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A comprehensive analysis of the literature on climate change education methods

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Abstract

An opportunity to do a systematic evaluation to determine what research may offer to our thoughts about successful climate change education has arisen due to the increased interest in climate change education and the rising realization of the obstacles inherent in tackling this problem. A total of 959 distinct citation entries pertaining to climate change education were located in the academic database EBSCOhost. The evaluation of climate change education programs was the primary emphasis of 49 of these sources. By analyzing these sources, we were able to learn more about the intervention's goals, evaluation procedures, and potential outcomes. Two commonalities were found in environmental education programs:(1) an emphasis on knowledge that is personally relevant and meaningful and(2) the use of active and engaging teaching techniques. Additionally, four topics related to climate change were identified: (1) participating in group discussions, (2) communicating with experts in the field, (3) clearing up misunderstandings, and (4) carrying out initiatives at the school or community level. Climate change and other contentious issues are addressed with suggestions.

KEYWORDS
Climate change; environmental education; systematic review

Introduction

More and more educational institutions are allocating resources to climate change education programs, more and more schools are including climate change in their curricula, more and more people are paying attention to extreme weather events, and more and more people are worried about the possibility of global social, economic, and environmental changes as a result of climate change. These factors have contributed to a surge in interest in climate change education in recent years. Research articles on climate change education have proliferated in response to this rising tide of interest. From 1990 to 1999, there were 12 articles published, 433 from 2000 to 2009, and 1,489 from 2010 to 2015, according to searches in Academic Search Premier using the terms 'climate change' and 'education.' Educators have several obstacles and lack consensus over the best effective strategies for teaching about climate change, despite the abundance of knowledge available. This study aims to synthesize the current literature on the topic of climate change education by conducting a systematic review. The review will focus on instructional practices that have been shown to be successful in both formal and informal educational contexts. Climate change is a complex issue that presents a number of challenges for educators. Teachers make every effort to disseminate factual knowledge via official channels such as school curricula, Extension services, and informal settings,

The majority of young people lack comprehension of fundamental climate science, and there are several misunderstandings about the factors that contribute to climate change (Chen 2011; Choi et al. 2010; Sterman 2011). Because of this, a lot of secondary school science teachers think that teaching students about climate science is all they have to do for a living. as some programs aim to teach young people to think critically and identify the causes of climate change conflict, others put an emphasis on problem-solving abilities as they work on local initiatives to adapt and reduce the effects of climate change (Hudson 2001). Still others take action by considering the ethical,

psychological, and evolutionary dimensions of climate change (Harris 2009; Grady-Benson and Sarathy 2015; Brownlee, Powell, and Hallo 2013).

Differentiating between "just the facts" and "also the actions" may drive a wedge between environmental and science educators, but it may also reveal when teachers feel a fundamental scientific issue has crossed the line into politics and is therefore too close to advocacy to handle in the classroom. There is a wide range of objectives in environmental education, from imparting scientific knowledge to developing students' problem-solving abilities, action competence, and advocacy (Mappin and Johnson 2005; McNeal, Petcovic, and Reeves 2017; Stevenson 2007), despite the fact that promoting social change is fundamental to the field (UNESCO 1978). Educators and scholars have also come to the realization that addressing climate change may need a different strategy than addressing other environmental concerns. Although the subject demands thorough consideration due to its ambiguity and complexity, adults react to climate change by defending their group identity and way of life, seemingly more so than ethical debates surrounding the disposal of hazardous waste or the dwindling biodiversity of our planet. One result is cultural cognition, which causes individuals to safeguard their group identity, adhere to group leaders, and disregard information that contradicts their group's stance (Kahan 2010), as well as the tendency to seek and recall information that supports one's initial judgment (i.e., confirmation bias) (Haidt 2012; Kahan 2010; Kinder 1998; McCright and Dunlap 2011; Nickerson 1998). Raising awareness of climate change while also recognizing the influence of cultural ideology on perception and learning may be a delicate balancing act in the development and execution of climate change initiatives (Guy et al. 2014). The purpose of this article was to determine if there are any practical techniques suggested in the literature, but it does not attempt to address the specifics of how this may be achieved.

Teachers of all ages, from elementary school students to people in their communities, face unique obstacles when trying to convey the complicated nature of climate change in an engaging and effective way. Concerned about parents' reactions, teachers are reluctant to educate about climate change (Wise 2010). Morris et al. (2014) and Tyson (2014) found that some educators avoid discussing climate change because they are afraid it would diminish their credibility and effectiveness. Similarly, Sommers (2014) and Wojcik et al. (2014) found that some educators avoid discussing climate change because they are concerned about losing their credibility and efficacy. Also, some teachers don't think they know enough about climate change to teach their students about it (Monroe, Oxarart, and Plate 2013; Plutzer et al. 2016; Prokopy et al. 2015).

An ideal chance to do a systematic study to comprehend successful tactics in climate change education has arisen due to the growing interest in and need of effective climate change education, as well as the growing realization that we may not know how to accomplish it optimally. If you want to find future tactics, you can only look at already published work thus far. However, it is prudent to be aware of previous endeavors before beginning new ones. In the past few years, other scholars have focused on comparable topics, conducting literature reviews on climate change education and communication (Wibeck 2014), professional development for teachers (Hestness et al. 2014), education about global warming (Bozdoğan 2011), attitudes and beliefs about climate change (Brownlee, Powell, and Hallo 2013), and the factors that impact changes in knowledge, perspective, and conduct (Anderson 2012). In contrast to the aforementioned reviews, this one use a systematic review approach to examine and publish findings from educational interventions aimed at combating climate change (see Methods). Educators may use these initiatives as a road map to discover more about climate change education's gaps, innovative methods, and requirements. 1

Methods

According to Cooper (2010) and Gough, Oliver, and Thomas (2012), systematic reviews adhere to specified protocols in order to provide repeatable findings. Systematic reviews, which are based on the work of health and medical researchers, have their critics (e.g., Evans and Benefield, 2001), but they also provide an opportunity to investigate, evaluate, challenge, and enhance the published data in the field. Systematic reviews are useful because they assist researchers stay away from cherry-picking, a practice wherein a limited number of papers are selected to back up predetermined results. This may lead to a poor evidence foundation that might not be able to withstand scrutiny from funders and other interested parties.

Literature search and review

For our assessment, we choose to use EBSCOhost, an academic search engine that provides a unified interface for searching several databases. Our research utilized EBSCOhost, which searches a variety of databases based on your institution's subscription. In November 2015, for example, Academic Search Premier, Education Full Text, GreenFILE, and PsychINFO were among the 76 databases searched through the University of Florida's library subscription. Finding the sweet spot between a wide enough search to get relevant results and a specific enough one to make the review process doable is key when choosing search phrases. Figure 1 displays the final search phrases that were guided by preliminary searches that used combinations of multiple terms. There was no restriction on the time period of publication; however, we did restrict the findings to sources published in English. With an unqualified search (i.e., the database searched the title, abstract, topic, keywords, and author) of the search terms in the EBSCOhost database, 1,091 citation entries were returned. In order to prepare for the first round of evaluation, we imported the findings into Zotero, a tool for managing bibliographic information. We then eliminated 132 duplicate entries, leaving 959 citation records. The search found find abstracts with relevant terms in the specified categories, but not a single document addressed the research query. Figure 2 shows the results of a decision tree that was developed and tested to weed out sources that did not evaluate an intervention for climate change education. Each member of the team looked at a different subset of abstractions using the decision tree until everyone was in agreement. During the first evaluation phase, a minimum of two team members examined all 959 abstracts.

We designated 886 entries as "exclude" using the decision tree. Rather of reporting on a tested educational intervention, some of the deleted records emphasized the need of climate change education or offered suggestions for its implementation. Not only did records not pass the decision tree's tests, but records that were either book reviews, sources written in a language other than English, or for which complete text could not be located were also omitted. We did not do a comprehensive search for relevant dissertations, therefore we eliminated the ones that were found in EBSCOhost.

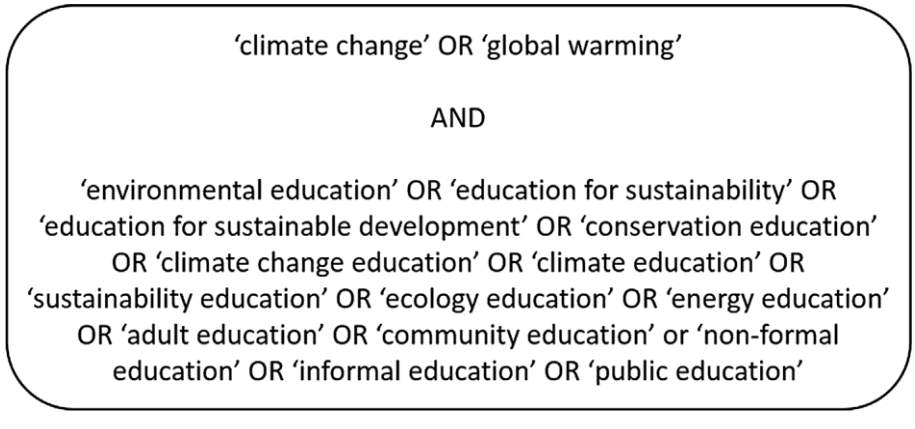

Figure 1. Search terms used in Ebsco*host* database.

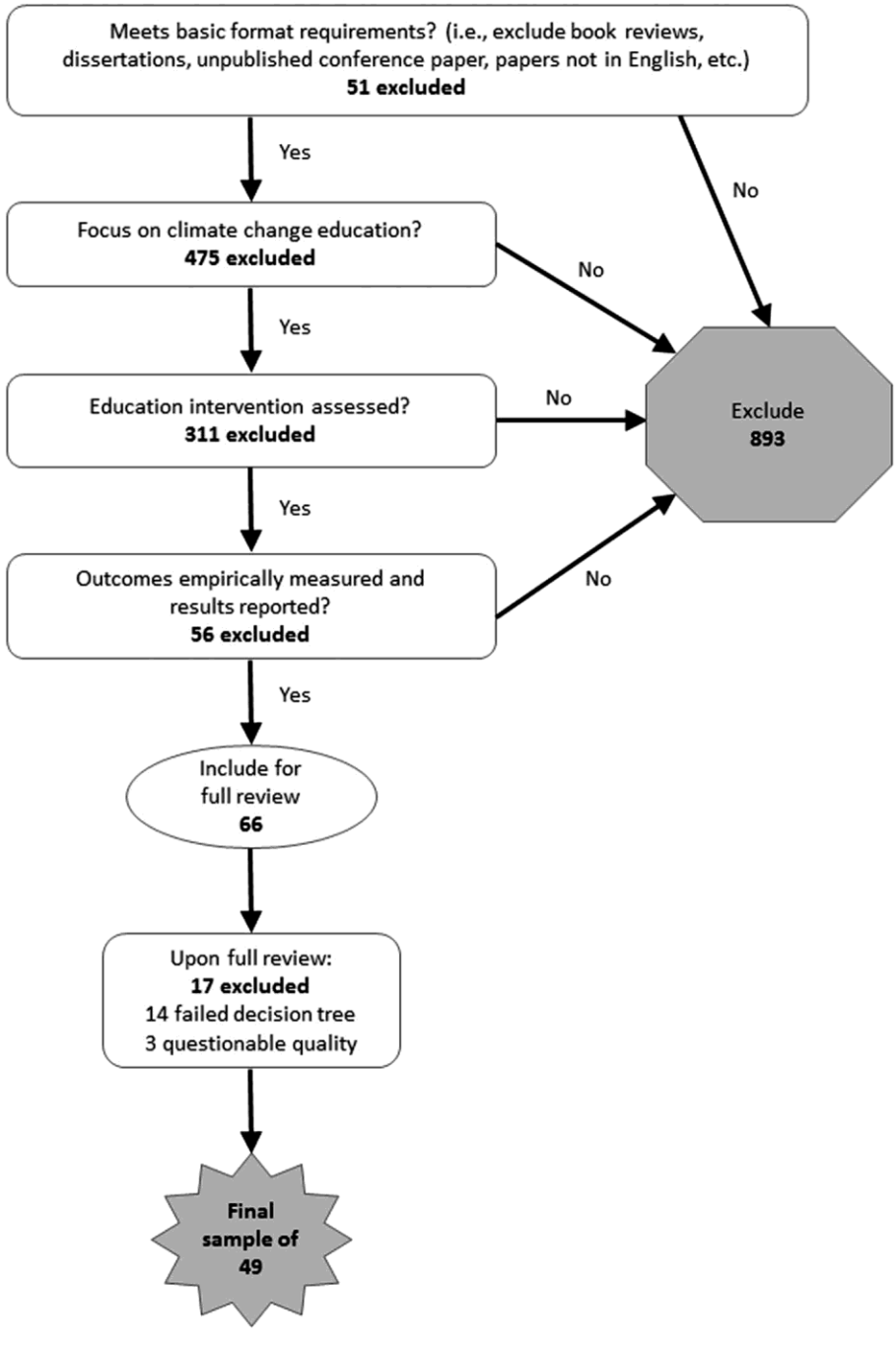

Figure 2. Vetting process and results.

The second round of review involved multiple team members reading each article. The lead author read all 66 publications; each other team member read 33 publications, so that each article was read in its entirety by three people. Decisions and comments were tracked in a spreadsheet, and each article was discussed and evaluated for inclusion in the final set, ultimately composed of 48 peer-reviewed articles and 1 book chapter.

Limitations of the review

Several possible resources on successful climate change teaching tactics were not included in our search results. We limited our search to English-language publications and those included in the EBSCOhost collection of peer-reviewed articles. While we do recognize that many researchers publish in both their native language and English, we do so with the understanding that this is a restriction. Furthermore, we refrained from searching the notoriously difficult-to-search gray literature, which includes things like assessment reports, conference proceedings, dissertations, and theses. Since we limited our search to academic databases, we missed some pertinent studies that didn't utilize our precise keywords. We think our results provide useful insight and consequences since they are based on a broad enough population, even if some contributions were overlooked.
Another drawback is the study's primary premise. By reviewing interventions that have been tested, we have sought to determine which climate change teaching strategies are most successful. In these cases, we are placing our faith in the writers—who are also our program's instructors, assessors, and developers—to shed light on the program's efficacy. Also, evaluation studies don't usually make it into the peer-reviewed literature unless they have more broadly applicable results, so the articles focus less on evaluating the climate change education intervention and more on comparing or contrasting different strategies. This review does not include the vast majority of the literature since therapies are not evaluated or tested. Another review may concentrate on these studies since they provide important information about how people learn about climate change, what stands in the way of comprehending it, and what educational tactics could be helpful. A review of these articles might broaden our understanding of climate change education and its potential applications, while also shedding light on fresh approaches to lesson planning.

Analysis

Members of the team documented the intervention details, the evidence for the intervention's efficacy, and the authors' (if any) views on the intervention's efficacy. There is no straightforward solution to the problem of how to communicate climate change since the programs were so diverse. The programs are also not easily comparable. For instance, some were multi-week classes and others were shorter interventions (like a festival display or a field trip). A few were required for university credit, while others provided overviews of whole semesters of study. Accordingly, we set out to identify recurring themes and commonalities in the works of these writers (Gough, Oliver, and Thomas 2012).
The primary author compiled an initial set of topics pertaining to the successful use of various climate change teaching methodologies. The ever-changing list of topics was bolstered by the contributions of other team members. All of us on the study team have worked in climate change education at some point, either as teachers or researchers, so we fully understand that our understanding of the literature and our own experiences shaped our theme identification (Corbin and Strauss 2015). We reviewed the developing themes, making note of the ones with strong backing and adjusting them as necessary. While certain articles and themes provide more in-depth analysis of the tactics' efficacy, the resultant themes do a good job of capturing the variety of programs and results and providing a common thread for all of the articles. In what follows, we go over these topics; however, we only cover those that have strong backing from the literature we looked at.

Results

Demographics

Of the 49 contributions (Table 1), the majority involved teaching students in primary or secondary schools (n = 28) or colleges and universities (n = 11). Within the school-based programs, the youngest students were in a third/fourth split class (age 9), but elementary programs were not typical. All but two school-based programs occurred in the classroom; a botanical garden and an assembly auditorium

Discussion

We identified six overarching elements that contribute to successful climate change education based on our analysis of 49 research that documented the outcomes of educational interventions. Learner age, cultural context, and opportunity were limits for each program, however every study claimed some aspect of success. Few programs utilized more than three themes in their tactics to involve learners in contemplating climate change. While using these tactics won't ensure that climate change education programs are successful, they are likely to be valuable additions to any program. The themes may help educators address climate change via curriculum and pedagogy choices.

Educational tactics that demonstrated either (1) personal relevance or (2) engaging teaching approaches were mentioned in every study. These recurring ideas center on many of the same principles that scientific and environmental educators have championed for many years. Example: according to the NAAEE (2004), "Learner-centered, inquiry-based learning opportunities should be provided so that students can actively construct their own understandings and acquire new skills." This is in accordance with the goals of environmental education programs and materials. The Knowledge Integration Framework (Linn and Hsi 2000; Svihla and Linn 2012) is a framework within science education that suggests the following: (1) educators should make content accessible by relating it to students' personal experiences or expanding on their ideas; (2) students should be able to learn from one another by comparing and contrasting ideas; (3) educators should use models, visuals, data collection, and analysis to make thinking visible; and (4) educators should encourage the development of an inquiry process and its use to promote lifelong learning.

This is a common feature of the reviewed applications. Some of the things students may do include discussing what they've learned, putting what they've learned into practice, and looking at real-world instances of how climate change is affecting their communities. We would want to stress once again that effective climate change education may use all of the tested and established methods of instruction, including but not limited to: field excursions, flipped classrooms, simulations, worksheets, data gathering, role plays, and community action projects. Regarding the first topic, which is personal relevance, the objective and difficulty are comparable to those in other types of educational settings. If education is to be effective, it must be personally relevant to students so that they can make connections between new information and what they already know, find the content interesting and meaningful, and pay close attention in class (Kaplan and Kaplan 1982). Educators may find it difficult to make their lessons personally relevant when discussing climate change due to factors like the absence of clear and visible culprits, the remoteness of impacts, and the time lags between emissions and impacts on the climate system (Dilling and Moser 2007). Nevertheless, as this review demonstrates, these connections are both possible and effective. The anticipated effects of climate change on regional ecosystems, crops, and people were a common theme in the programs we looked at. According to Gold et al. (2015), they were able to bridge the gap between faraway Arctic data and local weather patterns. A few of the

various programs have attempted to address climate misconceptions in different ways. Some have used constructivist reflection and discussion, while others have simplified information, provided relevant examples, and used vivid illustrations (Baker, Loxton, and Sherren 2013; Bofferding and Kloser 2015; Oluk and Özalp 2007; Reinfried, Aeschbacher, and Rottermann 2012; Holthuis et al. 2014; Mason and Santi 1998; Niebert and Gropengiesser 2013). Good education also requires the second component, which is engaging pupils. The educational programs that were reviewed in this article showcase many methods that are used to captivate pupils, such as group projects, debates, experiments in the lab, online conversations, and many more. But when considering this topic in light of the other aspects, climate change stands out. Teachers have a double-edged sword: the complicated scientific aspects of climate change and its solutions, and the social factors that complicate matters. These include group identity, the dangers that solutions pose to values, a lack of political will, and the media's tendency to balance opposing viewpoints (Dilling and Moser 2007; Kahan 2009; Monroe et al. 2015; Wibeck 2014). In a nutshell, educators concerned with climate change have the difficult task of fostering an inclusive classroom environment that values all points of view on the subject while simultaneously debunking the myths that students, influenced by their own social and cultural backgrounds, tend to believe about climate science.

Two wide-ranging views on education, both centered on the idea of actively involving students, may provide light on this problem. The first is experiential learning, which includes both hands-on activities and more theoretical study (Kolb 1984). Learning, according to the second school of thought, social-constructivists, takes place in contexts such as small-group conversations, debates, deliberations, and opportunities to contrast viewpoints (Powell and Kalina 2009). (Dillon 2003). The difficulty of teaching about climate change suggests that there may be a need to rethink the traditional ways of looking at things. Programs should reflect a "diversity of perspectives" and provide students "opportunities to construct their own understandings through hands-on, minds-on investigations," according to the NAAEE Guidelines for Excellence (2004). However, the guidelines are less clear about the fact that people can have different interpretations of scientific facts, different ideas about what the information means, or even choose to disregard the facts altogether. Instead of focusing on how we learn about the world, the NAAEE (2017) explains how to ask better questions and use different inquiry methodologies to learn about the world around us. It seems that the current approach to teaching about climate change may not be enough to motivate students to conduct the metacognitive work of reflecting on their own thought processes and challenging the validity of their own beliefs. Hence, in order to provide methods for investigating scientifically grounded, culturally impacted problems, the Guidelines for Excellence may be expanded.

Despite the fact that in some classrooms one perspective predominated (Öhman and Öhman 2013), additional research revealed that directing student investigations and encouraging deliberative discussion can enhance scientific comprehension and expose learners to different viewpoints (McNeal, Hammerman, et al. 2014). Students were encouraged to examine their own beliefs and viewpoints on climate change in relation to solid scientific evidence and the viewpoints of others through the use of classroom experiments, data analysis from field studies, and guided discussions. Many students reported an improvement in their knowledge of climate change science, a broader appreciation for the variety of perspectives, and an increase in self-assurance and clarity after having the chance to explain, defend, and expand upon what they already knew. Students also get experience addressing others who have diverse viewpoints.

Methods for resolving misunderstandings include data analysis and participating in deliberative debates that ask students to justify their opinions. As with other scientific fallacies, people's views on climate change may be influenced by their socio-cultural norms and worldview. This is especially true when it comes to ideas that are hard to see or experience, like the Earth's tilt or electron migration. Understanding other cultures is a recognized aspect

on how adults see climate change (Maibach, Roser-Renouf, and Leiserowitz 2009; McCright and Dunlap 2011), however it could have a much smaller impact on young people (Stevenson et al. 2014). Educators on climate change have not just the difficulties already mentioned, but also the additional burden of motivating students to take action. Public participation in reducing the impact of climate change, developing strategies to adapt to changing weather patterns, and shaping local and national policies and plans is central to climate change education (U.S. Global Change Research Program 2009). In light of the rapid pace of global change, the timidity of our leaders, and the influence of some sectors, it is easy to lose faith. Despite this, the reviewed programs discovered various strategies to inspire optimism and drive students to take action. Some of the applications scaled the problems such that students could tackle them. Offerding and Kloser (2015), Cone et al. (2012), Lee et al. (2013), and Pruneau et al. (2003) focused on local effects and potential responses rather than global shifts. Interacting with climate change experts (Hallar, McCubbin, and Wright 2011; Pruneau et al. 2003) and hearing from individuals who are living through the effects of climate change firsthand seems to inspire students to learn more and give them the tools to make a difference (Stapleton 2015). Several studies have shown that this is a common task for young students, including Lester, Ma, and Lee (2006), Pruneau et al. (2003), and Rooney-Varga et al. (2014). Furthermore, numerous programs have established a connection between human actions and climate change by illustrating the relationships between individual behaviors and carbon emissions or adaptation initiatives (Chauhan et al. 2009; Cordero, Todd, and Abellera 2008; Flora et al. 2014; Lee et al. 2013; Leigh 2009; Zografakis, Menegaki, and Tsagarakis 2008).

The difficulties of dispelling myths and motivating people to take action should be better understood in light of future studies that investigate the connections between student engagement and the themes of personal relevance. In order to assist students better understand this and other societal problems, teachers should encourage them to think critically, identify values, compare and contrast data, and debate their own perspectives (Sadler 2011). This

review found that misconceptions were strongly held in many of the studies. Future research could look at different ages to see how to tackle misconceptions, what role metacognition plays in differentiating between socio-cultural reinforcements and basic scientific misconceptions, and whether nonformal educators can help with this since they don't have as much contact with students as classroom teachers. Does age play a role in how students understand and respond to various climate change impacts? Does adults' care for native flora and fauna trump their worry about economic impacts? Future research could investigate whether students are motivated to understand climate science by local impacts, if knowledge of climate science is necessary to understand local impacts, or if parental perceptions of climate change influence students' motivation and action taking. This is important because optimism is a key component of climate change (Li and Monroe forthcoming).

Conclusion

People at every age are sensitive to social norms, and several programs used the development of community-based expectations to support participants' efforts to change behaviors or take action (Flora et al. 2014; Lee et al. 2013; Robelia, Greenhow, and Burton 2011; Stapleton 2015). It would be interesting to explore whether school and community projects that empower learners, build skills, and nurture hope for change (Leigh 2009; Pruneau et al. 2003; Rooney-Varga et al. 2014; Stapleton 2015) also affect one's adherence to social norms and worldviews. Several programs help adults feel comfortable enough to explore value-based positions and interests (Mathews 2014; McNeal, Hammerman, et al. 2014). Additional research might explore whether this process also helps them overcome their group identity and cultural cognition. And finally, a review of research papers cannot begin to articulate the state of climate change education and policy, but additional research could better understand how nations address climate change, the value or cost of a national curriculum that determines how this topic will be presented, gaps in pedagogy, and whether texts and programs seek the lowest level of agreement or shoot for the greatest vision.

References

This group includes Adger, W. Neil, Nadine Marshall, Katrina Brown, Jon Barnett, and Karen O'Brien. 2013. "The Cultural Aspects of the Effects and Responses of Climate Change." This article appears in Nature Climate Change, volume 3, issue 2, and pages 112-117. 10.1038/nclimate1666 is the DOI.

An article written by Aebli in 1983. Zwölf Grundformen des Lehrens: Eine Allgemeine Didaktik auf Psychologischer Grundlage [Twelve Basic Methods of Teaching: General Didactics Based on Psychology]. The authors are Klett of Stuttgart and Alexander and Poyyamoli. year 2012. "Educating Puducherry School Students about Water Resources and Climate Change through Hands-On Activities." Pages 557–578 in Walter Leal Filho's edited volume Climate Change and the Sustainable Use of Water Resources. A series about managing climate change. Springer, New York.

"Education on Climate Change for Adaptation and Mitigation" (Anderson, 2012). Volume 6, Issue 2, pages 191-206, Journal of Education for Sustainable Development.

The authors of the upcoming work are Ardoin, Holthuis, Noelle Wyman Roth, Alison W. Bowers, and Nicole M. Ardoin. "A Review and Analysis of Research on the Relationship Between Environmental Education and K-12 Student Outcomes." The Environmental Education Journal.

Joanna Baker, Jillian Loxton, Kate Sherren, and Jason Loxton. "An Evaluation of a Climate Change Instructional Module for Fourth Grade Through the Use of Art Elicitation" (2013). Volume 12, Issue 2, pages 130–142, Journal of Applied Environmental Education and Communication, DOI: 10.1080/15330 15X.2013.824248.

The article "Impacts of Climate Change on the Future of Biodiversity" was written by Céline Bellard, Cleo Bertelsmeier, Paul Leadley, Wilfried Thuiller, and Franck Courchamp in 2012. Article published in Ecology Letters, volume 15, issue 4, pages 365-377, with the DOI of 10.1111/j.1461-0248.2011.01736.x.

The ideas of climate change adaptation and mitigation strategies among middle and high school students were examined in a 2015 study by Bofferding, Laura, and Matthew Kloser. Publication date: 2014, volume 21, issue 2, pages 275-294, journal article number: 10.1080/13504622.2014.888401.

"Building Common Ground: Climate Change Communication Insights from Cooperative Extension Professionals in the US Southern States" (Bowers, Alison W., Monroe, Martha C., & Adams, Damian C., 2016). In 2011, Bozdoğan published an article titled "A Collection of Studies Conducted in Education about 'Global Warming' Problem" in the journal Environmental Communication, volume 10, issue 5, pages 656-670. The DOI for the article is 10.1080/17524032.2016.1176947. Articles cited as "Educational Sciences: Theory and Practice" range from 1618 to 1624 in volume 11, issue 3.

"A Review of the Foundational Processes That Influence Beliefs in Climate Change: Opportunities for Environmental Education Research." Article published in 2013 by Brownlee, Matthew T. J., Robert B. Powell, and Jeffery C. Hallo.

Doi:10.1080/13504622.2012.683389. Environmental Education Research, Volume 19, Issue 1, Pages 1–20. Rosalind Bybee, Joseph A. Taylor, April Gardner, Janet C. Powell, Anne Westbrook, and Nancy Landes. year 2006. The History and Impact of the BSCS 5E Instructional Model. Information compiled for the NIH's Office of Science Education. The file to access is located at this URL: https://uteach.wiki.uml.edu/file/view/UTeach_5Es.pdf/355111234/UTeach_5Es.pdf. The article "Science for Life and Living: An Elementary School Science Program from the Biological Sciences Curriculum Study" was written by Roger W. Bybee and Nancy M. Landes in 1990. Doi:10.2307/4449042. American Biology Teacher, 52(2), 92–98. Sheila Chauhan, Natalia Rita, Sita Rama Das, Martin Haigh, and Chauhan her. 2009. "Encouraging Avaishnava (Hindu) Education for Sustainability." Public Awareness and Environmental Education, Volume 8, Issue 2, Pages 114–125, DOI: 10.1080/15330150903133702. "Why Do People Misunderstand Climate Change?" (Chen, Xiang, 2011). Mental Models, Ontological Assumptions, and Heuristics. The article "Do Earth and Environmental Science Textbooks Promote Middle and High School Students' Conceptual Development about Climate Change?" was published in 2010 and can be found in Climatic Change 108 (1-2): 31-46. The DOI for the article is 10.1007/s10584-010-0013-5. Taking Students' Misconceptions into Account in Textbooks. American Meteorological Society Bulletin 91(7): 889-898. "Community Planning for Climate Change: Visible Thinking Tools Facilitate Shared Understanding." (Cone, Joseph, Shawn Rowe, Jenna Borberg, and Briana Goodwin, 2012). doi:10.1175/2009BAMS2625.1. The citation is from the Journal of Community Engagement & Scholarship, volume 5, issue 2, pages 7 thru 19. Research Synthesis and Meta-analysis: A Step-by-step Approach (Coper, Harris M., 2010). Juliet Corbin and Anselm Strauss. 2015. Sage, Thousand Oaks, CA. An Introduction to Qualitative Research. The fourth edition. Century City, California: Sage. Corrado, Eugene C., Anne Marie Todd, and Diana Abellera. "Education on Climate Change and the Environmental Impact" (2008). Paper number 89/6 from the American Meteorological Society is 865-872. COX, Helen, Kelly, Kimberle, and Yetter, Laura. 2014. "Using Remote Sensing and Geospatial Technology for Climate Change Education." doi:10.1175/2007BAMS2432.2. This article may be found in the Journal of Geoscience Education, volume 62, issue 4, pages 609–620, with the DOI number 10.5408/13-040.1. Center for Research on Environmental Decisions, or CRED-for short. that year. Scientists, Teachers, Journalists, Political Appointees, and the Curious Public: A Handbook on the Psyche and Climate Change Communication. Gotham City. Visit https://guide.cred.columbia.edu.hu. Contributors: Lisa Dilling and Susanne C. Moser. that year 2007. "Let us begin." Susanne C. Moser and Lisa Dilling edited the book "Creating a Climate for Change," which is numbered 1–28. Cambridge University Press, New York, NY.