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**Successes and Shortfalls:  
A Comparison of German and American Environmental Education**

Sophie Wieland

**ABSTRACT**

Germany and the United States have very different national policies related to climate change mitigation and adaptation, a reflection of starkly different public views on climate change. Public opinions on the environment have many influences, with primary and secondary public education being a factor in the development of environmentally friendly opinions and behaviors. The differences in each country's approach to the environment, overall methods of environmental education, and continuing problems in climate education are investigated here through a literature search. Both Germany and the US have education systems centered on regional control, and slow change of educational standards plagues both systems. Even so, Germany has more environmental education. The US public's greater skepticism of climate scientists creates shortfalls in both the reach and method of US environmental education.

Overarching climate policy in a nation requires considerable support. The majority of political parties in power must support action, as with any other law, but future coalition governments and the general public must support the laws as well. Entrenched damaging infrastructure, the perception that climate change will mostly impact other countries, and the long term nature of the problem and possible solutions means that climate change is not a problem solved in one administration or by quick-to-wane popular support (Spence et al. 958, 960, Gifford 290, Müller 463). When comparing Germany and the United States, it is clear Germany's renewable energy transition - the Energiewende - has considerable public support, with 88% of respondents generally approving in 2017 (Wehrmann and Wettengel). Younger generations - future voters and recent participants in the education system - are even more supportive of the Energiewende, with 93% of 14 - 29 year olds supporting the policy (Bild.de). This support has ushered in a national energy revolution and local energy changes (Archer and Banks). The United States has considerably less unity of opinion on climate change and possible solutions, with only 67% conceding global warming is happening, and 53% believing global warming is caused by humans (Marlon et al.). While many factors influence people's environmental beliefs and policy choices, environmental education within public schools is investigated here as a possible means of creating a society able to respond to the threat of climate change.

The German public school system includes Kindergarten, Grundschule, and then Realschule, Gymnasium, or Hauptschule (Eckhardt 25, 26). Additional education (i.e. universities, trade schools, etc.) varies widely with possible careers, and is beyond the scope of this paper. Education is primarily the responsibility of the Länder (German states), through the Standing Conference of the Ministers of Education and Cultural Affairs (Kultusministerkonferenz, KMK). The KMK develops standards for education (Bildungsstandards), which are implemented at local schools ("Teaching", Eckhardt 110). Non-educators - parents, students, or business leaders - may be consulted during the finalization of the standards in the KMK procedure ("Teaching"). The

federal government has limited control over education though the Institute for Educational Quality Improvement (Institut zur Qualitätsentwicklung im Bildungswesen, IQB), which creates some nationwide standards, assessments, and recommendations (Eckhardt 40).

Primary and secondary education in the United States is nearly entirely a state concern, and most states grant considerable control to local school districts (US Department of Education, “Federal Role”). This leads to more variation within the US education system than in Germany. Standards are normally adopted state-wide by state legislatures or departments/boards of education, though curriculum itself is adopted at the local level (see table 1). Parents, public officials, students, community members, and business leaders have considerably more input at the local level, and much of the curriculum is determined at the local level. Thus non-educators have much stronger input on education in the US, though of course not in every state (see Hawaii). Federal policies have no effect on curriculum (US Department of Education), though some groups of standards, like Common Core or the Next Generation Science Standards (NGSS), are voluntary federal standards states can choose to implement (“Frequently”, “Next” [*Department*] xiv).

**Table 1: Information on a selection of US state education standards, showcasing the variety of approaches.**

State	Standards developed statewide by:	Curriculum adopted locally by:	Includes climate change:
Arizona	State Board of Education, with comments from public <sup>1</sup>	Districts and schools, with public input <sup>1</sup>	Yes <sup>2</sup>
Arkansas	Curriculum Support units, within the Department of Education <sup>3</sup>	Districts <sup>4</sup>	Yes, but does not suggest human impact is the main cause <sup>5</sup>
California	State Board of Education <sup>6</sup>	Educators <sup>6</sup>	Yes, NGSS <sup>7</sup>
Colorado	State Legislature, public, and State Board of Education <sup>8</sup>	Districts <sup>8</sup>	Yes, but suggests research is not concrete enough to concede human impact <sup>9</sup>

Table 1, continued

Florida	State Board of Education, public input; CPALMS <sup>10, 11</sup>	Curriculum support provided by CPALMS <sup>10</sup>	Yes, but does not suggest human impact is the main cause <sup>12</sup>
Hawaii	State Board of Education <sup>13</sup>	Schools and teachers <sup>14</sup>	Yes, NGSS <sup>13</sup>
Idaho	State Board of Education <sup>15</sup>	Districts <sup>15</sup>	Yes, but does not suggest human impact is the main cause <sup>16</sup>
Illinois	State Board of Education <sup>17</sup>	Schools and teachers <sup>17</sup>	Yes, based on NGSS, but does not suggest human impact is the main cause <sup>18, 19</sup>
Indiana	State Board of Education <sup>20</sup>	School boards <sup>21</sup>	Yes, though very skeletal and does not suggest human impact is the main cause <sup>22</sup>
Iowa	Department of Education <sup>23</sup>	Districts and teachers <sup>23</sup>	Yes, NGSS <sup>24, 25</sup>
Kansas	State Department of Education; reviews at least every seven years <sup>26</sup>	Districts <sup>26</sup>	Yes, NGSS <sup>27</sup>
Kentucky	Legislature, Department of Education, public input <sup>28</sup>	Districts <sup>29</sup>	Yes, NGSS <sup>30, 31</sup>
Louisiana	Standards Review Committee, which includes members of the public <sup>32</sup>	Teachers <sup>33</sup>	Yes, but suggests research is not concrete enough to concede human impact <sup>34</sup>

**Table 1, continued**

Maine	Department of Education, educator input <sup>35</sup>	Districts <sup>36</sup>	Yes, NGSS <sup>37, 38</sup>
Mississippi	Department of Education <sup>39</sup>	Districts, schools, and teachers <sup>39</sup>	Yes, but frames human impact as debatable <sup>39</sup>
Missouri	State Board of Education <sup>40</sup>	Districts and schools <sup>40</sup>	Yes, but frames human impact as debatable <sup>41</sup>
Montana	Board of Public Education, public input <sup>42, 43</sup>	School boards, public input <sup>43</sup>	Yes, but no mention of human cause <sup>42</sup>
Nebraska	State Board of Education, public input <sup>44</sup>	Schools <sup>44</sup>	No, very skeletal <sup>45</sup>
New Jersey	State Board of Education <sup>46</sup>	Districts <sup>46</sup>	Yes, NGSS <sup>47</sup>
Washington	Office of Superintendent of Public Instruction, public input <sup>48</sup>	School boards and educators <sup>49</sup>	Yes, NGSS <sup>50, 51</sup>

1 - (“K-12 Standards Section”)

2 - (“Arizona Science”)

3 - (“Curriculum Support”)

4 - (“Arkansas Academic”)

5 - (“Arkansas K-12”)

6 - (“Content Standards”)

7 - (“CA Content”)

8 - (“2020 Colorado”)

9 - (“Colorado Academic”)

10 - (Razzouk)

11 - (“Standards Review” [Florida])

12 - (“SC.912.E.7.7”)

13 - (“Next” [Hawaii DOE])

14 - (“Hawaii DOE”)

15 - (“Idaho Content Standards”)

16 - (“Idaho Content Standards Science”)

17 - (“EQ CL17”)

18 - (“High School”)

- |   |   |
|---|---|
| 19 - (“Illinois Vision”)                          | 20 - (“Indiana Academic”)                     |
| 21 - (“What Are”)                                 | 22 - (“Science and Engineering”)              |
| 23 - (“Student Standards”)                        | 24 - (“Earth and Human”)                      |
| 25 - (“Understanding”)                            | 26 - (“Curricular Standards”)                 |
| 27 - (“Topic Arrangements”)                       | 28 - (“Kentucky Academic Standards Revision”) |
| 29 - (“Kentucky Model”)                           | 30 - (“Kentucky” [2015])                      |
| 31 - (“Next” [ <i>Kentucky</i> ])                 | 32 - (“Louisiana Standards”)                  |
| 33 - (“Academic Standards” [ <i>Department</i> ]) | 34 - (“K-12 Science Resources”)               |
| 35 - (“Standards Review” [ <i>Maine</i> ])        | 36 - (“Curriculum Models”)                    |
| 37 - (“Standards & Instruction”)                  | 38 - (“Chapter 132”)                          |
| 39 - (“2018 Mississippi”)                         | 40 - (“Missouri Learning”)                    |
| 41 - (“6-12 Science”)                             | 42 - (“Montana Science”)                      |
| 43 - (“K-12 Content Standards & Revision”)        | 44 - (“Nebraska Career”)                      |
| 45 - (“Comprehensive”)                            | 46 - (“New Jersey Student”)                   |
| 47 - (Branch)                                     | 48 - (“Learning Standards & Instructional”)   |
| 49 - (“RCW”)                                      | 50 - (“Science K-12 Learning”)                |
| 51 - (“WSSLS Resources”)                          |   |

The fact that national systems of standards in the US are voluntary programs that states may opt into or opt into only parts of is one notable difference to Germany. Germany has some national standards, for example in math and German at grade 4, that are mandatory for all Länder (Eckhardt 40, 239). The second notable difference is the role that non-educators play. An informative example is the process for approving and purchasing textbooks. In Germany, conferences of teachers choose textbooks for each school, usually from a list of textbooks approved by the KMK (“Teaching”). In the US, textbooks and other instructional materials are sometimes approved by the state board of education or controlled considerably by educators, as in Idaho and Hawaii respectively (“Curricular Materials”, “Hawaii”). Many, however, are approved at the school district, usually by a school board with an opportunity for public input, as in Missouri (“Missouri”).

Environmental education is encompassed in international agreements both nations are party to. Climate education is included in the 4th Article of the 1992 United Nations Framework Convention on Climate Change, which both the US and Germany signed and ratified (“United Nations” [Treaty]). However, it is dictated only that “educational and public awareness programmes on climate change and its effects” and “education and training programmes” be developed and implemented, which could be interpreted as applying only to higher education or

training of professionals (“United Nations” [*Climate Change*] 17). Article 12 of the Paris Agreement specifically states that “Parties shall cooperate in taking measures, as appropriate, to enhance climate change education [...]” (“Paris” 16). Both Germany and the US were originally signatories, though the US withdrew from the agreement in November 2020 before rejoining in January 2021 (“Chapter XXVII”).

The UN Sustainable Development Goals include Education for Sustainable Development (ESD) (“Education for Sustainable”). In 2017 Germany formed a National Action Plan for ESD, the first step to bindingly incorporating sustainable development in education, including climate information (“Education and Research”). The United States’ locally-focused education system has no similar unified intention; implementation of ESD is under the purview of many non-governmental organizations, local and state governments, and grassroots movements (Smith et al. 3).

Even so, climate education in Germany and the US have considerable baseline similarities. In both countries, it is primarily the responsibility of concerned citizens to bring the issue up to Länder or state authorities, which may then be implemented at the local level. The biggest difference between the countries is the degree of implementation of environmental education. Germans have widely agreed that global warming is happening, primarily human caused, and should be taught in schools. Debate on education standards centers on interdisciplinary teaching of environmental problems and the degree or time invested in the topic. American debates are in an earlier phase of implementation and argue about the role of humans in climate change, whether it should be taught as a two-sided issue, and on the consensus of climate scientists. The educational differences reflect the general differences in environmental beliefs between the countries. 60% of Americans consider climate change a major threat or very serious problem, compared to 81% of Germans (Kennedy, “Germany”). As Morris and Jungjohann note, the US is still deciding on a direction of climate activism, beginning to fight fossil fuels, and expanding grassroots support. Germany has already decided on a direction, and is developing and implementing policies to meet those goals (Morris and Jungjohann).

Germany’s first environmental program, in 1970, emphasized the importance of environmental education. It was followed by recommendations for environmental education passed by the federal government in 1978 and the KMK in 1980 (Eulefeld 301). In 1981 the Kiel Institute for Science Education (Institut für die Pädagogik de Naturwissenschaften, IPN) published teaching materials and methodology, though they were rarely implemented in schools (Eulefeld 301). In circa 1985, further teacher training was introduced, and textbooks and materials had been created for teaching environmental education (Eulefeld 302, 306). The major flaws, as of 1991, were a failure to present environmental topics interdisciplinarily, spending too little time on the subject, a lack of teacher education, and a need for local, action-based education (Eulefeld 301, 305).

Stokes and colleagues provide an overview of environmental education policy in the European Union as of 2001. The European Parliament passed a Resolution in 1993 “which called on Member States and the Commission to: ‘include the environmental dimension in all aspects of education at all levels’ and to ‘emphasise the fundamental role of schools and their teachers in the development and implementation of policy’”, though it was not legally binding (Stokes et al. 5). Of the three Länder (Bavaria, North Rhine-Westphalia and Thuringia) researched by Stokes and

colleagues, Bavaria and Thuringia include the environment in primary education aims (Stokes et al. 5 - 7). In Bavaria environmental education is compulsory for primary schools (Stokes et al. 7). Environmental education is either taught in science classes or presented interdisciplinarily in secondary school in all areas of Germany researched (Stokes et al. 12).

Upper secondary schools offer more course choices, but environmental education is taught to students if they take coursework in geography or science (Stokes et al. 20). In Thuringia, environmental education is taught as one of six interdisciplinary topics, which are supported with materials and updated education for educators to help teach rapidly changing social problems (Stokes et al. 24). Bavaria has upper secondary students partner with local environmental agencies in action-based education or initiatives. In North Rhine-Westphalia, state funding has been allotted to specific school environmental projects, but no other overarching environmental education is mentioned (Stokes et al. 26).

Climate education in the US is considerably more haphazard. As of 2016, 13 states have implemented the NGSS standards (Plutzer et al. 11). This set of national, voluntary, science standards explicitly mentions climate change (“Next” [Department] 77, 84, 117). A 2016 report from the National Center for Science Education found that 90% of middle schools and 98% of high schools teach climate change (Plutzer et al. 11). Individual states, most notably New Jersey and Washington, have implemented legislation requiring climate change to be taught in public schools (Branch, “Integrated Environmental”). New Jersey had already implemented the NGSS standards, but the new state standards emphasize climate further and are interdisciplinary - that is, climate change will be discussed outside of science classes (Branch, “2020 New Jersey” 8). It should be noted that the local process of curriculum development means that teachers and school districts have the freedom to teach beyond what is required by state standards both in Germany and the US, though it is difficult to find conclusive evidence on individual teachers who teach environmental education without being required to.

The National Center for Science Education statistics paint a rosy picture of climate education in the United States, though a number of problems mar such positive percentages. First, the majority of states have not implemented the NGSS standards. The National Center for Science Education supports the NGSS for its standardized curriculum, explaining, “it is unrealistic to expect individual teachers to cover the topic comprehensively in every course, and the current lack of coordination is contributing to a situation where students are probably encountering some important topics repeatedly and others not at all. Whether it occurs at the level of a single science department, an individual school or, better, at the level of school districts or states, an agreed-upon curriculum is critically important” (Plutzer et al. 31). Legislatures can also undermine existing or prospective climate education standards, as recently demonstrated in Idaho and New Mexico (Cheskis et al., Stark). Though in both states anthropogenic climate change standards were upheld, this highlights the danger of rollback in standards, especially when state legislatures have control of standards and weakening climate education may be politically motivated. In 2020, eighteen state measures in support of climate change education were introduced; all failed or are pending in committee (“The Year”).

The slow and sometimes backward movement of climate education is compounded by the conventional method of approving and procuring textbooks. Textbooks have a large impact on

what students learn and teachers teach, and are often used for many years (Meehan et al. 499, 503). Social studies textbooks focus on mitigation more than science textbooks do, but many materials suggested climate change would mainly affect people in other areas of the world or in the future (Meehan et al. 511, 516). When textbooks do offer mitigation strategies, many only suggest low-impact solutions to students, like replacing light bulbs, over more dramatic and effective solutions like limiting air travel (Collins and Osborne). Choi and colleagues reviewed common earth science and environmental science textbooks, and concluded that even popular texts sometimes misrepresent science. Some are not clear enough to avoid perpetuating common misconceptions, like falsely equating ozone depletion and global warming or not differentiating between weather and climate (Choi et al. 890, 897). Teacher training and using more frequently updated materials were stressed as solutions to the weaknesses of textbooks (Choi et al. 896). While the Internet allows fast dispersion of the most current scientific knowledge, it also allows misinformation and inaccurate classroom resources to reach educators looking for materials (Plutzer et al. 33).

Another problem in US climate education is how comfortable teachers are teaching climate change science or solutions. The previously mentioned report from the National Center for Science Education determined that many science teachers are not well-versed on the greenhouse effect, decreasing the likelihood that they would devote significant time to the causes of global warming (Plutzer et al. 22). Only 39% of teachers surveyed knew that over 80% of scientists agree climate change is anthropogenic, and one in five responded that they did not know (Plutzer et al. 22, 23). Many educators did report a lack of formal climate education, or outdated education (Plutzer et al. 24). This is a concern even when legislation has otherwise supported environmental education, as in New Jersey; current laws provide professional development training, but no updated environmental or climate education for teachers (“New Professional” 3, Branch).

It is important to note that the NCSE survey was entirely voluntary, and received responses from only 1,500 of an estimated 3.2 million educators in the United States (Plutzer et al. 10, Riser-Kositsky). Personal opinions can subconsciously affect what and how teachers teach, and may also have affected who responded to the survey (Plutzer et al. 25). The current environmental education system is a positive feedback loop; when climate change or environmental concerns are not taught, educators are not introduced to the topic until late in their pedagogical instruction. They are often unable or unwilling to comprehensively teach environmental content to the next generation, perpetuating the gap in knowledge. Conversely, if the cycle of misinformation can be interrupted, it can become a positive feedback loop of another sort: when cultures or individuals are aware of and care about the environment, environmental education is likely introduced and maintained, thus increasing the number of environmentally aware citizens.

The final issue with US climate education is how climate change is presented to students. Problematically, some teachers do so through debate or other methods that question the validity of climate change. Thus it is unlikely that 98% of high school students are taught accurate environmental information, as the NCSE reports (Plutzer et al. 11). There is considerable scientific consensus, about 97% (Cook et al. 4), that the earth is warming from human causes, but presenting climate change as a debate grants equal weight to both sides. This gives increased legitimacy to conspiracy theory-esque climate deniers, and suggests that debating fact is an acceptable mode of education. Other educators present multiple, contradictory statements,

increasing confusion among students and decreasing the validity of all climate information they present (Plutzer et al. 14, 15).

Attempts to solve these problems encounter other problems and difficulties within the US education system. Teachers are often overburdened with content, so additional standards may feel overwhelming or be given little time in the classroom. Integrating climate content in many subjects is ideal, but would require resources and education for many teachers beyond science educators, to ensure all educators are comfortable and knowledgeable in the climate information they present (Collins and Osborne). The majority, 67%, of science teachers are interested in continuing education on climate change, though the role of government and by extension political affiliation is a stronger factor in what and how teachers teach (Plutzer et al. 24, 28).

Some educators turn to resources outside of the school, including field-trip style education. The burden of content and presentation is then on individuals who primarily study or educate on the climate. There is some concern that short term projects - as opposed to interdisciplinary approaches, which would expose children to the topic frequently - do not create long lasting effects. However, a study of German students at a one-day botanical garden educational experience suggests that even short programs have positive effects on environmental attitudes, which is correlated with climate-friendly behavior (Sellmann and Bogner 1084). In Germany, beginning from circa 1982, there was a “gradual shift of emphasis towards setting up and using environmental centres in order to help teachers to bridge any gaps in their training” (Eulefeld 302). While they play “a significant role” in German environmental education, their numbers, as of 1991, are not large enough to support all schools (Eulefeld 304).

The United States has a variety of resources outside of schools, including over 200 environmental education centers (Bourke et al.). Many centers, like Wolf Ridge Environmental Learning Center, are non-profits and offer education both to school groups and smaller, informal groups (“Academic Standards” [Wolf], “Our Story”). Other private and non-governmental organizations, like the University Corporation for Atmospheric Research, National Center for Science Education, and National Science Teaching Association, support climate education by curating environmental education materials, lesson plans, or teacher training - resources that may not be available otherwise (“What We”, “Home”, “Climate Change”). The National Environmental Education Foundation supports the Hands On The Land program, which works to get primary and secondary students onto public lands (“Hands”).

Whether comparing national standards, responses to international agreements, or implementation in the classroom, Germany consistently showcases a style of local education similar to the United States’ that differs by successfully including environmental education. While slow improvements have been made in both countries, environmental education centers and growth in interdisciplinary education indicate additional areas for progress. Such developments must be paired with constant movement towards or dedication to accurate climate science.

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