion, and the outcome of embarking on such activity in terms of their attitude, perceptions, gained knowledge and skills, and willingness to act. There is a dearth of literature focusing on the utilization of media-focused instruction, including discussion forums, in higher education courses, particularly science and environmental science courses. This 3-year study filled the existing gap in the literature by providing insight as to what types of environmental topics college students find interesting and decide to focus on when provided an opportunity to share and discuss environmental news. It was found that students most often utilized major mainstream news media outlets (e.g. NPR, The Guardian), followed by online science or environment-focused news outlets (e.g. Science News), to ascertain news stories and consequently came across and focused on national and international environmental news more often than local ones. Although the slight majority of the posts focused on environmental issues and the negative impact of human activity, a noticeable portion of the posts (~40%) focused on more positive and encouraging news focusing on innovations and technology or individual and collective action geared toward alleviating major issues.

In general, students reported not paying attention to environmental news prior to the course and having gained an interest in continuing to follow such news after the completion of the course. As with previous studies (Kazempour & Amirshokoohi, 2013; Amirshokoohi, 2010), students' understanding of issues was found to be minimal and superficial. Through their participation in the media-based weekly discussion, students gained awareness of environmental concerns in various geographical locations around the world, ways in which local and global human activity alters the environment and leads to the creation or exacerbation of environmental issues, and various means of positively impacting the environment through valuable solutions and actions to reduce our ecological footprint.

The utilization of the media-based discussion forum as an instructional tool in this course aligns with the several best practices identified in various guidelines. First, student posts and forum discussions addressed a broad web of interconnections involving the environment, economy, and society; hence, the discussion forum allows opportunities for focusing on sustainability and the relationship between social, environmental, and economic justice and equity. Second, the use of the forum allows for facilitating students' recognition of the interconnection of the political, economic, societal, cultural, and technological structures and systems and the environment as well as the impact of any issue or action on larger systems." Furthermore, it provides an interdisciplinary focus for recognizing the integration among disciplines in understanding the scope, causes, consequences, and possible solutions for environmental issues. Finally, participation in the weekly discussion forum encourages students to examine, gain awareness, and connect with their surroundings and develop 'lifelong learning' in terms of important skills including critical and creative thinking, collaboration, communication, as well as information, media, and technology skills.

According to Stibbe (2009), acquiring sustainability literacy allows individuals to "become empowered to read society critically, discovering insights into the unsustainable trajectory that the society is on and the social structure that underpin this trajectory." (p.11). Furthermore, it empowers them to "engage with those social structures and contribute to the re-writing of self and society along more sustainable lines" (Stibbe, 2009, p.11). Similarly, in this study, students encountering and discussing a balance of both positive and negative news stories would allow them to avoid a sense of despair and fear and instead gain hope and be educated about their civic responsibilities and the possible opportunities, both in their personal and professional lives, to contribute positively toward environmental protection and sustainability. This is aligned with recommendations (Strife, 2012) that environmental education should avoid focusing only on an environmental doomsday narrative which may create further anxiety and fear, especially among the youth. Additionally, it aligns with previous assertions that 'practical anxiety' (Kurth & Pihkala, 2022), that results in more in-depth reflection on the negative implications of our actions, may result in more extensive level of planning and positive changes in individual and collective environmental practices.

## **Conclusion**

Although the findings of this study are illuminating and promising, there is need for further research examining the connection between media and young people's environmental literacy and willingness to take action and advocate for sustainability efforts. Furthermore, the incorporation of instructional approaches that focus on the exposing students to current environmental issues and their underlying scientific, technological, economic, and societal connections using media sources and peer discussion are integral to advancing environmental and sustainable literacy and ought to be further explored. Finally, although this study's findings did suggest an improvement in students' knowledge and understanding of a range of environmental topics and issues as well as their cognitive and affective dispositions and skills, further studies examining students' behavioral strategies and informed decision-making skills are necessary.

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