Chapter 10
Going to Where Your Research Takes You

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Abstract I offer three principles of conducting and designing research—namely pursue a passion, question assumptions, and embrace complexity. These tenets have always been core to my own investigation, and I ensure they are prominently represented in work with new scholars. Each principle is about being attentive to the situation-bound characters of interests and interpretations, and they culminate in the advice of going where your research takes you. That suggestion is not about foregoing agency or making frequent turns but about being steadfast in the obligation to be mindful of our complicity in ever-unfolding possibilities.

Keywords Complexity in mathematics education research · Researcher attitudes · Research as reinterpretation · Contextualizing research sensibilities

In a 1972 radio contest, Peter Gzowski of the Canadian Broadcasting Corporation challenged the nation to "Complete the adage, As Canadian as…." Apparently, most listeners heard the contest as a quest for something quintessentially Canadian—a symbol fitted to an idealized sense of Canadian identity in the ways that *mom* and *apple pie* are invoked to characterize an imagined collective American personality. Most submissions were predictable: hockey, maple syrup, the Mounties. The contest judges, however, were not convinced that what it means to be Canadian could be captured by a single icon; the winner was "As Canadian as possible under the circumstances."

I remember the burst of pleasure when, as a child, I was invited into the paradox of that adage. Our essential Canadian character, it asserted, is that we have no essential Canadian character. And it's not that the nation is trying to skirt the issue. The point is simply that an awareness of the complex, circumstance-dependent nature of self-characterization is one of the defining qualities of Canadian identity.

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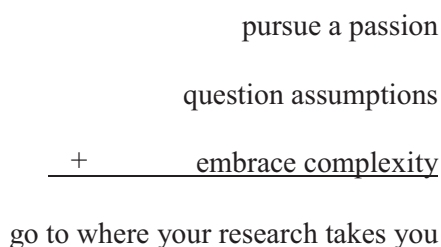e-mail: abdavi@ucalgary.ca; brent.davis@ucalgary.ca

The adage has been pinned to my psyche for most of my life. It was especially present for me throughout my graduate studies in mathematics education. In the mathematics education research community of the 1990s, it sometimes seemed as though the needle of the epistemological compass was spinning wildly. In my first months of doctoral study, I found myself learning about not just radical constructivism and sociocultural theory, but a host of disruptive upstarts such as postmodernism, complexity theory, queer theory, and enactivism. Weirdly, however, I never found myself daunted by my program's requirement to locate myself in the flux—and I think it had everything to do with where I was raised and where I was studying. I was immersed in a sensibility of "possible under the circumstances." It was never about seeking a singular truth but about living in the ever-elaborating conversation.

My purpose in opening on this note is neither to assert nor essentialize my citizenship nor to claim some sort of theoretical breadth. It is, rather, to frame some key commitments while I situate myself—tasks that I regard as necessary and foundational to all academic work. One thing that has become abundantly clear to me over my career is that "educational research" tends to have geographical and temporal flavors, influenced by pressing social issues, prevailing ideologies, linguistic nuance, and other elements of cultural ecologies. Further, and especially relevant to this writing, whenever purporting to offer advice to graduate students or colleagues, I make sure that I qualify what I say with some variation of what is "possible under the circumstances." I am regularly surprised how the academic system affords so much space to explore possibilities. The desire to find and learn from the play in the system is the anchor for most of the advice that I might offer a student or colleague struggling with an issue related to designing, conducting, or publishing quality research in mathematics education. Good academic work is not about meeting requirements; it's about expanding the space of the possible.

To that end, as I report in this chapter, I tend to organize my supervisory and mentoring advice around three pieces of received wisdom. That is, what I have to offer here is based on my practice, but it is entirely derivative—so derivative, in fact, that it would feel like plagiarism if I weren't to acknowledge upfront four people: Thomas E. Kieren and Max van Manen, who were especially influential during my graduate work, and Susan E. B. Pirie and David Robitaille, who guided me through my first years in an academic position. Drawing from (or, perhaps, echoing) their counsel, I pass along three principles of academic engagement which, for me, collect into a single guiding metaprinciple, illustrated in Fig. 10.1.

Fig. 10.1 A guiding metaprinciple

pursue a passion

question assumptions

+ embrace complexity

go to where your research takes you

I re-emphasize that each of these three principles comes with caveats of doing what is "possible under the circumstances," coupled to an acknowledgement that circumstances can vary dramatically. I don't pretend to offer any universally appropriate or context-free insights. But as one who has served as an editor on multiple journals, who has supervised dozens of graduate students, and who has mentored many junior colleagues, I can attest with great confidence that, although the presence of these three elements will not ensure high quality work, the absence of any one will almost certainly compromise quality and insight.

10.1   Regarding Research Topic: Pursue a Passion

When it comes to formal responsibilities of supervising graduate students and mentoring junior colleagues, especially at the start of the relationship, I typically find myself following a fairly routinized script that's modeled after ones experienced in my own graduate studies. Things begin by getting to know one another. I quiz people on where they're from, how they got into the field of mathematics education, why they're interested in graduate studies, what they imagine that to be, and so on. As we chat, I assemble a list of publications in mathematics education that is tailored to the themes of the conversation. Aiming to address historical depth, philosophical variety, and current discussions within the field, at some point I ask my conversation partner to do the same for me. Eventually, we compare those preliminary lists, using them to help lay bare the interests, biases, histories, and expertise that will condition our work together. The co-elaborated list inevitably serves to map out agreements and divergences that set the ground for many conversations to come.

One question that I *don't* ask in first meetings is, "What would you like to research?" In fact, I actually avoid the topic, especially with new graduate students. I work from the conviction that research in a field as complex and volatile as mathematics education is better guided by passionate interest than well-stated problems. At the risk of revealing too much, very few of the questions I've answered through my own research projects have been ones that I asked when I began them. In fact, even the question stated in the opening chapter of my doctoral dissertation (published as Davis, 1996) was something of a cheat. I crafted it in the final stages of editing the document. Only then was I able to express the question I might have answered. I witness the same phenomenon in many of my students' writings. In fact, I have supervised only one doctoral candidate whose research proposal and dissertation were framed by the exactly the same question. And I have supervised only one doctoral student who was driven by expediency rather than passionate interest. They were the same person.

I thus do what I can to encourage flexible and expansive thinking about what and how one might investigate, especially during the first months of the graduate student experience. I'd like to claim that's standard practice for me, but I can't. A few years ago, I broke the pattern—or not so much broke it as permitted the rush of existence

to eclipse it. At precisely the busiest time in our academic and teaching year, our Associate Dean of Graduate Studies requested that I take on a doctoral student who had fallen out with her assigned supervisor. Already well into her studies, Monica came with penultimate drafts of scholarship applications that were due in just weeks, a completed sketch of a research proposal and an extensive bibliography of completed and intended readings. Consequently, the getting-to-know-you and what-you-might-want-to-read preliminaries just didn't happen. In fact, the opposite occurred. Our getting-to-know-you discussions revolved around formatting her research interests and describing her personal history in ways that might make them more compelling to scholarship adjudicators.

Cutting a long story short, in the crush of other responsibilities, I didn't notice my lack of familiarity with Monica's deep interests until, many months later, it became apparent that she was struggling to craft a compelling research proposal—in spite of a strong committee, a coherent focus, and an excellent record in course-work. As we met one day to work through small issues on her very-well-crafted methodology section, the conversation shifted abruptly when she confessed that her heart just wasn't in the work. That wasn't a surprise, given our earlier conversations. But it was only when she added that she'd never been particularly interested in the topic that I awakened to the fact that something important had been missed.

One of my research mantras since my own master's study has been to focus on "something that keeps you awake at night." I heard and uttered this phrase hundreds of times during my graduate studies, and I've invoked it many more times since. Yet, it seems, that advice hadn't been part of my conversations with Monica. Realizing this detail, I attempted to introduce passion as an orienting theme in the conversation by asking the questions I should've asked many months earlier.

I was gobsmacked by her responses. Monica, it turned out, was a celebrated educator in her home country. Narrative after narrative of life-changing engagement fell from her lips, some with such subtle emotional potency that I only noticed myself crying when my hand reached to wipe a tear from my cheek. There were stories of not just providing lessons but of opening vast horizons of possibility, of not just transforming lives but saving them, and of, as Monica summarized it, not just *teaching* but *educating*.

Here is not the place to delve into the different meanings of those two words for Monica, but everything is different now in her research life, mostly because it flows in harmony with the rest of her existence. The shifts have demanded tremendous effort—in fact, almost starting over again on matters related to methodologies and elements of the literature. But, while she hasn't kept it secret that shifting her focus has brought on considerable extra work, Monica's "complaints" are currently spoken with a smile.

As it turns out, an antipodal narrative to Monica's unfolded in parallel over the past few years with a junior colleague. Dustin produced an outstanding doctoral dissertation on possible contributions of school mathematics to informing and affecting issues related to sustainability and systemic change. The work was completed at another university, and so I wasn't an official part of his program. Nevertheless, we spent many hours in deep-but-easy conversation on his research.

He was offered an academic position before graduating. Just before he moved to the United States to step into it, we made plans to blend and extend our research interests. Unfortunately, over the past year, it has been made clear to him that his passions and methodological expertise, while generative of interesting arguments, are not well fitted to the perceived needs and approaches in his new context. In our most recent conversation, Dustin confessed that he is giving into pressures to set aside his doctoral foci and to align his work with the research program of a senior scholar at his new institution. We agreed that the plans that we developed together do not fit well within his current situation, and so they have been set aside for the time being. I'm still working with him to hone arguments and craft manuscripts for publication. But, a prodigious thinker and a fluid writer, he confesses that he is struggling to generate even technical pieces of writing at the moment.

I am invigorated by stories like Monica's, and I'm saddened by stories like Dustin's. In one case, I see engagement and productivity massively amplified as passionate interest frames the picture, and in the other I see engagement and productivity drain away as passion declines. To be clear, in both cases, the passion is not articulated as a naïve enthusiasm but as a vitality that is self-aware, intensely analytical, mindful of biases, and generative of possibilities. Small wonder that both feel stifled when it is absent or suppressed.

Such examples notwithstanding, it's important to situate what I'm saying here alongside an important truth: Enthusiasm and personal investment distort perception. But that doesn't mean that passionate interest is antithetical to objective inquiry. We humans simply cannot step outside our biases. There are no neutral stances. It is true that bias steers perception, but it is just as true that perception is impossible without bias (Kahneman, 2011; Willingham, 2010). Indeed, for an interest to be both "academic" and a "passion," there must be a risk of it being proven misdirected or unimportant. An academic passion is not a conviction. It does not seek validation. An academic passion is not a direction, but it does orient. An academic passion is a care; it is a calling to take care.

10.2   Regarding Research Methodology: Question Assumptions

Several years ago, I was asked to be part of a colloquium on research methods. The invitation advised that I should frame my remarks with "the single, most influential quotation in my academic career." Clueless as to what that might be, I decided to go with a paragraph that has found its way into several of my publications, from Dewey's (1910) essay, *The Influence of Darwin on Philosophy*:

> Old ideas give way slowly; for they are more than abstract logical forms and categories. They are habits, predispositions, deeply engrained attitudes of aversion and preference. Moreover, the conviction persists—though history shows it to be a hallucination—that all the questions that the human mind has asked are questions that can be answered in terms of the alternatives that the questions themselves present. But in fact intellectual progress usu-

ally occurs through sheer abandonment of questions together with both alternatives they assume—an abandonment that results from their decreasing vitality and a change of urgent interest. We do not solve them: we get over them. (pt. III)

This text resonates with me for many reasons. The opening sentences peel back the fallacy that our most confident research claims are somehow free of "attitudes of aversion and preference." The next sentences problematize academia's profound-but-troubling commitment to framing research with well-structured questions. And the final sentence interrupts the project of pursuing solutions.

I realize that not everyone will agree—and, in fact, I acknowledge that I might be an outlier on this issue—but I hear Dewey's remarks as an apt description of the cultural project of educational research. Ours is an evolving domain. I've been active in the field long enough to observe slow transitions from multiple sets of obsessions and frames to entirely different ones. In fact, I've been around long enough to see cutting-edge ideas rise to prevailing orthodoxies and then slip into partial-at-best reminders of where the field used to be. I use such observations to frame one of my favorite activities when teaching graduate courses on research. It involves helping students develop the skill of identifying the decade (and, often, the year) that any given mathematics education research article was published based only on its abstract. It turns out to be really easy when one is aware of prevailing metaphors, epistemologies, and research foci. By the end of the course, accuracy approaches 100% across participants.

My aim in prompting students toward this competence is to afford them access to evolutions in the questions asked, the ways they're posed, the strategies through which they're justified, and the standards implicit in their responses. The global intention is to explore the truth value in the assertion that, following Dewey, it is vastly more important in educational research to be mindful of why we're asking what we're asking than it is to find solutions to whatever those questions may be.

A second exercise that I frequently use when teaching research courses starts by inviting students to select a topic in educational research with a strong thread of quantitative research and/or quasi-experimental methods. In stages, I work with them to push past the mounds of data that typically serve as the foci in published reports, wending to assumptions that reside in the questionnaires, tests, or orienting constructs that are suspended under the counts and statistical analyses. Most often, students react with something that falls between surprise and shock, as publications that on the surface masquerade as objective assessments of verified phenomena turn out to be not especially distant from opinion and riddled with ideological bias. Stated more directly, with very few exceptions, the student-selected quantitative studies we've deconstructed in my grad courses have proven considerably more subjective than nonquantitative articles. Maturana (1987) summed up this issue brilliantly with the concise statement, "Everything said is said by an observer" (p. 65). There are no observerless observations.

On this issue, I would argue on the bases of the analyses we have conducted in graduate research courses that educational research that explicitly aligns with or is situated in interpretive traditions is, in general, more "accurate" than research that

sits several layers of data removed from its originating constructs and assumptions. That is, owing to current expectations to be explicit about theoretical commitments and epistemological positionings, most interpretive research is better fitted to the complex cultural project of formal education than most statistics-riddled empirical research. Conversely, having read thousands of publications in the field, the most helpful of the statistics-based empirical studies are the ones that that include explicit and critical accounts of the interpretive acts that constitute their foundations.

That is what drives my conviction that some of the researcher's time should be given to interrogating assumptions, and much more should be given to interrogating assumptions that underpin assumptions. There should be attendance to personal history, context, and other influences on both personal orientations (e.g., convictions, interests, passions) and situational framings (e.g., prevailing discourses, pressing issues). As inevitably highlighted by the grad-class exercises just described, our research passions are never just our own. They arise and persist in an ecosystem of conventions, convictions, norms, and needs. My urging of students and colleagues to question their assumptions' assumptions, then, is an iteration of the advice to follow a passion. It is a call to wonder about "habits, predispositions, deeply engrained attitudes of aversion and preference" (borrowing from Dewey, above) that undergird understandings and frame perceptions. It is an invitation to recognize that "self" and "context" exist in complex-co-implicated relationship, the latter unfolding from and enfolded in the former.

To be clear, I'm not talking here about the commonplace and commonsensical advice that one must be explicit about one's positionality as one goes about designing one's research. Rather, I'm pointing to the fact that every key construct in the previous sentence (and in this one and in the next one) is a metaphor that is rooted in situated experiences and rendered meaningful through a weave of culturally conditioned associations. So, yes, we must be explicit about positionality, but we mustn't mistake statements on positionality as deep or enduring insights into the substrate of our thinking. Returning to Dewey's quote, and reflecting on the mottled landscape of mathematics education, positionality might just as well be understood as something to "get over" as the place from which we speak.

10.3   Regarding Research Attitude: Embrace Complexity

My first explicit encounter with complexity theory was in the autumn of 1994, when I read Waldrop's (1992) account of its emergence as a coherent domain through the last half of the twentieth century. The timing of the read is vivid in my memory, in large part because it happened just months after I'd graduated with my PhD in mathematics education. In my dissertation I had explored many of the defining themes of complexity theory as they might apply to understandings of the structure of mathematics, the nature of learning, and the possibilities for teaching… all while being completely oblivious to the domain.

In and of itself, that coincidence is easily explained. Indeed, as hinted in the previous section of this chapter, I was simply tapping into one of the things that was in the air at the time. Anyone listening intently would have picked up the complexity themes of self-organization, emergence, structural determinism, nested dynamic systems, and so on—at least, anyone who was listening while working at the elbows of someone like Thomas E. Kieren. My memories of our interactions through my doctoral program are peppered with his admonition to "Embrace complexity!" Expressed with frequency and with an infectious enthusiasm by someone with a quick mind and an encyclopedic knowledge, I could not help but embody the advice—even if the "complexity" he encouraged wasn't tethered directly to the emergent academic domain.

Importantly, Tom's advice was not to *avoid simplification*. That would be silly. We humans survive and thrive by reducing complexity. Rather, his caution was but to *avoid oversimplification*, to appreciate that there is no linear relationship between events and whatever they might trigger. It's not an overstatement to say that, since completing graduate work, my research program and my academic career have been all about navigating between the rocks of oversimplification and the rapids of too-entangled-to-be-useful.

I try to bring that attitude of mindful navigation to all my supervisory and mentoring work. Today when I say, "Embrace complexity," I intend it partly as Tom meant it and partly as a suggestion to consider complexity science. While I in no way insist that this domain be employed by everyone with whom I work, I do require that it be considered as a lens for every study. For the most part, I recommend it as a complementary discourse. Complexity thinking is readily partnered with methodologies focused on things (i.e., empirical approaches), those focused on persons (e.g., phenomenology, narrative inquiry), those on peoples (e.g., hermeneutics, ethnography), and/or those on systems (e.g., systems research), and so I've never encountered a situation in which embracing complexity meant rejecting previous thinking or preferred methodologies. That's the case because complexity is as much an attitude as it is an interpretive frame.

A note on the significance of complexity research in the contemporary academic world is in order here. In most other academic domains, complexity science is integrated into sensibilities. For example, all Nobel laureates in both physics and economics over the last quarter century have explicitly aligned their research with complexity science. By contrast, within education, complexity science has had relatively little impact. In fact, it is regarded by many as a fringe discourse. I personally find that alarming. It reveals both an insularity of our field and, possibly, a lingering devotion to oversimplification.

To rephrase in more lighthearted terms, with regard to embracing complexity, I believe that most of educational research is hovering around the second stage of academic argument-making: "Arguments against new ideas generally pass through three distinct stages, from, 'It's not true,' to, 'Well, it may be true, but it's not important,' to, 'It's true and it's important, but it's not new—we knew it all along'" (Barrow, 1995, p. 1). Even among mathematics education researchers, there is little

recognition that prevailing theories of learning and emerging accounts of the subject matter are all instances of complex theorizing.

Against this backdrop, I can't help but shake my head when colleagues complain—as they frequently do—that education is a marginalized domain and that colleagues in other disciplines don't listen to us. If we want to be heard, we have an obligation to listen. How else might we hope to frame our insights in terms they can hear. (On this count, my education colleagues are often surprised that I give more talks to mathematicians and physicists than to educationists.) We educational researchers also need to experiment with phrasings intended to communicate insights to colleagues in education, taking care to listen to how we're heard. As frustrating as it can be to receive yet another critical evaluation from reviewers unfamiliar with well-established principles, we are obligated to suppress the urge to respond in kind. If we desire to be heard, we must be open to rephrasing, doing everything we can to forestall misinterpretations, to explicate constructs, to situate assertions, and to ground interpretations. In those respects, I have occasionally run afoul of colleagues who advise that we should always aim for the highest-ranked journals and conferences. When working through the early stages of complex ideas, there's much to be said for engaging the generous expertise of colleagues who devote time to small specialist conferences and less-prominent journals.

On that count, as far as educational research goes, complexity thinking demands that we researchers understand ourselves as implicated in the phenomena we study. Thus, for example, when researching in a classroom, we must be cognizant that the addition of a camera or a person or a new routine irrevocably changes the system—in a manner that might completely transform what would have otherwise unfolded. Further, recognizing that the vast majority of phenomena of interest to educational researchers are associated with learning systems—that is, emergent, adaptive, structurally coupled, self-modifying, self-maintaining phenomena that arise from and that persist within similarly complex phenomena—it's vital to engage with methodologies that include requirements for on-the-fly monitoring and iterative modification. There is limited value in studying a dynamic system through a fixed lens or according to a preplanned agenda.

It is that detail—that is, that educational researchers are always dealing with dynamic systems—that most orients my insistence to embrace complexity. The recommendation arises in the realization that the project of formal education is itself a complex (learning) system, and our role is to participate in its learning. Our responsibility in examining and reporting on different aspects of formal education, then, is never to offer summary conclusions but to participate in making the system more intelligent. Through a lens of complexity, engaging in educational research is about struggling to represent thoughts that are at the edge of current comprehensibility, oriented by an awareness that what we ultimately offer are not final thoughts but scaffolds to more sophisticated thinking. Favorite examples of mine include the now-commonsensical notion of the butterfly effect and the now-commonplace understanding of brain plasticity. These were cutting-edge ideas when I used them in my doctoral research in the early 1990s. When I wrote or spoke about them, reviewers and audience members pushed back, often scornfully. When I invoked

them in my teaching, it usually took hours of discussion bolstered by multiple articles from *Science* and *Nature* to convince students even to consider they might be vague possibilities. Today they are uncontested elements of more sophisticated constructs.

10.4   Adding It All Up: Go to Where Your Research Takes You

While typing the first draft of the "Pursue a Passion" section of this chapter, I felt my fingers begin to hack in the oft-heard, "Do what you love, and you'll never work a day in your life." I made it as far as "never" before realizing the lie in the statement. While my career has been regularly punctuated by experiences of the joy of insight and affirmations of impact, pursuing my academic passions has been fraught with unexpected challenges, disheartening resistances, mean-spirited criticisms, and outright condemnations—and not just from others. On occasion, I have been my own worst enemy, rendering myself silent and immobilized at obligations to lay open beliefs and rethink personal commitments. It's what happens when really listening and sincerely embracing complexity.

Pursuing an academic passion, then, is work. It is an obligation to go where your research takes you. The notion of "going where your research takes you" is in no way flippant. It is similar in grammatical structure to the phrase "going with the flow," but "going where your research takes you" means entirely the opposite. It isn't advice. It is consequence. It is an emergent sum of pursuing a passion, questioning assumptions, and embracing complexity. Going where your research takes you can't but happen when attending to and participating in the forces and objects that generate and define the flow of one's academic existence. It is a mindful engagement with difficulties, contradictions, and ambiguities.

I conclude with one final illustrative anecdote. Steven, a former doctoral student and currently an assistant professor at one of Canada's top universities, tagged me in a Facebook post some months ago. "I think I've FINALLY found my focus," he commented at the end of an extended explication of "studying mathematics popularisation as a route to joyful human mathematical experiences." It's been 7 years since Steven graduated from his PhD program. The theme just noted might not be the focus he's been looking for, but it is a clear indication that he is going where his research is taking him. And even if he hasn't actually found his focus, I have every confidence that he eventually will. He's a person attuned to his passions, he's a disarmingly intense listener with an ear constantly to the ground, and he shames me in his commitment to embrace complexity. He cannot help but succeed.

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