

Week 5: Feb 10-16	Integrating mathematics and embodied, arts-based & outdoors inquiry activities	Reflections: Feb 14, 8 PM Responses: Feb 16, midnight
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EDCP 553 cohort Week 5, Feb 10 -16, 2026

Week 5: Developing mathematics pedagogies that integrate embodied, multisensory, outdoors and arts-based modalities

In preparation for the major project for this course, we will be discussing ways that we can design embodied, multisensory teaching and learning experiences at a variety of scales, both indoors and out, that integrate with curricular insights, topics and approaches in mathematics teaching. Is it enough to get students moving and making -- or is there more to integrating the arts and embodiment in math class?

Introduction: Our topic this week is integrating embodied arts, arts-based and outdoor ways or approaches to math education with more traditional ways of teaching: the main topic of the big project for this course, and the theme that we're developing throughout the whole course. At this point, let's spend some time thinking together about how we could possibly do this.

This may be the first time that you are bringing together these very diverse ideas, so consider this a space to experiment with it, to think why and how you might do so, in preparation for your project that you'll be starting to work on.

Mathematics is an important part of our world. Our human heritage from mathematics has been developed in cultures all around the world over thousands and thousands of years. It's an amazing way to think, to connect with the world, to appreciate patterns we can observe, and apply insights about these patterns in other places. We really owe it to the kids, to the upcoming generations, to share this tradition and let them engage with it using all the means that we have in hand. Given this, we have to be responsible and not just pretend we're doing math, we have to really do math, but what does that mean in terms of embodied and arts-based movement?

We've talked earlier about the way that math education has developed over the past 130 years or so since the beginnings of public schooling in the world -- mathematics learning been treated as something that was largely static, individual and silent and based on notation calculation and formulas. For many, including the parents of a lot of our students, many of our teaching colleagues and administrators, that's what they think about math, as that's what they've experienced. It continues to be treated as the default, even though there are many innovative mathematics pedagogies that are being developed currently.

So often we see mathematics work in classrooms comprising teacher lectures (with students copying or filling in notes); worksheets; and textbook problem sets. It's not that these are bad ways to learn math, and all of us have learned math to some degree through these teaching modalities. The established classroom practices that

are so familiar, especially in secondary schools, are certainly useful elements that we should be able to draw on as part of our repertoire, but there is so much more we can and should be working with, to build deeper mathematical understandings with our students.

In that 'traditional' way of teaching mathematics, it's often the teacher who's the only person who's really doing mathematics in the classroom. In our role as teacher, we may be developing ideas, experimenting, and representing mathematical relationships (and we are certainly deepening our own understanding of the topics we teach!) Students, on the other hand, may just be sitting quietly, copying notes, filling in blanks, plugging in numbers to formulas and memorizing, but not necessarily developing a deep understanding of the mathematical ideas through meaning making, and engaging in inquiry and experimentation that goes beyond marks on paper. Of course, there are some students who thrive very well on a very quiet, individual written way of doing things in a silent and static way, and we certainly don't want to exclude them, but that's not the majority of our students. We want to be able to offer multiple entry points for everyone into the mathematical traditions that are everyone's human heritage.

I would argue that lectures, worksheets and problem sets are just not enough. A balanced program of mathematics teaching and learning might certainly include some percentage of this familiar teaching style -- perhaps 30-50% of the time, I would suggest -- along with other modalities, and these could include:

- active collaborative problem-solving with diagrams, writing, symbols and dialogue (Building Thinking Classrooms offers a detailed way of enacting this)
- individual and small group inquiry projects into aspects of math history, non-standard problem investigations, connections of mathematics with practical issues, interdisciplinary connections with the arts and areas of learners' passions and interests (for example, math and magic, juggling, poetry, dance, sports, music, etc.)
- in-class inquiry activities that bring together mathematics and direct, embodied, arts-based and outdoor active engagement to build multiple perspectives and deeper understanding of mathematical concepts
- activities that delve deeply into cultural connections with Indigenous knowledges and traditions
- activities that delve deeply into connections with many multicultural traditions in our communities.
- activities that delve deeply into connections with the living world outdoors -- Land, rocks, soil, plants and trees, waters, birds, insects, other animals, weather, ... -- and the ways that mathematics arises from and comes back to our understanding of these kin, through our embodied, thoughtful and emotional/enspirited connections.
- (More...?)

Where educational practices too often veer from one extreme to the other, oscillating back and forth between "more theoretical, given mathematics" and "more experiential, exploratory mathematics". I think we really need to give attention to integrating all these elements, bringing them together meaningfully, to really do a good job of teaching mathematics.

And this means doing more than treating embodied inquiry and interdisciplinary in a trivialized way, as a sort of a fun add-on. If this is something you *only* do on the Friday before Spring Break when it's hard to get the kids to concentrate, your students won't see it as worthwhile or significant. If we just do mathematical activities of this sort as a fun but insignificant part of our math courses, they end up being 'orphaned', with no follow-up, no connections, no assessment of learning. They may make an impression or have benefit to students who really engage with them, but they are not integrated into our work as meaningfully as they could be.

Another way of thinking about embodied activities is as almost a substitute for mathematics. I have seen this with a few teachers who are not really happy with mathematics in themselves, who wish they weren't obliged to teach mathematics. In those situations, there might be a temptation to "just have the kids randomly dance around, move around, and we can say, we've done math". If and when this might happen, it would clearly not be adequate as a way of integrating mathematics with embodied exploration and movement!

Our aim is to honour and engage with the meaningful mathematical heritage passed to us from millennia of work, struggle and investigation by all our ancestors, without reducing this heritage to meaninglessness, either through superficial paper-and-pencil procedures *or* superficial embodied gestures that are disconnected from relationship and meaning. Integration of all these elements is key -- but as an innovative practice, it requires some thought and work.

Important practical questions immediately arise about how to go about moving from the familiar to the new in our pedagogy:

- Who has time to redevelop their whole curriculum, in the midst of our very busy lives as teachers (and all the other important roles we play in our lives)?
- How to work with the resistance we can readily picture coming from our students, their parents, our math teaching colleagues and our administrators?
- Where do we find ready-made resources for these teaching modalities?
- How do we develop new resources ourselves?

More generally, how do we overcome the inertia and resistance (in ourselves and others) that have built up over 130 years of public education in mathematics?

How do we begin to rebalance things in a good way, that does justice to the traditions and culture of mathematics as a discipline, and to the capacities of all our students for learning through all their embodied, cultural, intellectual resources, and their sense of surprise and wonder in the world?

First, from a very practical point of view, I suggest that none of us will be able to change our pedagogy in one semester or one year! This is a multi-year project -- but it can develop surprisingly quickly (say, over the course of 3 -5 years) if we take it on in a consistent way. Here is how I went about this as a secondary school math teacher, and I can vouch for its low stress practicality:

Year One: For each of the courses you teach, in each term (in secondary), or for one mathematical topic per reporting period (for elementary/ middle years), find or develop **one activity** that involves multisensory exploration, whole body movement, an arts approach, and/or the living world outdoors, and integrates well with the other work you are doing with this topic.

This may be something that you do over the course of a single class block (or part of it). It might be a take-home project that kids get started on in one class block, check in on with you a few days later, and then present or display in your classroom. Or it may be something that you come back to more than once

as an element of your unit on the mathematical topic. But in any case, start with something low-stakes, not too far from the familiar -- perhaps taking something that was small-scale (only written in an individual student's notebook) and adding an extra-large scale collaborative exploration (for example, a huge graph on the floor of your classroom or on the playing field).

Let students, parents, colleagues and admin have a preview of these exciting new activities if needed, to help them understand that these are designed to build deeper understanding, and that they will be enhancing, not substituting, for more familiar ways of learning math.

You will not be completely comfortable with these new activities (yet), and feedback from your students will help you develop them further; but your enthusiasm at trying something new and interesting will help carry you along, in ways that you might actually miss in future years once you feel more comfortable with it!

By the end of Year One, you will have developed an interesting, engaging, integrated inquiry activity for several of the topics you teach each year, and will have piloted these few new things in a low-stakes way.

Years Two, Three, Four, ... Keep doing the new activities you developed in Year One, and add a few new activities for other math curricular topics, in the same low-stakes way, each year.

Students and parents who might have been slightly resistant at first will start to tell younger siblings and neighbours about the cool projects they got to do in your classes. You will be approached by new students each year who have heard that you are an innovative teacher, and will demand that they have the chance to try these great learning activities too. Your reputation will precede you.

Over time, you may refine some of these activities and their integration into your curriculum -- drop or pause others -- and exchange ideas with colleagues in your school, your district and through pro-D days. Eventually, you may want to start a teacher inquiry group in your district, and may find yourself in demand in offering professional development to others as well. You may start to find extensions and variations that help adapt your activities to students who need a challenge or more support, to work with diverse approaches. (And try your best to resist turning an exciting, open-ended inquiry exploration into a routine worksheet!!)

Throughout this process, I suggest that there needs to be a kind of back and forth between your embodied arts-based activities and some version of mathematical notation and diagramming. For example, you may ask students to record what they are finding, and eventually find a way to notate it in a clear and compact form. They might bring their outdoors inquiries back inside, and work with those ideas, applying them to problems and in the course of doing so, learning what is the conventional way of writing it or saying it. The activities and the mathematical ideas and the traditional ways of teaching and learning ought to connect or dovetail well, so that embodied, arts-based work should all be as part of exploring a mathematical idea. It does take some ingenuity on our part as teachers, because there's a limited amount of curricular inquiry of this type that's been developed so far -- but it is growing!

We find ourselves in the forefront of people who are trying out these kind of ideas. We're not the very first ones, but we're in the first decades of the work being done in this area. The contributions of people in this class are important and should be shared as we develop them.

In a nutshell, our task in this course, and particularly our focus this week, is to find ways to use body movement, artistic engagement, collaboration, and getting outdoors with our classes as a means to explore particular mathematical ideas, curricular ideas, and/or enrichment math ideas that we think are valuable and important. And we should do it over time. It shouldn't just be a one-off; we will be able to refer back to these experiences and activities as a shared resource for thinking about a particular mathematical idea. We can try this process iteratively with variations and changes as a way of exploration of our work as math teachers. The written and notational part of it should come fairly naturally out of the exploration so that as you and your students are trying something, you will record it and look for ways to notate it that will be helpful in making sense of the patterns, variations and operations that you are working to understand.

I hope you'll have fun with the activities and the readings and the viewings this week. Let me know what you think about this, and how your course projects are coming along!

Viewing: [Sarah Chase: Dancing combinatorics, phases and tides \(long version 13:35\);](#)

[New teachers riff on Kandinsky in Binary](#) (5:00)

Activity: Please watch both the short films in the "Viewing" section (Sarah Chase and Kandinsky in Binary). Choose one of the activities shown in the films and try it: either (a) Sarah Chase's illustration of moving '3 against 2' (at around 6:00 mark of the film), or (b) Ali and Colin's activity of representing binary numbers as concentric circles with colouring, and doing arithmetic with this.

For whichever activity you choose:

- Try out at least 3 ways of extending the activity to explore an extended mathematical concept with it. (For example, you might try Sarah Chase's activity with numbers other than 3 and 2, and consider why you would choose particular pairs of numbers to explore. For Ali and Colin's activity, you might explore other bases besides base 3, other numbers besides 19 and 7, other operations besides addition, ...) Think about ways that the activity and its extensions might help you explore a mathematical topic through embodied, arts-based activities.
- Use the activity and its extensions (or any other embodied, arts-based activity that you have tried in this program or your classroom) and come up with a **brief sketch of a 'curriculum idea' integrating the extended activity together with more typical math class activities** like writing, using mathematical notation, mini-lectures, problem-solving, etc. This could be considered a starting point in designing a lesson or short unit of work in mathematics for your students.
- Your sketch should be written in point form as a brainstorming 'sketch' that you could fill in with more details later. If it is helpful, you can organize your sketch under headings like the following:
Issues/ Guiding questions/ The story/ Integrating embodied learning & other learning/ Possible extensions/

Readings:

- a) [Dietiker: What math education can learn from art](#)
- b) [Kelton & Ma: Reconfiguring math settings with whole-body, multi-party collaborations](#)
- c) [Riley et al: Movement-based mathematics without compromising learning](#)