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Youth Can Promote Marine Debris Concern and Policy Support Among Local Voters and Political Officials

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Many of the most sweeping social movements throughout history have been youth-led, including those related to environmental challenges. Emerging research suggests youth can build environmental concern among parents via intergenerational learning, in some cases overcoming socio-ideological differences that normally stymie attempts at collective action. What has not been studied is the potential for youth to also influence adults outside their immediate families. This study based in North Carolina, USA, explores the potential of today's young people as environmental change-agents in their communities on the topic of marine debris. Specifically, this evaluation examines responses from voters and local officials after participating in youth-led civic engagement events. After engaging with a youth-led civic engagement event, voters, and local officials completed a retrospective pretest survey that asked questions about levels of marine debris concern and their likelihood of supporting a local marine debris ordinance. Young people encouraged both concern and policy support among both voters and officials, and that concern and policy support increased independently of whether adults were voters or officials, liberals or conservatives, or knew the students personally. Further, participation in the youth-led engagement event reduced political differences in marine debris concern. This study suggests youth can play a critical role addressing marine debris challenges by promoting support for marine debris management policy, and doing so across political barriers.

Keywords: intergenerational learning, youth, civic engagement, youth activism, environmental policy, marine debris, environmental education, plastic pollution

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INTRODUCTION

Political solutions to environmental problems have long proven elusive. Although overall adult concern for and prioritization of environmental issues have increased in the United States over the last decade, environmental progress is often stymied by wide partisan gaps (Pew Research Center, 2020). In fact, political ideology has been shown to be a more prominent factor in predicting one's environmental attitudes than the weight of scientific evidence on environmental issues (Dunlap and McCright, 2008). This may be because political

affiliation is a key aspect of many people's personal and social identity (Iyengar and Westwood, 2015)—as the politicization of environmental protection has been woven into political ideologies, and therefore, in many cases, individuals' personal identities. For instance, a small but significant number of US citizens have switched their self-labeled ethnicity, religion, sexual orientation, or class to better align with their political affiliations (Egan, 2020), and polls suggest the same could be true with the environment. In the United States, support for environmental issues has become partisan, with 85% of surveyed Democrats prioritizing the protection the environment, while only 39% of surveyed Republicans shared the sentiment (Pew Research Center, 2020). These challenges associated with identity politics are compounded by adults and older Americans simply caring less about the environment than youth (Ballew et al., 2019). Taken together, identity politics and age can make political action to protect the environment challenging, or in some cases impossible (Egan, 2020).

Though this polarized context paints a bleak picture for generating solutions for environmental challenges, the perspectives and activism of youth may offer hope. While adults are polarized in their views on environmental issues, young people are less so. Several recent polls highlight how Millennials and GenX-ers are polarized on a host of issues, but less so when it comes to climate change and renewable energy (Pew Research Center, 2020). Youth may hold more united views on environmental topics than adults because their worldviews and political ideologies are developing alongside their knowledge of environmental science, making it less likely that younger audiences will reject scientific facts because of already cemented political ideologies (Stevenson et al., 2014). Further, youth have the most to gain by investing in a sustainable future (Ballew et al., 2019). Indeed, future consequences of inaction, such as climbing global temperatures and associated impacts, will be most felt when the youth of today reach adulthood, and older generations will no longer be alive (Hansen et al., 2013). Perhaps for these reasons, we see evidence of high levels of engagement on environmental topics among younger generations. Youth prioritize and care deeply about environmental topics (Pew Research Center, 2020), as demonstrated by the commitment displayed by "Little Miss Flint," Amariyanna Copeny, representing her Michigan, USA, community in its water crisis at age 8 and Greta Thunberg leading the globe toward climate solutions at age 15 (Marris, 2019), among others. Youth can and are politically active in responses to environmental change, and as historian Hogan (2019) notes, the future of democracy is in the hands of today's young people, who do not have to wait until they are of voting age to be politically impactful.

Environmental youth activism may be uniquely situated to transcend ideological barriers to adult commitment on environmental solutions, as youth may inspire adults to join them. The phenomenon of adults learning from children is described as intergenerational learning (IGL), or the bi-directional transfer of knowledge, attitudes, or behaviors from children to their parents and vice versa (Duvall and Zint, 2007; Bottery, 2016). Several studies have documented how this process can work particularly well for environmental issues (Duvall and Zint, 2007). Youth may serve as embodied reminders of future impacts of today's policies, thereby making the future impacts of environmental problems more tangible for adults (Bulc et al., 2019). Further, wanting what is best for future generations may offer the common ground needed to overcome political polarization (Lawson et al., 2019). For instance, when children discussed their climate change education programming with their parents, parents were found to have gains in climate change concern—and this effect was largest among politically conservative parents who initially had the lowest levels of climate change concern (Lawson et al., 2019). It is well-established that young learners benefit from engaging in the political process through increased agency, competence (Mitra, 2004; Zeldin, 2004), and self-confidence (Jensen and Schnack, 1997; Dworkin et al., 2003). It is quite possible that youth political participation not only benefits the youth themselves, but the entire political process, by inspiring action among older generations (Williams et al., 2017) and providing a pathway to overcoming barriers to political progress related to partisan polarization (Lawson et al., 2019).

BACKGROUND

Existing IGL research suggests youth can influence adult environmental perceptions and behaviors within their families. Evidence includes several quasi-observational studies in which youth-targeted environmental education programs have been associated with parental knowledge, attitudes and/or behaviors in the contexts of water pollution (Uzzell, 1994), air pollution and litter (Ballantyne et al., 2001), watersheds (Sutherland and Ham, 1992), and flood resilience (Williams et al., 2017). Notably, at least two experimental studies have found causal evidence that youth-led conversations at home have inspired both energy saving behaviors (Boudet et al., 2016) and climate change concern (Lawson et al., 2019) among parents. Further, as noted above, the influence that youth have over parents' climate change concern overcame political polarization, offering an uncommonly found pathway to political progress on environmental challenges (Lawson et al., 2019).

More research is needed to understand if and how young people influence adults outside of their family units. Behavior changes typically spread through personal relationships (Centola, 2021), and as youth bridge generational gaps and develop personal relationships both within and beyond their family units (e.g., with teachers, coaches), they may be well-positioned to drive broad acceptance of new ideas within communities. Attributes of personal relationships that can help drive the spread of behaviors and ideas, such as trust and communication frequency, are typical of family relationships (Centola, 2021), and may help explain the increasingly strong evidence in support of youth's influence over parents. Indeed, several studies have found that frequency of discussion between youth and parents has been shown to be a predictor in increasing environmentally friendly behaviors (Ojala, 2015; Valdez et al., 2018; Stevenson et al., 2019). Specifically, studies have shown that students discussing climate

change with family and friends was one of the biggest indicators of their climate change behavior (Valdez et al., 2018), and that frequency of discussion with friends and family was the second strongest predictor of climate change concern among students, with family having more influence than friends (Stevenson et al., 2019). Accordingly, youth may have a larger influence over adults with whom they have closer personal relationships. Several qualitative studies have found support for youth influence outside the family context, such as in Australia, where children led their communities to act more sustainably (Stuhmcke, 2012); in 11 communities in Thailand, where students researched deforestation and forest degradation and then brought the results of their investigations to local community members (Gallagher et al., 2000); and in Mexico, where local community leaders responded positively after students publicly participated in beach clean-up and natural area rehabilitation efforts (Schneller, 2008). Furthermore, Thew (2018) found that when youth have high levels of agency, their policy suggestions are generally well-received by adults in political spheres. Although these findings for levels of youth influence outside of the family context are promising, little quantitative research has examined how youth may influence adults in their communities beyond their parents (e.g., neighbor, soccer coach, Twitter follower, etc.).

Other critical questions include the degree to which youth can influence a specific group of unaffiliated adults: local officials. While local officials may have more immediate influence on policy than other community members, they have been found to be less likely to work across partisan divides for fear of appearing weaker to voters (Iyengar and Westwood, 2015). This may be especially true in the United States, where environmental issues have become partisan issues (Pew Research Center), and the politicization of environmental protection makes the compromises required for political action challenging (Egan, 2020). While the gap between environmental protection and political action may be large, youth-led environmental IGL may help bridge the way for local officials. Qualitative instances of youth influencing their local officials have been found, such as youth-made climate change video screenings contributing to officials taking next steps toward climate solutions in the Philippines (Haynes and Tanner, 2015) and youth environmental activism contributing to community solutions toward environmental challenges in Hawai'i (Volk and Cheak, 2003); however, no studies have been conducted quantitatively or explored how youth may influence perspectives on environmental issues and policy among local officials. Finally, as highlighted by the rise of virtual engagement with the onset of COVID-19, research on the mode of student engagement (e.g., in-person vs. virtual) may be beneficial. Virtual learning poses multiple problems including adding unnecessary complexity to the learning process (Pan, 2010), negative effects on students' motivation, and a lack of peer interaction (Aliane et al., 2010), but given the increasing norm of both educational and civic processes occurring virtually, understanding the degree to which youth can influence adults even when in-person interactions are not possible would be valuable.

We began addressing these research gaps with a particular focus on whether young children (aged 8–10), with no formal political power, might motivate adults. Specifically, we examined how community events led by young children around marine debris may inspire marine debris concern and support for policies to address marine debris among both voters and local officials. We chose the issue of marine debris for several reasons. First, marine debris is an emerging environmental challenge and poses significant threats to coastal ecosystems (Riggs et al., 2011). Second, it is a compelling environmental cause for young people to champion (Hartley et al., 2015) because the problem is highly visible, persistent, and concrete solutions like trash reduction are readily apparent (Torres et al., 2019). Further, a recent study found that environmental advocacy videos on the topic of marine debris were able to reduce attitude and behavioral gaps between partisan groups (Jennings et al., 2020). Engaging with younger audiences on marine debris therefore provides a promising approach to address a pressing environmental issue and to empirically evaluate the community impacts of political activism led by young children (Ballantyne et al., 1998; Duvall and Zint, 2007; Lawson et al., 2019). In this context, we tested 5 hypotheses:

(1) all adults would report increased concern for marine debris and support for policies to address marine debris after participating in a youth-led event,
(2) changes would not be as strong for local officials as for voters,
(3) pre-existing personal relationships with youth presenters would predict larger gains in marine debris concern and support for policies to address marine debris,
(4) adults who attended in-person youth-led civic engagement events would show greater gains than those who watched online public service announcement (PSA) videos made by youth, and
(5) political polarization around marine debris concern and support for policies to address marine debris would lessen among all adults after engaging with the youth-led event.

METHODS AND APPROACH

Study Context

This study was based throughout coastal, piedmont, mountain, urban, and rural counties across North Carolina, USA and examined changes in marine debris concern and support for policies to address marine debris among voters and local officials after participating in youth-led civic engagement events focused on marine debris. These youth-led engagement events were designed by 8 to 10-year-olds as part of a year-long marine debris curriculum over the 2018–2019 and 2019–2020 school years. As part of the marine debris curriculum, students developed civic engagement events for their local officials and community adults that were either in-person (e.g., formal presentations at their local town hall meetings) or virtual (e.g., public service announcement videos). In-person events included talent shows, poetry nights, student art exhibits, and formal in-person presentations to local Town Halls and School Boards. Virtual events included production and dissemination of virtual public service announcement videos (PSAs). In each case, teachers supported their students in preparing the events, but the events

themselves were student-designed and delivered. For instance, in the case of the video PSAs, students first watched examples of other video PSAs and then designed their own. The curriculum included activities to help students research relevant facts about marine debris, develop talking points to communicate the issues of marine debris to others, create a script and storyboard for the PSAs, and film the PSAs (DeMattia et al., 2020). The freely-available marine debris curriculum and complete descriptions of the activities can be found on the Duke University Marine Lab Community Science website (DeMattia et al., 2020). Specific examples of youth-made marine debris PSA videos are available on YouTube (Hartley, 2020).

Instrument Development

We measured levels of marine debris concern (hereafter as "MD concern") and support for marine debris-related ordinances (heretofore "MD policy support") with a retrospective pre/post-survey (Moore and Tananis, 2009). After development of an initial survey, we asked 11 Town Managers, City Planners, and Local Officials to pilot the survey and provide feedback to strengthen its relevance, applicability, and usefulness for communities. Based on feedback from these pilot sessions, we made adaptations to the language and overall structure of the surveys. In the final version of the survey, we asked respondents to consider their level of MD concern, both before and after the student presentations with a five-point Likert style scale. We asked: "*Consider your level of concern about marine debris. What was your level of concern BEFORE the student presentation*?" and "*What is your level of concern NOW, after the student presentation?*" Response options ranged from not at all concerned to extremely concerned. Similarly, we asked: "*Consider the likelihood of your supporting an ordinance in your county to address marine debris. How likely were you to support such an ordinance BEFORE the student presentation?* and "*How likely are you to support such an ordinance NOW, after the student presentation?*" Response options ranged from extremely unlikely to extremely likely. We also asked respondents to self-report race, gender, political affiliation, and whether or not they knew the students previously.

Data Collection

In order to recruit local officials and local voters we paired intercept surveys at in-person engagement events with an active recruiting strategy for local officials via email. At the events, we conducted intercept surveys of attendees (voters and officials) by handing out a small post-card with a link to an online survey. There were eight youth-led, in-person events in the 2018–2019 school year, including a beach clean-up, talent show, art show, fashion show, local School Board meeting, a presentation at a brewery, and two school plays written and directed by the students on the topic of marine debris. We supported teachers and students in advertising the youth-led civic engagement events via flyers posted in the community, social media posts, emails sent to school families from the teachers and principals, emails sent to local officials from the county where the event was taking place, and press releases run by local news outlets.

Though more events were planned in the 2019–2020 school year, all but one (a town hall meeting) were canceled in response to the COVID-19 pandemic. As a result, students refocused their efforts on PSAs which could be delivered online. For the student-generated video PSA events, we focused our efforts on recruiting local officials. This online recruitment represents a different pathway than the intercept method, but was necessary because online PSAs did not have an in-person mechanism to engage local officials during COVID-19. To supplement recruitment of local officials, we developed a list of mayors, school board officials, town hall members, local soil, water, & conservation officials, county commissioners, city council members, school Superintendents, and members of Environmental Affairs Boards (where applicable) from all 100 counties in North Carolina. We searched county and municipal websites for email addresses, and where there were no email addresses provided, we followed up by phone to gather contact information. We drew from this list to directly invite local officials to all in-person events. When possible, we emailed officials a link to the student-developed PSA video(s) from their own county and a link to the survey. In counties where there were no participating students, we sent local officials a link to a YouTube channel with a sampling of PSA videos from students across the state, as well as a link to the survey.

In total, we contacted 1,984 local officials via email for online PSA "events." For the in-person events, we handed out ∼300 survey cards to in-person attendees. For both in-person and online events, 172 adults (65 voters and 107 local officials) completed a retrospective-pretest survey that asked questions about levels of their MD concern and the likelihood of their MD policy support (generating a response rate of ∼22% for voters and <1% for local officials). Of these, 37 voters attended an in-person event, 22 interacted with the video PSAs, and 6 did both. In terms of local officials, most (89) interacted virtually only, with 7 attending in-person events, and 11 doing both. Community voters and local officials received the same survey, but were asked if they were a local official or not in the survey.

Retrospective pretest methods are commonly used because they allow research addressing temporal changes to occur with only one data collection event (Allen and Nimon, 2007; Gouldthorpe and Israel, 2013), making them a "simple, convenient, and expeditious method" for assessing programmatic effects of an intervention (Pratt et al., 2000, p. 347). This approach, however, has well-known limitations centered on recall bias and social desirability bias (Gouldthorpe and Israel, 2013). We believe the former is relatively small given respondents were asked to recall their views over a relatively short time period of <1 h (Gouldthorpe and Israel, 2013). To the degree social desirability bias existed, it would require interpreting overall program impacts with caution (hypothesis 1), but would not affect hypotheses 2–5 which dealt with relative change in MD concern and MD policy support.

Data Analysis

To test hypothesis 1, we used paired *t*-tests that compared means of pre- and post-engagement event levels of MD concern and MD policy support for the whole sample. To test hypotheses

2–4, we used a multiple linear regression to model change in levels of MD concern and MD policy support as a function of whether the adult was a local official or not (hypothesis 2), if adults knew the students previously (hypothesis 3), and type of engagement event attended (in-person, PSA video, or both; hypothesis 4). We also controlled for pre-test MD concern or MD policy support in the associated models with respect to ceiling effect (Allison, 1990; Dalecki and Willits, 1991), self-reported sex (male vs. female), race (White vs. Non-White), and political orientation (liberal, conservative, or independent/other). Because we included respondents from various parts of the state, we also included distance from the coast as a co-variate in the models, but as it was not significant in either model nor was it central to our hypotheses, we excluded it. Similarly, as most local officials attended virtual events, we examined the variance inflation factor (VIF) as a measure of co-linearity between voters vs. officials and event type, and found VIF levels were well below the acceptable levels of 4 (MD concern: mean VIF = 1.28; MD policy support: mean VIF = 1.28; O'Brien, 2007). Finally, we tested hypothesis 5 using a *t*-test to compare mean polarization in MD debris concerns (i.e., mean MD concern among liberals minus mean MD concern among conservatives) before and after engagement with the youth-led events. We compared pre- and post-engagement polarization on MD policy support using the same approach. To test variation of levels of political polarization in hypothesis 5, we removed responses from participants who selected "independent/other" from analysis and only considered liberals and conservatives as binary politics variables on opposite ends of the political spectrum. All analyses were conducted using STATA 14.2. Relatively small sample size ($n = 161$) in this study dictates caution when interpreting non-findings. Specifically, with limited statistical power some relationships not detected in this study may be both statistically and socially significant in a study based on a larger sample. This, however, means that relationships that were detected would likely be found in subsequent studies, potentially with large effect sizes.

RESULTS

Respondents were relatively evenly distributed in terms of political identification (liberal = 35%, conservative = 37%, independent/other = 28%), being a voter or local official (62% local officials), and gender (55% female). The average age of respondents was 57 years ($SD = 13.1$, ranging from age 23–89), most identified as White (87%), and most did not previously know the students participating in the engagement events (91%). Demographically, our sample was fairly representative in terms of gender, as 51.4% of residents are female (US Census Bureau, 2019), but over-represented White, older adults in North Carolina, as only 70.6% of North Carolinians identify as White, and the average age is 38.7 (US Census Bureau, 2019). However, these measures more closely align with the demographic make-up of elected officials in North Carolina, as elected officials generally are older and more White than the general population, including in North Carolina, where 99% of state legislators were White in 2015, and the average age was 59 (NCSL, 2015). In terms of political affiliation, it is possible that our sample over represents independents, as only 17% reported not being affiliated with Republicans (41%) or Democrats (43%) (Pew Research Center, 2015). However, it should be noted that the proportion of unaffiliated voters in North Carolina, and nationwide, is increasing (Tippett, 2020), so our sample may not deviate from the population as much as available population data would suggest.

We found support for hypotheses (1) that all adults would report increased concern for marine debris and support for policies; (2) that changes would not be as strong for local officials as for community adults; and partial support for (5), that political polarization would lessen among all adults. Specifically, polarization decreased around marine debris concern, but differences were not detected for polarization in support of policies to address marine debris. We did not find support for hypotheses (3) that pre-existing personal relationships with youth presenters would predict larger gains in MD concern; nor MD policy support (4) that adults who attended in-person youth-led civic engagement events would show greater gains than those who watched online public service announcement (PSA) videos made by youth.

We found support for hypothesis 1, as adults exhibited 12.5% more MD concern and 12.2% more MD policy support after engaging with the youth-led civic engagement events. Marine debris concern increased from 3.93 ($sd = 0.77$) to 4.42 ($sd = 0.66$; $t = -9.63$, $p < 0.001$) after community members participated in the events. Similarly, MD policy support increased from 3.92 ($sd = 1.022$) to 4.40 ($sd = 0.85$, $t = -8.56$, $p < 0.001$) after community members participated in the events.

We also found partial support for hypothesis 2, as both voters and officials had similar gains in MD concern, but voters had bigger gains than officials in terms of MD policy support. Marine debris concern for local officials increased by almost 9 percentage points (mean change = 0.44/5, $sd = -0.62$) whereas MD concern among voters increased by ∼13 percentage points (mean change – 0.65/5, $sd = 0.60$; **Figure 1**). Though different in magnitude, the regression model suggests only a weak statistical difference between these gains in MD concern between voters and officials (beta = 0.148, $p = 0.097$; **Table 1A**). We found stronger differences among voters and local officials for MD policy support, with nearly 8 percentage points gained among officials (mean change = 0.39/5, $sd = 0.60$) and an increase of nearly 13 percentage points among voters (mean change = 0.64/5, $sd = 0.95$; **Figure 1**). The regression model also supported that officials had smaller increase in MD policy support than voters (beta = −0.263, $p = 0.020$; **Table 1B**).

Results did not support hypothesis 3 because we did not detect relationships between MD concern and pre-existing personal relationships with youth presenters (**Table 1A**) or MD policy support (**Table 1B**). Similarly, we did not find support for hypothesis 4 because type of event (i.e., in-person vs. virtual) was not related to changes in MD concern or MD policy support (**Tables 1A,B**). Women expressed higher levels of MD concern than men (beta = 0.248, $p = 0.001$; **Table 1A**), and we found a similar, but weak, difference associated with MD

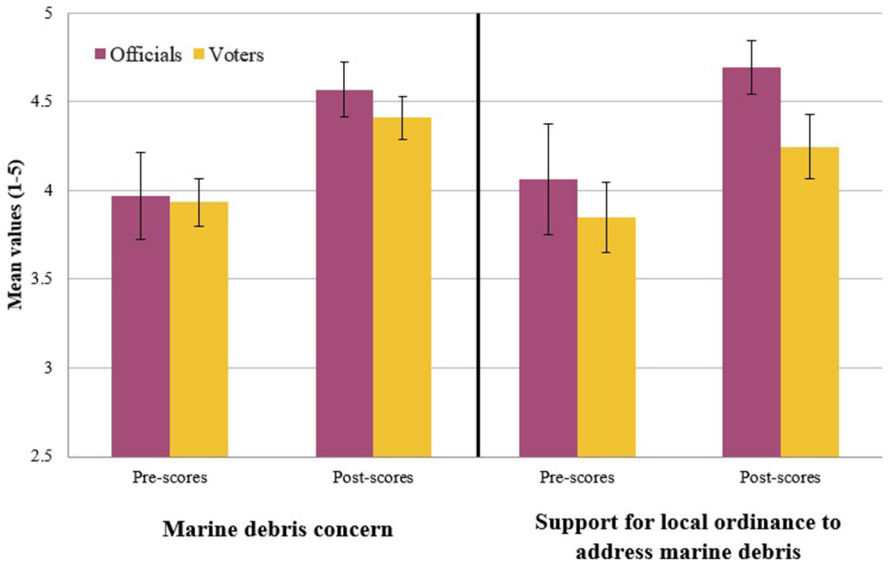

FIGURE 1 | Levels of marine debris concern or support for local ordinance (respectively), shown for local officials vs. regular voters. Retrospective-post-questions posed on a 5-point Likert scale were "Consider your level of concern about marine debris. What was/is your level of concern BEFORE/AFTER the student presentation?" with a scale of 1–5 (1, extremely unconcerned; 5, extremely concerned) and "How likely were/are you to support such an ordinance BEFORE the/NOW, after the student presentation?" with a scale of 1–5 (1, extremely unlikely; 5, extremely likely). Error bars represent 95% confidence intervals.

policy support (beta = 0.194, p =0.052; **Table 1B**). The MD concern model explained more variance in data [$R^{2adjusted}$ = 0.480, $F_{(8, 151)} = 19.40$, $p < 0.001$; **Table 1A**] than the MD policy support model [$R^{2adjusted} = 0.384$, $F_{(8, 151)} = 13.50$, $p < 0.001$; **Table 1B**]. Although not a part of our hypotheses, we also note from the regression that women were more likely than men to increase MD concern (beta = 0.248, $p < 0.001$), and there was a similar, but weaker relationship between gender and changes in MD policy support, with women increasing more than men [beta = 0.191, $p = 0.06$].

Finally, we found partial support for Hypothesis 5, as polarization between liberals and conservatives decreased around MD concern but not for MD policy support. That is, liberals' and conservatives' MD concern levels came closer together after the intervention, but liberals and conservatives remained relatively polarized over MD policy support. With MD concern, liberals and conservatives were polarized on their pre-test responses, with conservatives less concerned (mean = 3.69, sd = 0.518) than liberals (mean = 4.36, sd = 0.518). Both groups increased MD concern levels after participating in youth-led events, with MD concern levels of conservatives (post-test mean = 4.33, sd = 0.36) approaching those of liberals (mean = 4.64, sd = 0.37). Differences between liberal and conservative MD concern levels were significantly smaller in the post-test (mean difference = 0.30; sd = 0.33) than the pre-test (mean difference = 0.67; sd = 0.35; t = 5.808, $p < 0.001$). A similar, though not statically significant, pattern occurred for MD policy support as differences in support levels were smaller in the post-test (mean difference = 0.39; sd = 0.39) than the pre-test (mean difference = 0.49; sd = 0.43; t = 1.21; $p = 0.226$; **Figure 2**).

DISCUSSION

Previous research has found experimental evidence for how youth can shift familial adult's environmental concern and behavior, such as in the context of climate change (Lawson et al., 2019) and energy saving behaviors (Boudet et al., 2016). Similarly, mixed methods and qualitative research suggest youth shape conversation and perceptions around environmental topics among adults outside their immediate families (Vaughan et al., 2003; Volk and Cheak, 2003; Haynes and Tanner, 2015). However, to our knowledge, this is the first quantitative evidence of youth influence outside their families, and the first to specifically examine how youth can impact local officials' approaches to marine debris. We found increases among all groups of adults for both MD concern and MD policy support, and despite the nuances we discuss below, our results point to a clear and powerful role for youth in shaping adult perceptions of marine debris and participation in political processes to address marine debris.

Though we found that the influence of youth-led engagement seems to extend well-beyond the family unit, different responses across adult groups highlights a need for future research to understand the mechanisms of youth influence. Social change most profoundly occurs through strong social ties among friends, family, and neighbors (Centola, 2021), which helps explain results from previous studies demonstrating the influence of youth within their families (Williams et al., 2017; Lawson et al., 2019). However, we found that adult marine debris concern and policy support increased regardless of whether the adults knew students or not, and even whether the events were in-person or virtual. That youth seemed to have this impact may

TABLE 1 | Regression results of models predicting difference in marine debris concern **(A)** and support for marine debris policy **(B)** after engagement with the youth-led civic engagement events.

(A) Regression results of model displaying factors predicting differences in marine debris concern after engagement with the youth-led civic engagement events.				**(B) Regression results of model displaying factors predicting differences in levels of marine debris policy support after engagement with the youth-led civic engagement events.**		
	Marine debris concern			**Support for marine debris policy**		
Variable	***B***	**SE**	***β***	***B***	**SE**	***β***
Pre-event levels	−0.599***	0.055	−0.685	−0.452***	0.048	−0.613
Event attendance: PSA video (virtual)		*(Reference variable)*			*(Reference variable)*	
Event attendance: In-person	0.090	0.120	0.050	0.189	0.151	0.090
Event attendance: Both	0.070	0.133	0.031	0.004	0.169	0.001
Gender	0.248***	0.079	0.189	0.191	0.099	0.125
Race	−0.113	0.120	−0.056	−0.117	0.150	−0.050
Politics: Liberal		*(Reference variable)*			*(Reference variable)*	
Politics: Conservative	−0.046	0.097	−0.034	−0.089	0.115	−0.057
Politics: Independent/Other	−0.013	0.100	−0.009	−0.203	0.125	−0.118
Previous relationship with students	0.007	0.170	0.003	−0.068	0.216	−0.023
Local official or voter	−0.148	0.089	−0.109	−0.263*	0.112	−0.166
Constant	2.701***	0.292		2.293***	0.313	
N		160			160	
R^2		0.510			0.419	
R^2 adjusted		0.480			0.384	

Data were collected between March 2019 and October 2020 survey results from 4th and 5th grade public school civic engagement events and youth-developed PSA videos across the state of North Carolina.
Coding for all variables was as follows: Event attendance: 1, Video; 2, Community Event; 3, Both; Sex/Gender: 0, Male; 1, Female; 2, Other; Race: collapsed to 0, Non-White; 1, White; Politics: collapsed to 1, Liberal; 2, Conservative; 3, Independent/Other.
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.*

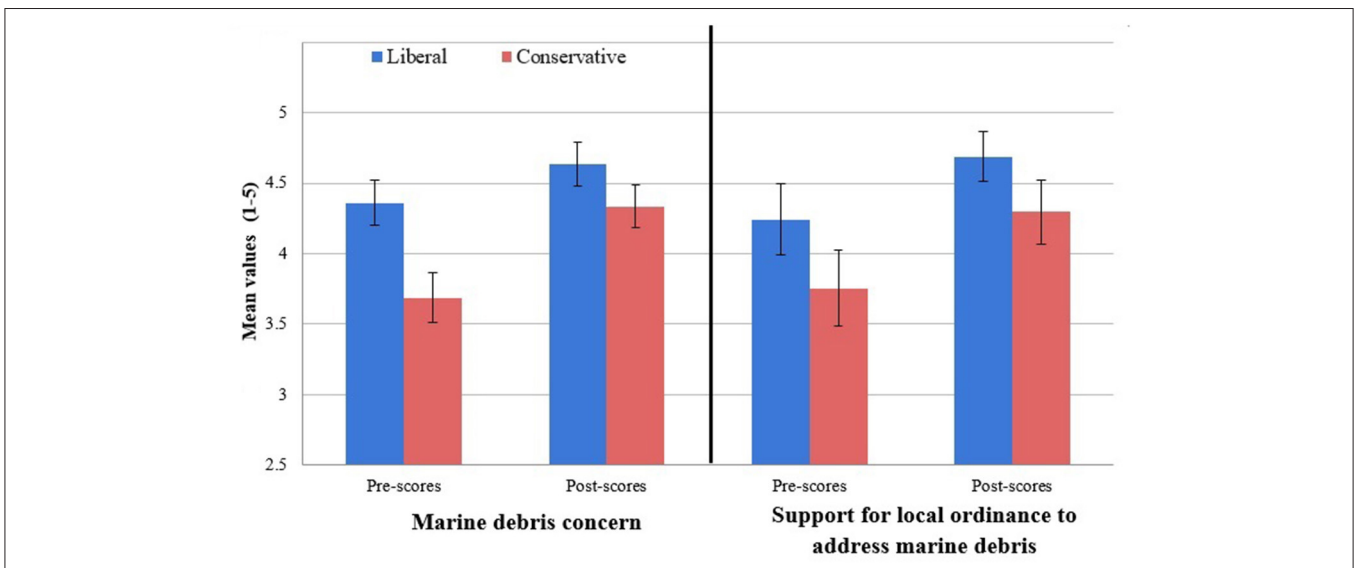

FIGURE 2 | Levels of marine debris concern or support for local ordinance (respectively), shown for groups of political affiliation. Retrospective-post-questions posed on a 5-point Likert scale were "Consider your level of concern about marine debris. What was/is your level of concern BEFORE/AFTER the student presentation?" with a scale of 1–5 (1, extremely unconcerned; 5, extremely concerned) and "How likely were/are you to support such an ordinance BEFORE the/NOW, after the student presentation?" with a scale of 1–5 (1, extremely unlikely; 5, extremely likely). The error bars represent 95% confidence intervals.

reflect that youth have greater accessibility and approachability than adults, which combined with their genuine empathy and concern for the environment and the issues impacting it (Young et al., 2018), may make them trusted messengers to adults (Peterson et al., 2019). Our research design pointed local officials to videos made by youth in their own jurisdictions, and these local connections may also help explain the youth's influence, as locally framed messaging seems to be effective in engaging adults on even controversial issues such as climate change (Evans et al., 2014). Furthermore, considering that approximately half of the videos were viewed after local lockdowns occurred due to COVID-19, the connections created by virtual videos may have been amplified by the scarce nature of community connections at the time (Antonello et al., 2020). Our finding that officials were less changed by youth presentations than their community adult counterparts is perhaps not surprising—given officials must operate within the structural systems of government and represent the will of their constituents (Staerklé, 2015).

This study builds on previous research within households (Lawson et al., 2019), to suggest that youth can reduce polarization over environmental issues in communities. Community members from both political parties increased in their overall levels of marine debris concern after the youth presentations, but conservatives shifted most, shrinking partisan gaps in marine debris concern. This finding is particularly promising since political partisanship has historically been a major factor in attitudes about the environment and, as a national priority among the public, holds one of the largest partisanship gaps (Pew Research Center, 2020). Future research is needed to unravel the mechanisms allowing youth voices to build consensus in politically divided adult spaces. As highlighted above, youth may be a more trusted information source than adults (Peterson et al., 2019), and bring a level of enthusiasm that adults find compelling (Young et al., 2018). These characteristics may help explain why youth presenters were compelling enough to impact the levels of MD concern among their local community adults, reducing political polarization seen in the pretests. Weaker impacts from youth on policy support than concern seem reasonable, given policy support emerges from a complex political milieu including funding and pressure from lobbyists (Vesa et al., 2020). Building a shared concern about marine debris represents a baseline need for productive policy negotiation (Vince and Stoett, 2018) from which bipartisan support for marine debris policy can be developed. Given the small sample size and short timeframe of our study, we encourage future researchers to continue to explore how youth may impact environmental policy support, particularly where longitudinal efforts can address policy development and implementation that often takes several years.

Our results also suggest that youth may effectively impact community members regardless of gender or race. Dozens of studies have found that women care about the environment more than men (McCright, 2010; Xiao and McCright, 2012), and our results were consistent with these findings, as women were more likely to increase MD concern and support for MD policies. Race was not a significant predictor in any models, a finding that reflects research demonstrating that people of color are equally as supportive (Mohai, 2003) if not more supportive than White Americans on environmental, climate, and energy policies (Leiserowitz and Akerlof, 2010; Ballew et al., 2020). However, these results should be interpreted with caution, as our sample sizes among people of color were low and led to groups that were too small to examine without collapsing racial categories. We acknowledge that people of color are not a monolithic group, and therefore future research with larger sample sizes is needed to facilitate stronger inference about specific racial groups. Accordingly, future research could also investigate interactions between race of the youth presenter and race of the participating adults. Other studies have demonstrated that having adult role models is highly impactful for young learners in increasing motivation and achievement (Connell and Wellborn, 1991; Skinner and Belmont, 1993; Midgley et al., 1995; Ryan and Deci, 2000; Martin and Dowson, 2009), and that youth of color particularly benefit from role models of the same race (Egalite et al., 2015). Future intergenerational learning research may investigate if similar relationships exist in the opposite direction from youth to adults, where adults are more likely to listen to young people that look like them.

CONCLUSION

In conclusion, our results suggest that youth participation in environmental politics may help galvanize immediate political action among current voters and decision makers. Youth voices may also be able to transcend adult partisan divides, given youth can decrease polarization around marine debris management. As research on both the dynamics of intergenerational learning and strategies to address marine debris continue to emerge rapidly, there are multiple avenues for future research. Youth are already taking the lead in many social and environmental movements and are enthusiastically seeking solutions to combat marine debris (Prisco, 2017). Accordingly, designing environmental education curricula that taps into this demonstrated appetite for civic engagement (on the topic of marine debris or otherwise) may help to harness the solution-seeking energy already present among young people and inspire adults to follow where the young people are leading. Innovative research designs drawing on psychology, sociology, and social contagion (de Lange et al., 2019; Centola, 2021), could help reveal the mechanisms through which information and motivation move from youth to their communities, and how kids may drive that information mobilization. As with most research conducted during the global pandemic, we acknowledge the need for research outside the context of COVID-19. Pressures on local officials' time and priorities related to serving their communities during the pandemic could have rendered youth impacts larger because they were a welcome respite, or dampened youth impacts by rendering their work on marine debris relatively less urgent in the context of a pandemic. Similarly, relatively low response rates among local officials may indicate our results are biased toward the perspectives of officials most concerned with opinions of their youth constituents or engaged with local schools or marine debris management issues. These officials are important because they are most likely to act on the marine debris issue, but future studies

could mitigate the potential bias using sampling methods linked to high response rates (e.g., in-person interviews; Manfreda et al., 2008). Nonetheless, this study suggests youth-led marine debris education programming can positively impact adults (including local policy-makers and decision-makers). Perhaps most importantly, youth influence seems poised to overcome long-standing divisions that continue to stymie political progress on environmental challenges.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by IRB#12847. Consent for minors to participate was granted by the participating students' parent/legal guardian, and consent for non-minors to participate was self-granted.

AUTHOR CONTRIBUTIONS

ED, MP, and KS contributed to study design. JH was responsible for data collection, data preparation, and preliminary analysis, with assistance from SP and TF on data collection. JH was responsible for the initial drafting of the manuscript, with assistance from SP and TF. KS and MP supported with the secondary analysis. ED, MP, and KS edited the manuscript. All authors approve of its final form.

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