# Teaching the "Wicked" in Geography: Educational Structure, Standards, and Teacher Training as Obstacles to Teaching about Climate Change

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## Introducing wicked problems

Wicked problems are "a class of problems that are complex, contentious, defy complete definition and resolution, and for which there is no single solution, since any resolution generates further issues" (Rittel & Webber, 1973, 4). These intractable issues – often viewed from a planning or social problem perspective – span all areas: antibiotic resistance, food insecurity, poverty, terrorism, environmental degradation, drug trafficking, and so on. Each of the previous and more are certainly complex and defy easy resolution.

Rittel and Webber identified 10 characteristics of wicked problems that contribute to a problem's insolvability.

1. They do not have a definitive formulation, meaning that the problem can be framed in multiple ways (with differing solutions).
2. They do not have a "stopping rule." There are no clear signals indicating when or if the problem has been solved.
3. Their solutions are not true or false, only good or bad. Solutions are subject to a host of interests and ideologies.
4. There is no way to test the solution to a wicked problem. Implemented solutions can have far reaching and unintended consequences.
5. They cannot be studied through trial and error. Solutions are irreversible so every trial counts.
6. There is no end to the number of solutions or approaches to a wicked problem and no way to know.
7. All wicked problems are essentially unique. A solution that has been tried before or somewhere else is likely irrelevant.
8. Wicked problems can always be described as the symptom of other problems. Solutions often hit symptoms and not the underlying condition as a result.
9. The way a wicked problem is described determines its possible solutions. A problem framed in economic terms will likely have economic solutions proposed.
10. Planners have no right to be wrong. As solution proposers and implementers, planners are held responsible for the consequences of their solutions.

These 10 characteristics of wicked problems have been used to explain approaches – and inaction – toward dealing with climate change. Climate change is a concern of Geography, a field of study encompassing physical and social science with a focus on place variability. Interactions among physical systems are still being learned (e.g., the role of oceans as a carbon sink) and the choices being made by people as it relates to the environment are frequently ideologically driven (see Characteristic #3). Geographers, working at the intersection of nature and society, see the uncertainty present with climate change, especially as its effects – and responses by people – are unique from one place to another (see #7).

It would seem that greater education over time would be strongly favored to at least eliminate ineffective solutions (however, see #6) and empower new leadership and decision-makers where others have failed. Yet we inch along in this direction, and for good reason. In this paper I argue that there is a "wickedness" in educational systems that make the teaching of wicked environmental problems like climate change to K-12 students a "super-wicked" endeavor.

## What are wicked problems to a geographer?

For the geographer, human-environment problems are generally at the forefront of "wicked" investigation. A long-time focus on nature-society interaction drives this inquiry, often with an added dimension - a look at uneven spatial patterns present in wicked problem sources, outcomes, and so on. Simm et al (2021) identify a far-from-exhaustive list of wicked problems that includes human-induced climate change, global poverty, and terrorism. Considerable uncertainty about drivers, solutions, costs, and even some physical Earth processes themselves hinder action when there are no correct solutions or way of knowing which particular solutions will work (or at least cause less future harm).

## What are wicked problems to an educationist?

Education systems are beset by wicked problems, too. Educationists seek to understand and improve teacher training programs; study the range of environments and factors that impact student achievement; investigate best practices for evaluation and assessment; and many other aspects of the education endeavor. Recent scholarship that specifically references wicked problems in education include providing professional experience in initial teacher education (Southgate et al, 2013), chronic absenteeism (Child & Lofton, 2021), and education assessment (Zhao et al, 2019).

More broadly, the provision of education – especially K-12 – can be described as wicked. Most identified problems have differing solutions, only good or bad options, no way to test without the possibility of introducing other problems, and so on. Educating students on wicked environmental problems is confounded not just by the nature of the wicked problems to be taught, but by the "wickedness" in the educational system. These wicked issues include a lack of appropriate teacher training, the misunderstood purpose of academic standards, the poor curricular position of geography, and the politics and ideologies that drive the teaching of some topics while ignoring others.

## How do we approach wicked problems in geography education?

Geography education concerns itself with identifying best practices in student learning and teacher training (content, pedagogy, technology) for the mastery of geographic content and concepts. The subfield brings together the research bases of geographers and educationists, but there is little to date in this realm focused on wicked problems as specifically named (clearly some wicked problems have been investigated in geography education, but largely under other terms like "hazards"). A recent symposia published in the *Journal of Geography in Higher Education* is a welcome exception. The lead editorial there asks "At what academic level is it most appropriate to introduce wicked problems? It is important not to shy away from complex issues, but they should be taught in appropriate ways at various educational levels, whether at primary (elementary) school or university" (Simm et al., 2021). The contributions that follow focus on climate change in UK and Ireland geography courses (Cross & Congreve, 2021); tourism management (Şeremet, Haigh, & Cihangir, 2021); bridging subject matter silos by bringing geography techniques to business students (Rivera & Groleau, 2021); and geography, climate change, and storytelling with drama students (Law, Corbin, Wilkins, Harris, Martin, & Lowe, 2021). Four other papers round out the symposium, and besides sharing wicked problem teaching strategies they each have a singular

focus - university students. Undergraduates are featured in the earlier work by Cantor et al. (2015), too. But what of the K-12 audience? What is appropriate and when? I argue that a new level of "wickedity" is introduced through the very nature of K-12 educational systems.

## Creating the "Super-wicked": wicked problems wrapped in a wicked system

Where is there room for teaching about wicked problems such as climate change in educational systems that fight against their inclusion? Though the word "fight" suggests some form of deliberate push back - for which I will address - more problematic can be "wicked" educational structures themselves. Yes, there are those that hope to suppress climate change discussions in K-12 classrooms for ideological reasons (see wicked point #3), as I have had to counter via legislative testimony in my home state. Those issues appear to moderate themselves over time. Witness the evolution of the question of whether climate change is actually occurring to contemporary discourse that takes that point as a given. My concern is over three educational "wickedities": 1) the rigidity or inapplicability of some academic standards that mis-guides wicked teaching opportunities, 2) poor teacher preparation in geography and its pedagogy, and 3) a mindset that over-emphasizes outcomes compared to skills honed during an inquiry-based process (a teaching strategy well-suited to investigating wicked problems).

Mitchell, Borden, and Schmidtlein (2008) demonstrated the possibilities for teaching about wicked problems such as natural (hurricanes) and technological (chemical spill) hazards in a middle school classroom. There, students gathered data, conducted analysis via geographic information systems, and presented possible solutions (even if almost all were still confounded in some way by the wicked characteristics posed earlier). Nonetheless, students embraced uncertainty and learned about place-based variability even when the "right" answer was elusive. Introducing this successful strategy to classrooms elsewhere ran into one obstacle: academic standards. Meant to serve as a content guide and instructional signposts for assessment, academic standards can do much to focus instruction. Where we run into difficulty for wicked problems is when the standards - though well-intentioned - limit opportunities. For example, a student may learn far more about earthquakes and volcanoes as part of understanding plate tectonics but learn next to nothing about them in terms of their hazardousness to humans, different vulnerabilities, or mitigation opportunities (Mitchell, 2009) as the standards do not leave room for venturing into this realm nor was it their intent. This is not the fault of the standards or even their writers, per se, but an example of how standards can narrow the curriculum in ways that make teaching the "wicked" difficult or impossible.

A second education wickedity is the paucity of teachers well-trained in geography content and pedagogy. A near-constant problem, the curricular position of K-12 geography has been long marginalized in schools and teacher preparation programs. Despite teacher preparation models proposed to bridge this issue (see Mitchell (2018) for ideas on building a successful pre-service teaching geography methods course), much time is needed for these changes to take hold. The often social or planning nature of wicked problems lead themselves to geographic exploration. Unfortunately, a geographically undertrained teaching corps either does not recognize "wicked" instructional moments or is ill-equipped to teach about them well.

The third issue - and one that I believe is key to opening up the K-12 classroom for tackling wicked problems - is overcoming a focus on an end result (of which there isn't with wicked problems) and instead teaching students how to engage in inquiry. Where academic standards employ a deliberate "vagueness" within certain bounds, wicked problems have no difficulty entering the curriculum. For example, in South Carolina's seventh grade geography standards (SCSDE, 2019), students learn about each continent's climate, among other issues, and ultimately "gather evidence and construct a map or model to investigate a significant contemporary cultural, economic, or political issue facing [that place] at the local, regional, or global scale." The stage is set here for a full look into climate change or other wicked problems using the skills of mapping, models, scale, distribution, and pattern as the academic standards are loosely defined and do not limit learning to one prescribed topic. An inquiry approach (see for example National Geographic's Geo-Inquiry Process[1]) can utilize student teams and technology in an attempt to solve the unsolvable, and in the process improve global awareness and student critical thinking (Simm & Marvell, 2016).

Wicked problems "are complex, contentious, [and] defy complete definition and resolution." So too are many of our K-12 educational systems. When paired together, we can become paralyzed by the "super-wicked" confluence of the two. I suggest here that there are opportunities to temper the wickedness more readily in the education realm than in the wicked content we hope to better understand. Continued work by geographers and educationists to "un-silo" content areas, reimagine how standards can facilitate opportunities, better train and provide continuous geography professional development to teachers, and embrace a student-centered inquiry-focused classroom are a few steps toward educating the future on the joint wicked problems we face.

## Notes

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1. The Geo-Inquiry Process has students engage in five steps: *Ask* a geographic question, *Collect* data, *Visualize* the information, *Create* a map or other representation to tell the problem's story, and finally *Act* (sharing the outcome of their work).

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