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Methods, Theories, and Tools: Why There are No Methodologists *Per Se*

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This paper argues that there are no generic methods in academic research that can be categorized in terms like quantitative or qualitative. Each different area of research uses a distinctive combination of methods, theories, and tools in which these methods, theories, and tools have been customized to work together. Grouping every area that uses numbers under one label and every area that uses non-numerical interpretation under another label—and calling those areas that use both "mixed methods"—is incoherent. It is a bit like grouping animals into two big categories: those that are black and/or white and those that are colored and calling those that are both "mixed." You can do it, but it does not really buy you anything in terms of understanding.
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This article develops a perspective on methodology. I use examples from linguistics, my own discipline, but nearly any other discipline could have served the same purpose. My remarks here are, however, meant to speak to the dilemmas of methodology and methods classes in education, my other area of interest.

The perspective I develop may well be seen as contentious, because it goes against the grain of traditional practices in Schools of Education. The article is meant as an *opinion piece*, albeit an opinion based on decades of teaching a methodology class (discourse analysis) in both linguistics and education.

Disciplines, Sub-Disciplines, and Challenges

Today, academic disciplines are little more than department names. For a long time now, research has been done at the level of sub-disciplines. For example, linguistics is a discipline and things like theoretical grammar, sociolinguistics, anthropological linguistics, historical linguistics, discourse analysis, language acquisition, neurolinguistics, and others, are sub-disciplines. Often sub-disciplines split into sub-sub-disciplines; thus, within sociolinguistics there are interactionist and variationist sub-areas and within theoretical grammar there are sub-areas like lexical studies, syntax, phonology, morphology, and formal semantics.

Very often the sub-disciplines in an academic department do not see themselves as really belonging together. For example, cultural anthropologists and physical anthropologists in anthropology, theoretical grammarians and applied linguists in linguistics, or ecologists and biochemists in biology often have quite different views about what constitutes *real science* in their discipline.

We should distinguish between disciplines and fields. A field, like Education or Communication, contains people who use different disciplines. They sometimes have degrees from departments that represent those disciplines and sometimes not. There are, for example, many people who engage in some aspect of linguistics in Schools of Education, but their degrees often come from outside linguistic departments.

Just as modern science gave rise to ever greater specialization so, too, contemporary science is now turning away from disciplines and departments in a yet different and important way. Today, at least at the cutting edge of knowledge production, many scientists master a sub-discipline but define their work around a major challenge or deep problem (a so-called *hard problem*) that requires the pooled work of different sub-disciplines from different disciplines as well as the creation of new forms of language and new methods shared by everyone involved in the endeavor (Nielsen, 2012).

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For example, many researchers from various disciplines work on complex adaptive systems whether these be biological, natural, social, computational, or artificial and see this as their new *mega-discipline*. The area of cognitive science historically arose this way, combing linguistics, computer science, neuroscience, cognitive psychology, mathematics, and philosophy. It has been around long enough that there are now departments of, or programs in, cognitive science. There are a great many other examples.

Ontology: The Things to be Studied

To discuss methods, let's stick for the moment with sub-disciplines, still in many respects, at least for a while longer, the canonical level at which science is done. Fields like education often have "methods classes" as if researchers in different disciplines (or none) can just dip into a generic bag of methods and use them across the board. They usually have two bags (given our human love of binaries, this is not surprising) called "Quantitative" and "Qualitative." I do not believe any of this makes any sense. If you somehow mix these "Quantitative" and "Qualitative" in the same methods class, you get something called "mixed methods." Combining two things that do not make sense does not usually get you something that does.

What counts as "real" ("out there" in "the world") and what its properties are is not, for humans, pre-theoretically given. Our ideas about reality are constructed, though this does not mean they are not "true" in the sense of being able to underwrite effective predictions and practices. Atom bombs are constructed, but they can have a powerful impact on the world indeed.

What color is a flower? Human vision sees colors very differently than does a bee's eyes. Is color a sensation or wave lengths of light? Is a paper cup "really" made of paper, trees, or molecules? Because trees are connected to a great many other trees underground through their interacting and communicating roots systems, is the forest more real than the trees seen just as individual things? Is an ant a cell in a colony or a separate animal? Is a virus a living thing or something else? If a student fails in school is he or she a failure or is it the teacher or the school or something else that failed? Where does failure reside?

So, when a researcher wants to study "something" like, say, evolution, the researcher must first say things and properties of things he or she is going to study. We all agree that trees exist, but researchers disagree at what level they should be studied. Should we study whole eco-systems of which trees are just a part; forests; individual tree species; individual trees; or the molecules and atoms of which trees are made? Is the tree a thing or a process? Should it be viewed synchronically (as it is at a given time and place) or diachronically (as it changes over time)?

So, let us call the work a researcher does to delineate what he or she takes to exist and the level at which it is to be studied as the *ontological task* of research. "Ontology" is a word from philosophy for what you take to be real in the real world or what you want others to assume exists in a fantasy or virtual world. If you are playing *The Sims*, your ontology is the set of things you can (or will allow) to be put in the virtual world you build and the properties they have.

My own ontological theory of the *real world* contains the claim that human races do not exist. I do not think this is just my opinion. I think that people who do believe races exist do not read enough. I believe that the theory that races do not exist is true in the sense that it underwrites better, more effective, more accurate predictions, descriptions, and explanations of a wide array of phenomena than does the theory that races do exist. If you disagree and we want to do science, then we argue with logic and evidence (which by no means excludes passion).

So, your ontological task is to choose what will be the things that you are going to study. If you are going to study evolution, are you going to study it at the level of genes, individual animals, or species. It is not that you don't think that all these three things exist, you do. But you believe that one is the level at which evolution operates as a process and the others are not. Only one exists as the focal point for evolution. The others do not.

How and why do you choose the things you will study? Researchers usually choose because current theories in their area work that way. They inherit an ontology. In the study of evolution, species were the thing to study, the place where evolution happened. However, when current theories break down, researchers have to pick a new ontology and they do this by *guessing* (forming a hypothesis) and then seeing whether that makes for a better theory than the current one. Species as the focal point of evolution was eventually replaced in new work by genes and gene pools. And, by the way, many biologists do not believe species really exist; species are just a convenient way to sort the natural world.

Traditionally people believed races were real and used the concept to explain racism. Once you do not believe races exist, then you can't explain racism by appeal to races. You have to choose something else, an interesting task indeed.

Methods and Tools

After researchers have accomplished (or inherited) their ontological task, they must engage next in what I will call their *methodological task*. If a biologist argues that evolution exists and happens at the level of "selfish genes" and another one argues it happens at the level of "species" and yet another one thinks it happens at the level of individual animals, they have answered their ontological

question differently (and there are yet other alternatives). This will mean they must answer the methodological question differently. It takes different methods to study genes than it does to study species and different ones again to study individual animals.

So, theory and method are never separable. A method requires a theory of ontology (the things and their properties you will study to answer your question) and a theory requires a method (how to go about answering your question in a trustworthy—i.e. valid—way). Here, we can already see that generic methods classes make no sense. They offer "methods" with no ontological theories and thus no real methods at all.

I believe that methods are often misunderstood, especially in fields. People often confuse methods and tools. If I want to garden, I can do inground gardening, container gardening, straw bale gardening, raised bed gardening, hydroponic gardening, vertical gardening, hügelkultur, and many more. These are methods of gardening. All of these methods are based on different theories about how plants grow best.

Whatever method you use to garden, you will need tools to carry it out. Some of these tools will be fairly generic (like a watering hose or shovel) and some will be more specific to the method (such as tools to help you lift bales in straw bale gardening; tools to help take care of fish in aquaponics; or tools to build containers for container gardening. However, even rather generic tools like a hose or shovel tend to be customized to different methods.

So, we can add a third task for researchers beyond the ontological task and the methodological task. The third task is the *find or build the right tools for your method task*. At best, we could view generic methods classes as generic tools classes featuring one size fits all hoses and shovels, the ones next to no one adept at gardening buys.

Let me give two very simple examples. When linguists want to know what sounds in a language can make a meaningful difference (something they call a "phoneme"), they engage in a method called "minimal pairs" (Swadesh, 1934). So, take the two sounds [l] and [r]. Do they make a meaningful difference in English? Well, to check, take the world "low," which is a meaningful word in English, and switch the [l] to an [r] and get "row." Then ask a native speaker if that is a different word or the same one. You will find that it is also a meaningful word and a different one. So, the difference between [l] and [r] makes a meaningful difference to English speakers.

There are languages though where changing [l] to [r] will not make a difference. The sequence "low" and the sequence "row" will be heard as the same word. This means that in English /l/ and /r/ are different phonemes, but in some other languages they are not, they are just different variations that sound pretty much the same to speakers in that language. To engage in the minimal pairs method requires no complicated tools, just a notebook to right down the results and maybe a tape recorder to play the words and sounds.

In psycholinguistics, researchers know that English speakers hear "pill" and "bill" as different words and, thus, that /p/ and /b/ are different phonemes (sound variations that can make a meaningful difference in the language). However, when humans produce a /p/ sound they do exactly the same things in their mouth that they do when they produce a /b/ sound except that in the case of /b/ their vocal cords are vibrating and in the case of /p/ they are not. The amount of the vibration of their vocal cords can vary across speakers and contexts of speaking. Psycholinguists want to know, if you vary the variation of the vocal chords (or the sound waves they produce) from a lot to a little and then to none, where in this continuum will English speakers hear a /p/ and where a /b/? Where is the cut-off point?

So, to study this question, psycholinguists use a method that involves playing a sequence of sounds that vary from very clear /p/ to a very clear /b/ with variations in between (Miller et al., 1986). Though you might think that people will hear the sounds in the middle of the continuum as ambiguous (hard to tell whether it's a /p/ or a /b/), they do not. The point at which people switch from hearing /p/ to hearing /b/ is discrete; hearers (of a language like English, where /p/ and /b/ are different phonemes), put the continuum of sounds into two discrete binary bundles. This method requires complicated tools. You need to digitize speech, carefully measure each variation in the continuum, and play the variations at high fidelity for subjects

What is the difference between a method and a tool? A method is an approach to solving a problem or accomplishing a task, like straw bale gardening versus inground gardening. Tools are what you use to enact the method, like hoes and spades. If I am trying to solve a problem using statistics of a certain sort, then that is a method and a computer may well be a tool I use. If I am trying to solve a problem using real-time observations of social interactions and use statistics to ensure my observers aren't biased by race, then statistics is a tool.

By the way, the only studies in which standard frequency statistics of the sort most often used in education and psychology is a method all by itself are studies whose question is about whether some phenomenon is statistically significant (which does not mean it is significant in the everyday sense of the word). But science more often asks why something happened, searches of an explanation. Statistics never answers a why question and so such studies use other methods and statistics are but a tool.

The minimal pairs method belongs to the sub-discipline of phonology in linguistics and the

continuous speech variation method belongs to the psycholinguistic sub-discipline of psychology, though it is sometimes in linguistics departments.

So, how do novices in sub-disciplines learn methods? Usually not in a methods class, but by immersion in shared practice with more senior researchers. They learn methods—and the tools that are needed to carry them out—as craft knowledge through apprenticeship.

The Disadvantages and Advantages of Fields like Education

A field like education has some disadvantages in comparison to disciplines and some advantages. The disadvantage is that in many cases educators are trained in a much more general or eclectic way than are people in disciplines, and sometimes they are trained in no discipline at all. Many schools of education have problems offering advanced courses in different specific areas with prerequisites, something common in disciplines.

When I was a doctoral student in theoretical linguistics, I had five courses in syntax, each more advanced than the other and each a mixture of theory and method so closely integrated that it was mostly irrelevant to distinguish between them. Furthermore, thanks to the prerequisite system, I went through these classes with pretty much all the same people, so we were all on the same page and no one needed to rehash more introductory material later on to get new students caught up.

An advantage a field has, though, is that it can and should be organized in the transdisciplinary approach of contemporary science. Education is replete with hard problems on which we have made little substantive progress. It is ripe for researchers to pool expertise from a variety of different areas and create new shared theories, methods, and tools to deal with a major challenge than can only be accomplished by collaboration and invention. However, I know of no school of education that has done this so far.

Let me close with one last example, this time an example of a "hard problem" that requires collaborative transdisciplinary research. This is a problem I discuss in a new book called "What is a Human?" (Gee, 2020). If you wanted to nurture and teach a donkey, say, you would have to know well what sort of creature a donkey is. Donkeys do not flourish and learn on the same terms as, say, dogs or dolphins. If you do not know what sort of creature a donkey is, then you are liable to do more harm than good if you want to nourish or teach them.

There is lots of emerging research, from a wide array of different areas, that deals with the question of what sorts of creatures humans are (Gee, 2020; Tomasello 2019). It turns out that it is clear from this research that humans are not the sort of creatures we think they are or that our institutions have been built to serve. There could not be a more important problem for education. Our schools are built for some other sort of creature—perhaps an alien—not for what we are just now discovering human beings are.

This should be a central issue around which many different researchers bond, collaborate, and innovate in Education. Methods and tools would be learned and even invented in apprenticeships, with perhaps a few tools classes covering the sorts of generic tools these new researchers will later learn to customize to their shared challenge.

In the end, there are no such things as methodologists. There are only theory-method-tool combinations. If you want to do aquaponics, you need to go to an aquaponicist (if there is such a term). If you want to work on a hard problem, a major challenge, the situation today in academics is the same as with doctors. We used to take for granted that if you were seriously sick you went to see a specialist. However, today you are better off going to see a medical team. The team will pool many different methods and tools in the service of new theories and practices that pay due respect to the fact that bodies are complex systems.

Classrooms are complex systems as well. Ironically, despite the fact that "controlled studies" are said to be the gold standard in classroom research, controlled studies are one method that, in principle, cannot be used to study complex systems. You cannot control a complex system—that is what makes it a complex system.

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