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EDUCATION

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Editor's Introduction

Ilan Safft

We are living in challenging times. We are witnessing, almost helplessly, what appears to be the dismantling of the American State and the brutal trampling of the avowed values of a composite nation committed to generosity of spirit and equal opportunity. Meanwhile, overseas, violent wars that seem to belong to a century past continue to wreak immeasurable suffering and destruction.

History teaches us that this, too, shall pass, that after destruction the rebuilding begins, that the long arc places crisis in perspective, that a lesson will be learned.

But when the dust will settle on current events, as dramatic and at times tragic as they are, we will still need to face the greatest challenge of them all, which is not going to go away. In the simple and poignant words of poet Amanda Gorman, already a voice of a young generation, "Climate change is the single greatest challenge of our time" (see her poem "Our Purpose in Poetry: Or, Earthrise" on page 43).

Climate change and its challenges seem to have faded into the background as some kind of a fad that had run its course. Still, even if attention might have waned, or been pushed aside by other catastrophes of our own making, the reality of climate change, of transformed and difficult living conditions, keeps coming at us in accelerated speed. Our task, as Waldorf teachers, remains in essence the same: to keep preparing our students for the challenges of both a personal and a common future. And preparing for the future of climate change might be the single greatest challenge of our profession. This is the theme of the current issue of the *Research Bulletin*.

Cedar Oliver, a "traveling teacher" who has been making his impact on and learning from Waldorf students throughout the country for close to three decades, seizes on this theme in the opening article, "Teen Education in a Time of Climate Crisis."

Who is education for? Oliver ponders while reviewing his teaching of, for example, organic chemistry. How does the role of education shift in adolescence? The insights he provides in this meditation are invaluable:

Around the globe, throughout humanity's long tenure on Earth, the message given before and after puberty has been remarkably clear: Before, we elders are responsible for you. After, you are responsible with us. The rites of passage into

maturity communicate clearly, "This is your world now. You are steward, caregiver, entrusted."

Crucially, in this new stage of life, education is no longer for your benefit.

The context of these reflections, that weave in and out of Cedar Oliver's own teaching experience, both in indoor and outdoor classrooms, is the theme of this issue, how to prepare students for their role, their stewardship, their responsibility. Oliver measures success in this task by the transformation of the students' way of perceiving anew, perceiving differently: an object, a living thing, an ordinary experience. One of these new ways of perceiving, and especially in the context of climate transformation, is that of time beyond the human scale. Oliver induces this new perspective by studying hominid evolution in relation to the climatic changes that posed possibilities and impossibilities along the long way.

This is also the focus of Harlan Gilbert's succinct and meticulous "Arcs of Climate," several pages ahead, where he unfolds, side by side, several time scales of Earth's climate transformations. Demonstrating the complexities of the dynamic system which is Earth's climate, Gilbert places the one that we are very much concerned with—the one of anthropogenic climate change—in a wider context that could open up new avenues for perceiving, thinking, and teaching.

In her elegant article, "Responding to the Climate Change: The Earth as a Living Whole," Marisha Plotnik, a seasoned science teacher and a staff member at the Nature Institute in Ghent, demonstrates from within the Waldorf classroom and lab how guidance is offered to high-schoolers to "know Earth differently." "When we bring students towards a meaningful encounter with observable processes," Plotnik concludes her description of the pedagogical process, "interacting with those processes through careful experimentation, and uniting their discoveries, through thinking, with other dimensions of experience, we set them on the path towards understanding the Earth as a living whole."

Michael Holdrege has recently published an extremely rich resource for the 11th grade biology blocks, the book *Embryology, Genetics, and Ecology: Windows into the Dynamic Nature of Living Organisms* (Waldorf Publications, 2024). In the current issue, Holdrege describes a unique collaboration between science

and Eurythmy in the 10th grade classroom. Grappling with the question, how to concretize for the students large-scale atmospheric phenomena that cannot be directly perceived by the senses, Holdrege turns to Eurythmy's movements and gestures. Recognizing in their Geophysiology class the similarity between certain atmospheric motions and certain Eurythmy letter gestures, the students turn to a choreographed illustration of sky-high natural phenomena through their own bodies. It is hard to overestimate the impact this way of learning can have on students: the literal embodiment of knowledge and the exercise of affinities between one's own individual body and that of Earth in its widest atmospheric reaches.

Caroline Martin, with the experience of teaching middle and high school science in several Waldorf schools and with a doctorate in geochemistry, reflects here on the right balance in teaching climate change and global warming to a generation that is emotionally fragile and jaded at the same time. "Merely teaching the blunt forecasts and grim deductions," Martin writes, "may be as directly injurious to the teenage population as global warming to human civilization." One of her important recommendations in this reflective essay is "that teachers instill in our students today a view of Earth that is robust in its ability to rebound against a backdrop of constant change." While by no means playing Pollyanna, Martin, informed by long-view science and a deep-seated trust in human creativity and resilience, concludes with an optimistic tone: "I take too much comfort in the geological perspective to fully believe Earth is not on humanity's side."

In my own contribution to the conversation, I offer to see the challenge of teaching the challenges posed by climate change as a pedagogical opportunity, just as climate change itself is an ethical-existential opportunity for humanity to come into its best by responding to the call of responsibility. The pedagogical opportunity I discuss in laying out a senior year History main lesson, entitled "Ecological Citizenship," is that of pulling together all the strands of idealism implanted in our students throughout the grades, and encouraging them into the universal mission of this and the following generations. The concept of "ecological citizenship," academically articulated but also intimately resonating, offers an identity variant wherein we see ourselves as part of an ecological whole and take on the challenge of committing to both survival and justice in climate change adaptation and mitigation.

We conclude our offering on addressing climate change and environmental crisis with a reprint of a conversation piece with John Fentress Gardner, a beloved educator and thinker who guided the Waldorf School of Garden City for a quarter of a century, as it developed from a three-grades experiment into a full-fledged

N-12 Waldorf school. Originally published in 1971, as a Myrin Institute Proceeding, this conversation, addressing the question of an environmental crisis before climate change has come into collective consciousness, is still very much relevant today in both its description of the human causes of the crisis and the need for a new human awareness and attitude in addressing it. Gardner advocates for intuitive perception and knowledge of the world, whereby we can recognize beyond the material appearances of nature that which we can also find within ourselves, regaining a human-world affinity that has been lost to a mechanistic, materialist perspective. "Any turning away from intellectualism towards intuitive understanding," Gardner states, "will lead to a renewal of warmth and of conscience towards nature." When we find again in the natural environment "values that match what is intimate and basic in ourselves – we shall find ourselves at home again in the universe."

Later on, Gardner expands:

If we are to find a goal other than material goods, it can only be goodness itself. As Plato said, humankind's real goal is not goods but goodness. Goodness can be achieved only by the free choice and effort of each individual, but it can also be achieved only when the spirit of the whole awakens in each of us.

More than fifty years later, this conversation continues to be helpfully instructive in its outlining of the kind of consciousness, the kind of attitude, and the kind of education that is needed in the time of environmental crisis, the time we are living in.

Following this collection of thematic articles, we turn next to introduce an ongoing research project of the Research Institute: A Qualitative Meta Research in Current Educational Practices. The project aims to review and compile contemporary research on pedagogical topics relevant to Waldorf practices. The Research Institute hopes that these overviews would be helpful to schools, teachers, and parents as we continue to verify the efficacy of Waldorf pedagogy in light of newly acquired knowledge.

Two examples of the Qualitative Meta Research Project are included in this issue: Jason Child's review of studies affirming the various benefits of music classes for all students, and Nettie Fabrie's expansive study of current research on the teaching of cursive handwriting in the elementary grades. We hope that these two samples would pique your interest in the much more that is yet to come.

With great confidence in our ability, as individuals, as educators, as a community, to face all challenges coming our way, we wish you thoughtful, helpful readings.

Teen Education in a Time of Climate Crisis

Cedar Oliver

This article isn't about the past. I'll tell some stories of things I've done with young people in Waldorf high schools, but that's not the point, really. My goal is to offer some "conversation starters"—mostly questions, not answers—focused on the future. How can we, how must we, transform what we're doing as teachers in Waldorf high schools? Is it possible to overcome fatalism and cynicism when observing major world crises with students? If we dare to imagine effective, meaningful positive change, in what directions would we be pointing?

I'll begin with an image, a small true story, then I'll ask your patience as I try to think clearly about what's going on and what might need to go on. Then we'll return to stories, possibilities of how we can work together with young people a bit differently and invite you to imagine new stories with me and with your students. Here goes:

Encountering Reality

A couple dozen post-pubescent young people are shuffling into a science classroom. They gather around lab tables, jostling and joking, some opening notebooks, some not yet realizing they didn't bring a pencil. A fifty-something teacher—that's me—chats convivially with a few of them as they settle. At the teacher's prompting, they quiet themselves and mostly listen as the course is introduced: Organic Chemistry, the study of substances in living organisms.

In your imagination, in our collective cultural expectation, in each student's eager or reticent anticipation, what happens next? What will we do during this coming month? Where? Most importantly, why? Who are the intended beneficiaries of this work together?

I'd like to challenge our customary answers to these simple, obvious questions—including my own. I'd like to invite you, and invite my future students, to notice and challenge their, and my, answers to these questions. My rather bold thesis in this article is that the fate of the world may depend on it.

I tried, in small and large ways, during that 9th grade main lesson block, to defy some cultural expectations. An hour later, the lab you might expect to find us in is

empty. We are scattered throughout the nearby springtime forest, some wet-sneakered by the stream, some dirty-fingered in soil under leaf litter, some running to beckon others to come see their botanical discoveries. We are finding, wondering, encountering the living beings whose inner secrets we hope to learn. We are learning what lives and dies, here and now in this place. I am learning, having boldly placed myself in the position of guide and mentor in an ecosystem that I, as a newly arrived visiting teacher, know little about. We gather, openly discussing and debating whether to kill or try to keep alive the beautiful plants and tiny animals we've met. We decide not to kill animals, but to sacrifice some plants. It's a decision—not everyone, including me, is comfortable with it. We, perhaps unexpectedly, care.

The chemistry we explore, back in our warm and comfortable lab, is almost entirely extracted from these living beings we hesitated to kill, gathered in multiple visits to the forest. We learn their names, their traditional medicinal and practical uses, we learn which of them has lived here for thousands of seasons and which are newly arrived "invaders" competing fiercely at the expense of others for a place in this new home. Should we harvest more of the invaders to save the natives? It's a decision I let the group make.

My hope is that together we encountered reality. My belief is that carbon from the corpse of someone you've briefly loved and sacrificed may teach you something different than what can be learned from carbon from a "thing" or a labelled jar. My experience is that young people seeing a bright flame arise from gases expelled out of a plant they had to carefully pry from soil, trying not to damage its delicate lacy roots, inspires more wonder and more complex feelings than the same flammable gas from part of a dead plant they never really met. No matter how urban or digital or self-centered our lives become, young people still recognize that living beings, the non-artificial world not created by humans, is and will always be Reality with a capital R.

To study the substance of life without joy over each individual living being, or death without grief, may be chemistry. But it is perhaps not the education our world needs of us.

There were tests, writing on paper, sitting in chairs. Vocabulary, concepts, names, even formulas. Tests are about memory. Here's what I hope a young person remembers while taking the test:

When we stood around that tree, and we took a long time to breathe, and we had some trouble focusing on our breath at first but then we imagined our lungs, branch by branch, and saw, branch by branch, how the tree's shape was the same. And the next day when we drew and talked about it, I understood why they both have branches and I liked that. And when we really felt, some of us really did, how our bodies get a bit lighter with each breath, and how the tree is, right now in Reality, taking that little bit of me and making itself bigger, and what was my body is now its body. And how we actually saw that black carbon from that "carbonic air" in the little tree-like plant I collected and brought in, and how I felt a moment of sadness that I had done that to it, and now while we are taking the test I remember for a moment that I am breathing in "vital air," oxygen, from the tree—it's right outside, I see it through the window—and I feel suddenly delicate because without it, if we sealed the tree-breath out, we'd all soon perish.

All these memories make test taking a little harder, as an academic exercise. And they make the actual learning unforgettable. More importantly, we might, on a good day or a good month, get a glimpse of the larger "why:" that education is not for *my* benefit, not to make me smarter or more successful or more wealthy. It's for *us* and for all the living beings we can choose to kill or let live. I need to know their secrets because I am responsible for them. They are, and I am, actually Real.

From Child to Adult

Our picture of what the teen years mean in the story of a lifetime has changed dramatically in modern times. For untold millennia, in diverse cultures around the world, puberty was ritually marked as an entry into adulthood. These rituals held deep meaning for a young person being accepted into adult society, and held deep meaning for their elders as well.

Not only did puberty signify readiness to protect and provide for one's neighbors and family—including raising one's own children—but it also signified a major

shift in what kind of *education* one needed. In a richly diverse array of culturally specific ways all over the world, post-pubescent human beings almost always transitioned from education focused on *learning* to education focused on *doing*. As young adults assumed their new role as members of society, the role of elders shifted from *entrusted caregivers* to *trusting mentors*.

The primary task of a teenager has nearly always been the same: to be *worthy of trust*. This is at the core of what makes a newly-accepted adult a good co-worker, a good parent, a good family and tribe and community member.

Around the globe, throughout humanity's long tenure on Earth, the message given before and after puberty has been remarkably clear: Before, we elders are

responsible for you. After, you are *responsible with us*. The rites of passage into maturity communicate clearly, "This is *your* world now. *You* are steward, caregiver, entrusted."

Crucially, in this new stage of life, education is no longer for *your* benefit. Your education is now for the world's benefit. This fundamental change in the purpose of education has been a nearly universal, cross-cultural feature of entering the teen years for most of history and pre-history.

From Adult to Child

In many cultures today, including mine, all this is very different. Roughly a century ago, coinciding with industrialization, *adolescence* was first conceived as a new stage of life, a kind of rift between childhood and adulthood. Since then, the rift has widened: the early years of adulthood have increasingly been moved into childhood. At the same time, biological puberty has somewhat mysteriously shifted from the mid- or late-teens to early- or pre-teen age. Puberty rituals are less common and less culturally important, often taking on the character of special childhood birthday parties rather than qualifying trials for adulthood.

Educational institutions for teens more closely resemble institutions for children: practices such as apprenticeship or inherited family vocation have given way to continued schooling and delayed entry into professional and personal adult responsibilities. While intellectual maturity, embodied in an expanding list of cerebral skills and ideas for teens to master, is expected

at younger and younger ages, social-emotional maturity is increasingly delayed. Cultural stereotypes of people “high school and college-aged” expect *less* responsible behavior even than children, as if self-centered self-destruction is the natural final stage of child development, before the move on to adulthood.

The removal of youth from adult life has consequences for all of us, and perhaps ultimately for the planet as a whole. Some consequences may be positive: Having children a bit later in life is often good for both the new parents and their offspring. Freedom from the expectation of early motherhood can be hugely liberating for young women especially, and on a large scale has been instrumental in allowing women to more fully participate in diverse roles in society. Young people of any gender who can defy the expectation of self-destruction during their teens and early twenties may have many more richly rewarding options available than in olden days when family tradition often rigidly determined one’s life path. Extended education and delayed adulthood may just be practically necessary given the complexity of many modern jobs.

On the other hand, some consequences may be dire. The energy and idealism of youth are precious resources. Keeping them out of the workplace and sequestering them in school for an additional decade must have effects on innovation and values in those workplaces. Ironically—though not surprisingly—many of the most innovative companies are started and staffed by young people who, defying cultural norms, enter the business world while peers their age are still in school. Likewise, many of the most effective “movers and shakers” in politics, nonprofit charity work, and social change movements are young people fortunate or strong-willed enough to shorten the usual timeline for being able to become fully active in adult life.

Notably, over the same century during which an increasing number of young adults were infantilized and institutionalized out of the working world, life expectancy and thus average working age increased dramatically. People living and contributing longer is of course a wonderful thing. Yet the combined effect has, demographically, amounted to an “elder takeover.” The age at which a new person steps into a leadership role in an established institution has increased to the point

where there is often little hope of advancement other than by the bold, risky act of founding one’s own company. This all has some advantages: wise, grounded, experienced leadership can be a great social good. And of course “older” doesn’t always mean “less creative.” Yet, at the risk of ageism, I would suggest that there are in fact stages to any biography, and the way we think and act later in life often over-emphasizes past experience and under-emphasizes fresh perspectives, especially in a rapidly changing environment.

A Sense of Time

Let’s pause that train of thought for another story. A group of teens, standing shoulder to shoulder, gaze out through tall second-story windows beyond some maple branches, over suburban houses, toward a distant ridge-line populated with buildings. That very second, a bird perches in the maple tree.

Ten seconds earlier, notes a young woman, a breeze riffled through the trees shaking a few more autumn leaves loose. In the last hundred seconds? Some of us had noticed the motion of cars and clouds, of a lone pedestrian in the distance.

A thousand seconds is half an hour. We had all entered the room, the sun moved noticeably. Ten thousand? Night to day, we’d woken and traveled. Imagine gazing out the window for a day, a month, a year, a decade, a century. Farms and greenhouses were replaced by houses, these maples grew from saplings.

Not one tree in sight is more than a century old. We, in our minds, see the ancient forest vanish in a moment of sped-up time. Later, we will discuss how and why it disappeared.

But now, can we condense time even more? Can we imagine the timescale of that ridge-line hill appearing? Some students have heard about the glaciers that carved this valley, how great ice rivers rolled and smoothed the boulders we play on in the

park. Ice a mile deep, still receding as humans first come to hunt the great roaming mammals of this cold, cold place.

There is power in looking, and wondering, even when nature has been largely overrun by a human-made artificial environment. How old are the things we see? Are

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there any signs of what came before them? Are there a few Old Things left to tell their stories?

We go out the next day with cameras and try to photograph time. This beautiful spider with raindrops on its intricate web—how long has its kind been living here? This church was built in what year? How far away in space and time did these paving stones come from? How long will this tiny creature live? Can we come away, after wondering over one another's discoveries, with a lasting sense for perceiving a thing's shape in time as clearly as we see its shape in space?

My number one goal every day when teaching, the single criterion by which I judge success, is the transformation of *how we perceive*. If one everyday object or living thing or ordinary experience—in the perception of the students—is forever different after today, our time together will have changed us forever. Anything less than that, as a goal for educators, is aiming way too low.

Young people observing photos or models of hominid skulls from millions of years of evolution, trying to see the differences, must imagine a time when five or six different human-like species shared a world. Looking at a million-year temperature graph, one cannot help but shiver: Suddenly and totally unexpectedly, our increasingly hairless ancestors' warm world turned into an icy endless winter. For a hundred thousand years, we see ice ages coming and going—the next, ominously overdue.

Giving young people an experience of time beyond limited human scale is a great gift, not only to them, but to a world that needs us to see beyond the next fiscal year.

Global Crisis

Businesses, governments, and charitable organizations, during the century in which we've increasingly excluded youth, have grown to become global in scope. A decision at one corporate board meeting can have effects on multiple continents affecting millions of people and vast ecosystems.

One could make quite a study of how the rise of multinational corporations and industrialized nation-states, coinciding with the recategorizing of young adults as

adolescent children, has played out in terms of the ideals embodied in those organizations. What is clear already, without much analysis, is that young people feel frustrated and unheard, as our world faces unprecedented global-level crises deeply entwined with these new massive global power structures.

Arguably the greatest of these is industrialization's impact on climate worldwide. If not an existential threat to the human species, rapid climate change is at very least a direct threat to millions of species of living organisms as well as billions of individual human beings. Yet somehow as a global society, we are seemingly paralyzed—or actually the opposite of paralyzed, stuck in a manic sprint of fossil-fuel powered frenetic activity with no ability to collectively slow down.

That said, there are many efforts to solve this enormously challenging set of problems. Technologically, we humans are more than clever enough. And plenty of people truly care. Most of the vexing roadblocks have to do with the politics of profit or misperceptions of economic benefits.

In progressive educational circles, we are engaged in much collective handwringing about how to do something helpful for our world, and how to engender hope rather than despair when informing students about the state of it. Surely sharing some of the positive efforts going on has to be part of our role as teachers.

In reading this far, you've surely gleaned my sense that global problems are exacerbated by deep systematic issues in education, including Waldorf education, and we ought to be facing and fighting them. This has at least as much to do with our hidden assumptions about human development as any particular "curriculum content."

Yet there are also more obvious and direct ways to address the global climate crisis that do connect to the overt "content" we teach. Young people do need to actually know what's going on in the world, what solutions are being worked on, and what obstacles seem to be most stubbornly in the way. That doesn't always have to involve going outdoors to encounter natural Reality, or transforming perception in the feeling-imbued ways I've alluded to. As an example, here's another tale from a class of 17- and 18-year-olds.

A Numbers Game

So imagine that you, rather than being a senior in high school, are a top Chinese official in charge of energy. You get to choose the mix of renewable and non-renewable energy sources to meet your nation's future needs. What decisions do you make? On what basis do you make them? Can you reduce pollution and global warming and still provide enough energy for your citizens to prosper? If so, how fast?

Using real-world data on energy sources, each student uses a spreadsheet to adjust the mix of natural gas, oil, coal, hydro, wind, solar, and nuclear energy development. Each has its own timescale, environmental impacts, and costs when building plants. You have vast government funds and near-absolute power to do what you decide (benefits of a totalitarian government!). So the problems are easy to solve, right?

Conversations between young, idealistic people given this heady power are fascinating and show a consistent progression over time from naively trying to build a billion solar panels or wind farms to realizing the complexity and trade-offs of the situation. Invariably, there comes an “aha!” moment when you suddenly understand why natural gas is “having a day”—large investments in natural gas turn out to be the only way to get a quick change away from the coal-dominated status quo and “buy some time” to build out a more sustainable energy future while immediately lowering pollutants and greenhouse gas emissions.

Outwardly, this type of exercise, where young people stare at abstract numbers on a computer screen, is the exact opposite of a feeling-imbued direct nature experience. However, it carries a quality of trusting young adults with decision-making powers. There is not a “right answer,” but instead they become quite invested in comparing various approaches and compromises, arguing earnestly about the trade-offs and benefits. When you are in the room with people doing this, it feels important and definitely meets the criterion of changing how they perceive and think about energy and environmental issues.

It's worth noting that preparing this kind of exercise is a quite different learning experience for me as a teacher, as well. I'm not “teaching” something I “know,” but rather gathering information I don't know, trying to empower young people to make big (simulated) decisions. There is always debate, well-founded, about whether I'd set up the spreadsheet in as realistic and accurate a way as possible, and after that debate I always find a better way to set it up next time. Even

updating it with current data for another group always educates me on new progress, issues, and trends. Something about this process feels more like working alongside responsible young adults with respect, rather than dictating “learning” to children.

Who Do You Work For?

A disturbing analogy that often comes to mind for me: If the kindergarten was on fire and the fire department couldn't come because the road was washed out, would I continue this class? Of course not. Without hesitation, the teens and I would rush to help the kindergarteners as best we could.

In the midst of global crises (climate being only one, I'm sure you have others on your list), teaching The Usual Subjects often seems like continuing a quiz while the kindergarten burns. The subtext is clear, even if not stated: Your efforts, young people, are not needed right now. Furthermore, my efforts are not needed either.

We teachers can work hard (as we all do) to convince ourselves and our students that today's lesson and homework are so very important that it's worth taking a workweek worth of person-hours away from other tasks that these energetic, idealistic, competent and insightful young people could be doing to help the world. But are those really clothes that the Emperor is wearing?

We ask ourselves real, important questions like, “How do I include climate change in my curriculum?” and “How do I inspire students instead of depressing them while honestly educating about big problems?” The subtext, or perhaps the actual “main lesson” is that we can't actually do anything *or we'd be doing it right now*. Is this genuinely true? If so, how did we get here and how do we get out of here to help with the fire?

I think these difficult-to-face questions take us back to a fundamental one: Who is this education for? We as teachers and students do a lot of work, literally human lifetimes worth of people-hours. Who are we working for?

I hear a culturally ubiquitous, loud and clear answer in the independent Waldorf schools where I work as a traveling teacher: The individual student. Parents and donors pay money with loving faith that our institutions will give each precious child a leg up in life, an advantage over the teeming masses in a competitive world.

The message to a young person is relentless: “You are worthless to society now and are not yet accepted into it. But you must learn and gain all you can from school,

and this great gift to you will result in your success and happiness in the future. Your focus must always be on yourself, your own individual knowledge and skills and grades, getting all you can, getting more than you feel like you can, getting more and more next year and the next. Get all you can now so you can choose a college that will give you all you want and then, some day you can't quite imagine yet, real life will begin and you will get even more—all you want and all we want for you. Because, despite your current worthlessness, we love you and want the world for you."

In Waldorf schools, we are earnestly striving with all our hearts to provide an alternative to the mainstream idea that education is a cerebral hot-dog-eating contest, with the grand prize being a lifetime supply of hot-dogs. "Education through the arts" aims to at least balance massive intellectual consumption with a healthy dose of creative production. To use a more Waldorf metaphor, the arts can be the out-breath to an asthma attack of continual academic in-breath.

Even the arts, however, can easily be subsumed into the cult of individual selfishness. Am I actually making and doing for *someone else's* benefit, for the world and not myself? Am I performing for the audience's benefit, or is the audience just people who love me, who are viewing my art and performances for my benefit, to celebrate what a good job I did?

The next story, the last one I have to offer here, is one I ask myself these questions about. It's about an attempt—with questionable success—to do something at least a little bit for the benefit of the community.

Sharing What You Love

One definition of art is sharing what you love. The first step in the process is falling in love.

I recently fell in love with a little trail through some trees behind a Waldorf school. I spent a lot of time there with two groups of teens, 9th and 12th graders. We spread out along the trail, hoping to see who lives there. Sitting for a half hour at a time, looking, listening, is hard work. We tried together to see what sort of habitats this place had. We marked the trail with flags, so each student could go back to exactly the same spot repeatedly. We let time pass—still hard work.

There are stages to this work. First, nothing seems to be happening. Soft wind sounds over a late-summer-green and autumn-brown colored stillness. My own busy mind is all I can perceive. Trying to draw what I see sometimes helps quiet me, centers my gaze outward.

Then, the first miracle happens, at a different time for each person. The Reality of something alive penetrates my perception. A spider's staccato walk, then she leaps, trailing silk. She has eight eyes, golden stripes. Or ants spiral up a vine to a final tender newborn leaf unfolding. And there, grey dots... or are they something... tiny creatures! The ants wave their antennae over the aphids, then an ant puts its mouth on the aphid's back. Or here, beneath a leaf just in the surface of the soil, white shapes wriggling among the little lobster-like roly-polies... Or, how did I not see the rabbit before, when she was seeing me the whole time? Suddenly the featureless nothing-happening world has one small bit of life, then is, shockingly, full of life. Sketchbooks and cameras and poetry journals are active as previously unseen marvels unfold.

The next stage is also predictable: So much becomes seen that I am overwhelmed. How many species of plant are in this square meter? How many kinds of insect have we seen—how can there be more and more every time we go out to look? Don't ask me who eats what, or what all these creatures are doing—how could I ever even begin to know? I need to block some of it out, this place is so thick with life and complicated it's impossible to wrap my mind around it.

Then, with time, the second miracle: *I'm starting to know something*. This is a jumping spider, eyes in front, far from a web, while this other spider waits, barely visible in its web—always in the ivy, never on any other plant. The ants are farming the aphids, drinking their sweet excretions, protecting them from predators. The thicket habitat has these plants and animals, the woody shrub mid-story these others, the canopy its own world.

Each of us finds something, someone, we have started to love. There are quizzes on identifying types of plants and animals. We now feel we know them well: A student notes that everyone obviously got everything right, so why did we even take the quiz? (It's a fair point.)

So together, we make a guide to this trail. The 9th

In the midst of global crises (climate being only one, I'm sure you have others on your list), teaching The Usual Subjects often seems like continuing a quiz while the kindergarten burns.

graders each make a section of habitat map for the small place they've spent so much time, coordinating on the design and colors, including advice for visitors on who they might find and where to look, what to notice. Our fold-out trail map has poems and microscope drawings and photographs and sketches for each place on the trail. The 12th graders each write an article, illustrated with photos, with in-depth studies of the spiders or trees or worms or caterpillars. As editor, I help the groups design a guidebook, and we make it available to the school community. It means something, maybe, to know it will be read by many people, and that perhaps some of these readers may feel a little of our love for these beings and this place.

Answers?

I want to be direct and honest here: As promised, I've shared more questions than answers... perhaps *no* answers? In none of my stories have I revealed how a small group of teens with an adult or two can solve massive endemic political roadblocks to climate action, or even systemic problems with how modern cultures educate teens.

What I have tried to reach toward is a different way of seeing, a small shift in perception, that might stay with us and alter how we work with young people. I truly believe, and invite you to try on the idea, that we can and should mentor youth differently. We can do better by them, and more importantly, do better by the world alongside them. Some targets, while not easy to bulls-eye, are worth aiming for:

- Encounter non-human-created Reality together. Spend time there.
- Experience time beyond the human scale, and learn to see the shapes in time around you.
- Be clear that our work together is not for your benefit. It is for the world, which needs you.
- Question infantilism. Can we, even in small ways, un-sequester and take responsibility? Show teens that the world does need them, and entrust them with acceptance into society.
- Learn together about the big problems and big possible solutions. Practice nuanced, complicated, compromise-based decision-making and problem-solving.
- Counterbalance individualistic, self-centered intellectual consumption with collaborative, other-centered artistic production.
- Fall in love with a place and its life. Share your love

with an audience, for their sake not for yours.

Doing all these may not solve much, on a global scale. But not doing these, and not asking the kind of questions I've tried to raise here, will certainly perpetuate big problems on every scale.

Waldorf education came into existence explicitly to prepare the soil for a spiritually healthier future for humanity, arising from deep insight into human development. Let's take that mission seriously enough to earnestly question our own cultural understanding of what it means, or can mean, to be a teenager today.

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Responding to Climate Change

The Earth as a Living Whole

Marisha Plotnik

Climate change is now a presence to be reckoned with. Waldorf teachers in different schools and working with a variety of ages and subject disciplines are actively striving to respond. At the Nature Institute, we are answering this call with a series of colloquia for teachers in the natural sciences. During the first two of these gatherings, in summer of 2023 and winter of 2024, participants formed and worked with the shared picture that, as Jon McAlice writes in his report on the first colloquium, “climate change is not something that can be ‘fixed’, but rather challenges us to learn to know Earth differently.”¹ One aspect of this different form of knowing is an experienced understanding of the “Earth as a living whole.”² This work continues, with the next colloquium taking place in February, 2025, – after the time of this writing, but prior to its publication.

Learning to know Earth differently calls for not only new concepts, but also for a methodology appropriate for living beings. I refer here both to the human beings engaged in the teaching and learning but also to the more-than-human Earth, understood and studied as a living whole. This methodology must recognize both the profoundly relational existence of living beings – that is, existing in co-dependent relations with what is immediately observable and with what is hidden from view – and also the essential nature of beings as *processes* rather than as mere objects.

In this article, I first trace the conceptual development among contemporary biologists towards understanding living beings as profoundly relational, co-creative processes. I then describe concrete examples of practice, first as a researcher coming to understand the Scarlet Oak outside my window, and then as a teacher of high-school age students learning to understand combustion. In both cases, we work with direct observation, respectful experimentation, and a continual weaving together of our prior knowledge and lived experience with our work in the present moment. It is this methodology of working, more than arriving at one specific concept or another, that offers the possibility to understand the Earth as a living whole.

The concept of a “living whole” is not easy to define; what is a living being anyway? In their 1980 book, *Autopoiesis and Cognition: the Realization of the Living*, biologists Humberto Maturana and Francisco Varela coined the term *autopoiesis* to describe the self-sustaining quality of living beings.³ When my body is healthy, I am able to receive into myself substances external to me – the food I eat, the water I drink, the air I breathe – and transform them into my own bodily substance. My body is renewed through these processes in such a way that my own integrity is preserved: I am still myself even as cells in my body die away and are re-created out of fresh materials. This is the body’s self-sustaining quality.

As important as the self-maintenance of my own physical organism is my organisms’ relationship to the surrounding world. The concept of *sybiosis* reflects the mutual benefits that organisms gain through their interconnections. You may have learned in school that the nitrogen-fixing bacteria that infect the roots of legumes are there in a symbiotic relationship with the host plant. We may dig up a wild clover and note signs of infection on it: little white spots like pimples on skin. These spots signal the presence of bacteria that transform nitrogen from the air into a form that can be metabolized by the clover, and which in turn receive sugars and starches from the roots of the clover plant. In this description, we are presented first with a pathological description of the meeting of two organisms – an “infection” – and then with commodified exchange between clover and bacteria: they are separate but have come together in a mutually advantageous economic exchange. But this is a human social construct that we are imposing onto beings that are not buying and selling anything in their co-dependent existence; this concept of symbiosis is insufficient to describe how deeply life is interwoven in a manner that is neither pathological nor economic.

The feminist theorist Donna Haraway adopted the term *sympoiesis* to characterize not only interconnection through exchange, but indeed the profound *interpenetration* of living beings:

1 Jon McAlice, “Addressing Climate Change in Education,” *In Context* Fall 2023.

2 Ibid.

3 H.R. Maturana and F.J. Varela, *Autopoiesis and Cognition: The Realization of the Living* (Dordrecht: D. Reidel, 1980).

Symposiosis is a word proper to complex, dynamic, responsive, situated, historical systems. It is a word for worlding-with, in company. Symposiosis enfolds autopoiesis and generatively unfurls and expands it. . . . Another word for these symposioteic entities is *holobionts*, or, etymologically, “entire beings” or “safe and sound beings.”⁴

Reading Haraway’s surging, vibrant, messy prose pulls one away from the tidy boundaries our rational consciousness imposes upon the continuity of existence. Even as we pull things apart, separating and analyzing in our efforts to understand the world, Haraway demands that we acknowledge what we have lost in the process. No being is ever separate from other beings but rather actively “worlding-with, in company.”

Coming from a different perspective, that of an evolutionary developmental biologist, Scott Gilbert also works with idea of the holobiont. In an article from 2024, he notes that at least half of the cells in our adult human bodies cannot be traced to the zygote formed in our mothers’ wombs: equally “me” are a host of micro-organisms essential for the healthy functioning of my body. Gilbert writes:

Organisms are now seen as holobionts, consortia of several species that interact metabolically such that they sustain and scaffold each other’s existence and propagation. Symposiosis, the development of the symbiotic relationships that form holobionts, is critical for our understanding the origins and maintenance of biodiversity . . . these bacteria, fungi, protists, and archaea are not just travelling in our body and sharing our food. They are critical for our healthy physiology, development, and immunity.⁵

From self-sustaining, to mutually reliant, to “worlding-with,” we can trace an evolution of the concept of “living beings.” Indeed, one might ask, as Craig Holdrege does, “Where does a living being end?”⁶ When I pause to consider the natural environment, the built environment, the social fabric into which I am interwoven, it becomes increasing difficult to point to a boundary between one being and another. As Holdrege proposed in an opening lecture at the 2024 *Evolving Science* conference in Dornach,

I want to highlight more radically the nature of relational understanding. We can say: an oak tree grows out of an acorn; a plant grows out of its seed. That seems self-evident. It is correct, but it is also wrong. What’s missing is the other half. We also need to say: The environment becomes the oak through the acorn. If we can’t think those two together, we don’t have the living world, the etheric world.⁷

If we pause to think this thought concretely, we must form a picture of what actually takes place in the formation of an oak tree. Approaching the Scarlet Oak at the edge of the small meadow near my office, its many broad leaves, conveniently at eye level, call my attention. Right away, I notice that the top surface of the leaf is entirely different from the bottom surface. Particularly at the end of summer, the top surface of this scarlet oak leaf is very deep green and waxy: scratching my nail along its surface will cause the wax to come off in hard, transparent flakes. The underside of the leaf is entirely different. Much paler in color, it is tender in texture and without wax. On this underside the veins of the leaf are clearly evident in raised ridges, the largest of which is the central mid-rib, and then branching into side ribs that reach to the end of each lobe and into a network of finer and finer veins that trace a lacy network through the entire surface of the leaf. It is on the large veins that I can see, here and there, that galls have formed: little, hard, red growths shaped like berries with a flat cap. I learn that these are the co-creations of the tiny gall wasp and the oak tree; evidence that this tree is intimately connected with a world of insects that I have not perceived.

Meeting this tree in this way, situated in its own context, draws me into a relationship with this living being, just as the oak is in continual relationship with a multitude of living beings, of which the gall wasp is only one. At the same time, the gradual coloring of its leaves is only the most obvious sign that this scarlet oak is a continual process. This tree is no longer merely an object in my field of view, but it has begun to mean something to me; I want to know more about it. If we are to respond to climate change appropriately, we will need to have this same attitude towards the living Earth.

Now I have the right mood for respectful experimentation. Taking a leaf from the tree and into my laboratory, I can cut a cross-section and place it under the

4 Donna Haraway, *Staying with the Trouble: Making Kin in the Chthulucene* (Durham: Duke University Press, 2016).

5 Scott F. Gilbert, “Inter-Kingdom Communication and the Symposioteic Way of Life,” *Front. Cell Dev. Biol.* 12 (2024).

6 Cf. Craig Holdrege, “Where Does an Animal End? The American Bison,” in *Seeing the Animal Whole - And Why It Matters* (Great Barrington: Lindisfarne, 2021).

Also available as a Podcast, including a conversation with the author, through the website of The Nature Institute: natureinstitute.org

7 Craig Holdrege, “Symposiosis: From Thinking About to Being With,” *Wochenschrift für Anthroposophie* 8 November 2024:12-14. Available on the Goetheanum website: dasgoetheanum.com.

microscope.⁸ Now I see the distinction between the top surface, the bottom surface, and the veins of the leaf further developed in the cell structures, which I can see under the microscope. The top layer of the leaf, the palisade mesoderm, shows tight, regularly arranged columns of cells. The bottom layer, the spongy mesoderm, shows irregular islands of cells, loosely arranged with air between them, and right on the edge of the leaf an opening, the stoma. In the middle, the veins reveal two different kinds of cell structures – the xylem and the phloem – through which substances are transported into and away from this leaf.

So now I consider what I know about the oak tree. Here, through this upper surface, light penetrates into the leaf. Through this bottom surface, via the stomata, air enters the leaf and circulates among the cells. Through the xylem, water and minerals are transported from the ground through the roots, trunk, branches, and twigs into the leaf. Here, in this leaf, air, and water unite through the agency of the light to form the very substance of the tree. Through the phloem, sugars and starches are carried away from the leaf into the other parts of the tree.

It is not simply that, through some process of accretion and elaboration, that which is contained within the acorn unfurls itself into an oak; I must also recognize how, through the acorn, the surrounding air, water, and light, are transformed into the oak tree. This is a powerful thought to inhabit, and now I work to extend that thought over the entire Earth, imagining the dynamic interplay of elements and forces that manifest as living beings.

Teaching and Learning

Surely, a true imagination of a living Earth, an imagination essential for a healthy response to our changing climate, must encompass these qualities of profoundly interconnected, dynamic processes that are living organisms. As educators, we can develop the necessary capacities for that imagination in our students.

For young children, it is direct experience that is the key. As McAlice describes, “Young children who are given the opportunity to experience the natural world directly through meaningful activities can grow to both

trust nature and to keep a sense of wonder alive for the beauty and mystery that we find in nature. Being with adults who care for Earth is essential.”⁹ He goes on to describe that as young people reach the next stage in their development, typically around 7th grade, a new approach becomes necessary. It is especially in the 7th-

10th grade span that careful study of observable processes – the practice of science – is essential for the development of just this picture of a living Earth.

As Waldorf teachers are well aware, an education in science that only presents facts to be memorized or models to be manipulated distances us from the world. When processes are reduced to only schematic marks on the page – think of the Lewis dot structures of your organic chemistry courses – the

world becomes a collection of dead objects that can be easily manipulated but lie impossibly distant from our lived experience. The view that scientific understanding must include attention to sense experience is by no means limited to Waldorf education. *The Blind Spot*, published in 2024 by MIT Press, begins with an eloquent description of the hazards of a mechanistic, reductionist science, including the bias towards what the authors term “smallism” – the mistaken belief that tiny things (the proton, the electron) are somehow “more real” than the original sense experiences from which these concepts were derived.¹⁰

When we bring students towards a meaningful encounter with observable processes, interacting with those processes through careful experimentation, and uniting their discoveries, through thinking, with other dimensions of experience, we set them on the path towards understanding the Earth as a living whole. Taking phenomena from the physical sciences – chemistry and physics – allows us to ethically engage with processes that are much more transparent than the complex and hidden processes of biological beings. We can identify physical and chemical processes that have this quality of dynamic transformation: studying them on a small scale, in the “scientific workshop,”¹¹ not only enables us to understand these important processes in their own right but also develops the skills and capacities we

9 Jon McAlice, “Addressing Climate Change in Education,” *In Context* Fall 2023.

10 Adam Frank, Marcelo Gleiser and Evan Thompson, *The Blind Spot: Why Science Cannot Ignore Human Experience* (Cambridge, MA: MIT Press, 2024).

11 This is the phrase used by *The Blind Spot* authors to describe the space of the laboratory experiment.

8 Much gratitude to Henrike Holdrege for teaching me how to do this.

need for coming to an authentic understanding of a living Earth. One recent experience I had teaching tenth graders will illustrate what this can look like.

Combustion

The motivation to look carefully at the process of combustion arose when, using a Bunsen burner to warm water, one group of students had its flame adjusted in such a way that the whole beaker was quickly covered in a thin, dry, black coating. What was it? We were able to wipe it off easily, so it did not seem to be a transformation of the glass, rather a deposit of some sort that had come from the flame. Indeed, the moment the golden yellow flame touched the glass of the beaker, this black substance appeared. One student suggested it was chalk – it had that dry, powdery feel, but we know that chalk is white. Another suggested it was soot – the same substance that blackens the inside walls of an open fireplace – and quickly others chimed in, remarking on its similarity to the charcoal sticks they use in the art studio and to the charred wood left over after a campfire. We remembered that soot is a form of carbon and recalled the many forms in which carbon appears, including as graphite in pencils and as diamond. But why had it appeared from that Bunsen burner and not from the others?

As a teacher, one does not always see it as possible to seize such moments as opportunities for inquiry. There is content to be covered, a lesson plan to follow: under other circumstances I would simply have told those students to adjust their flame properly – turning the little ring to admit more air – and moved on with what I had planned. Indeed, I had planned to take the course in an entirely different direction for the next six weeks. But there it was: the chance to look closely at something that had caught our interest, just as the Scarlet Oak outside my window had captured mine. We needed to study combustion.

Before the next lesson, I carefully prepared the classroom space, separating the desks so each one could be a little island of concentration, pushing the extra desks against the walls of the room, and lowering the shades on the windows.

The students entered in their typically friendly, boisterous way, chatting and joking with each other. They gathered around my table, each one getting a candle

and fixing it firmly in a holder. Then, each student sat down in his or her own space, and I turned off the room lights. I asked one particularly tall, fidgety, restless boy to take his candle to the lab room down the hall and light it, then to bring back the lit candle. The matches should stay in the lab, I directed.

As that single candle flame was carried into the darkened classroom, the entire room fell silent: quiet expectation filled the space. I directed one student to light her candle from the single flame that was brought into the room, and one by one each student took a turn to light theirs. Without admonition or instruction, these lively tenth graders had entered into a mood of reverence, and they spent the next twenty minutes in silence, simply writing down observations of the burning candle. We had established the right conditions for a meaningful encounter with combustion.

Studying the candle over the next several classes, we moved between engaged observation, experimentation, and bringing in what we knew about the candle from other sources. In another observation exercise, the students worked with watercolor paints, trying to match the colors that they saw in the different regions of the flame, including a particular golden yellow and an elusive blue. In the laboratory across the hall, they experimented with a metal spoon to investigate where exactly in the flame the soot was produced, with a bent piece of glass tubing to siphon off a heavy white vapor from a different part of the flame, and with a glass jar placed over the top of the flame to catch a clear, wet condensate. Each different substance was a delightful discovery. That white vapor could be caught in a tiny test tube, where it soon hardened into wax, while the clear, wet, condensate was something entirely different again – like your breath on the window, one student described, or the steam from your shower when it hits the cold mirror: water for sure.

What knowledge did we have of the paraffin that was fueling the flame? It is a hydrocarbon, and the class recalled what they had learned about hydrocarbons in their chemistry and earth science main lessons. Organic material, falling to the ground millions of years ago, covered by sand and rock until it was deep underground and subject to tremendous pressures of heat and temperature, transformed into what we call fossil fuels, then pumped out of the ground as crude oil and

Without admonition or instruction, these lively tenth graders had entered into a mood of reverence, and they spent the next twenty minutes in silence, simply writing down observations of the burning candle.

refined into the paraffin wax of our candles.

Gradually, all of these aspects of their work with the candle—observation, experimentation, and received knowledge—began to unite both in each individual student and in our collective work as a class. Each time we revisited our burning candles – over the gaps of days between classes – the recollection of these different aspects began to develop an imagination in the students of an amazing process of continuous transformation. Before our eyes, solid paraffin became a liquid in the cup at the top of the candlestick, a vaporous substance we couldn't see directly, but which we could catch if we interrupted the process, and then into invisible gasses: water on the one hand and carbon dioxide on the other.

In our own human bodies, a delicate form of analogous transformations take place; we can bring our awareness to the food that we eat, the oxygen-rich air that we inhale, and the water and carbon dioxide-rich air that we exhale, knowing that the internal processes of digestion and respiration are largely beyond our conscious awareness. As with the oak leaf, we are called upon to unite what we can see directly with what we can confidently infer and what we can only imagine to re-create a meaningful whole. So does our changing climate call us to reimagine Earth, in its visible and invisible aspects, as a living whole.

There is no end to these imaginations over space and time – thoughts of a closed loop or isolated cycle are inadequate to the task; we must also, for example, imagine the vegetation across the entire Earth taking up water and carbon dioxide and exhaling oxygen. There is nothing new in these ideas, but it is easy to reduce them to abstractions that can be manipulated as equations for combustion and photosynthesis, thus putting an end to our active engagement with our lived experience. Instead, concretely picturing all of these processes happening continuously across the globe, grounding them in our own experiences of the humble candle and a single oak leaf, can open up further generative questions about global processes.

Our February 2025 colloquium at the Nature Institute will include a close study of moisture. What is its relationship to temperature on the one hand and to pressure on the other? We will look closely at these processes both outdoors – frost forming on the edges of fallen leaves, melting to droplets and evaporating in the winter sun – and in the laboratory. The pressure differences resulting from evaporation and condensation are powerful forces, and essential ones for an

understanding of climate; studying together through observation and experimentation is always central to our methodology at the Institute. We will also imagine together what could serve as exemplary topics to take up in a tenth grade main lesson block on climate towards an authentic experience of the Earth as a living whole. I look forward to reporting on this further work.

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Geophysiology and Eurythmy

Michael Holdrege



As they move into their high school years, Waldorf students become increasingly aware that all matters involving the environment are embedded in urgent questions around climate change and the role that humans play in it. In the 10th grade geophysiology/meteorology block, for example, they learn about the increases in global surface temperatures over the past half century and how greenhouse gas concentrations have risen constantly since the advent of industrialization, and that they continue to do so. In conjunction with their study of ocean currents—and their effects on global heat distribution—the students learn about ocean warming, ocean acidification through CO₂ absorption, sea ice melting, coral reef bleaching, and rising sea levels. They take note of how extreme weather-related phenomena—such as exceptional heat waves, drought, wildfires,¹ flooding, etc.—have become more and more common in recent years.

In connection with their studies of the carbon cycle, the students become familiar with prevalent views that seek to address the challenges of anthropogenic climate change by phasing out fossil fuels and moving to various forms of renewable energy. Beyond this, the 11th grade ecology block addresses—among many topics—another aspect of decarbonization that has a huge significance for biodiversity. The students learn not only that we need to leave more carbon (coal, oil, and natural gas) in the ground, but that we need to leave it in the biosphere as well—and to increase its levels there. What that means is explored in connection with one of the greatest environmental crises of our time: the devastation of huge expanses of the Amazon Rainforest for logging, mining, and agricultural purposes. After describing the degree of destruction and its impact on the global climate, we look at the value of these forests in and of themselves as the most diverse terrestrial ecosystems on the planet. But the issues don't stop there. It is very important for the students to be made aware of the difference between merely protecting an environment (conservation) and rejuvenating it—returning it to the kind of vitality and diversity that it once had, and maybe even beyond that.

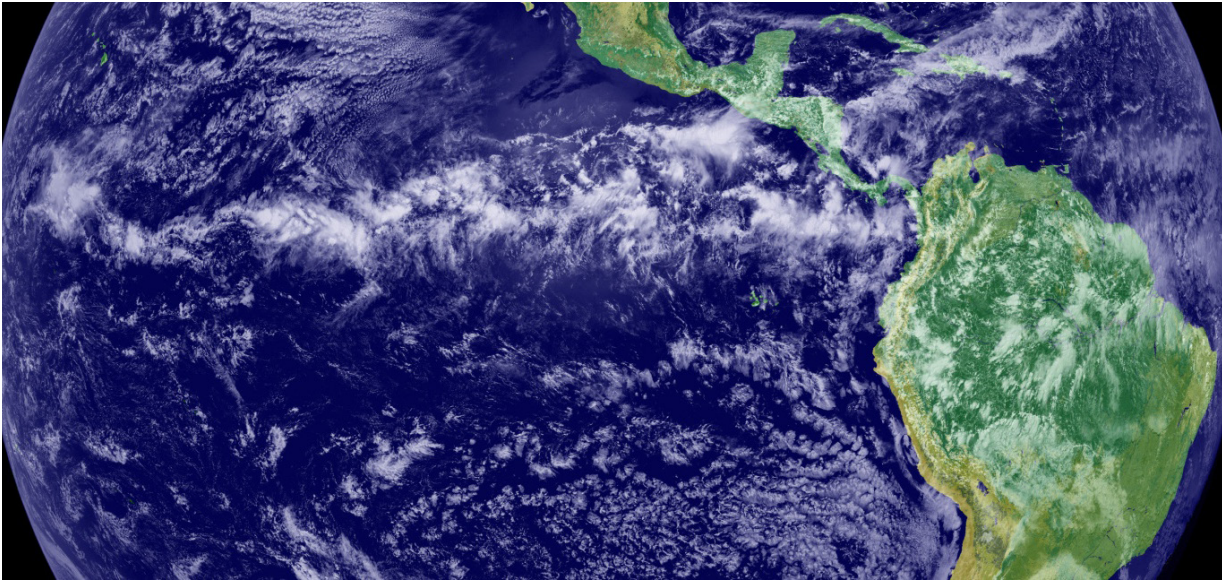
This perspective takes us to the amazing discovery—still unknown to most people—that the lush and bountiful Amazon region did not come about by itself. Human activity over thousands of years played a key role in shaping the biodiversity, distribution of wildlife, and environmental health in Amazonia. The students learn how indigenous peoples, through very refined methods of agro-ecology that they have practiced for centuries, have been able to alter and manage ecosystems in ways that have significantly increased their biodiversity. They learn how individuals fighting for the rights of indigenous peoples have helped them take back control of millions of acres of Amazon Rainforest. How the “Andean, Amazon, Atlantic Corridor Project” has partnered with Indigenous communities, NGOs, and national governments to create the world's largest ecological corridor, that stretches from Columbia across Venezuela and Brazil to the Atlantic Ocean. This project gives the students a sense of whole new possibilities that involve not only stopping ecological devastation, but of developing—with the help of Indigenous wisdom and commitment—new ways of rejuvenating the environment and influencing climate change. These topics speak strongly to the students, who are seeking in their youthful idealism for large and worthwhile goals that can help heal and renew our challenged planet.²

As a way of warming up the students to these “burning” issues, I have found it valuable to “get them moving” first. In this short contribution, I would like to illustrate how bodily movements help students connect with—get a feeling for—large scale phenomena in nature that are not directly perceptible to the senses. Through the recruitment of certain movements familiar to them through their Eurythmy classes, we help them develop a more concrete sense for certain patterns that are central in the geophysiology of the entire Earth.

After learning about the solid earth beneath their feet and how it came about in the 9th grade earth science block, they move on in the 10th grade to the much more dynamic phenomena of geophysiology (atmosphere, oceans, etc.). One of the unique characteristics of this realm of nature is that, in many instances, we do not stand over and against something with defined

1 For example, the *New York Times* (Sept. 22, 2022) reports that researchers have found a 27-fold increase over the past decade in the number of people experiencing an “extreme smoke day”—which is defined as air quality deemed unhealthy for all age group—caused by wildfires.

2 For much more on how these issues are addressed in the 11th grade, see Holdrege (2024).



Band of clouds that circle the Earth near the equator (Source: <http://earthobservatory.nasa.gov/IOTD/view.php?id=703>)

boundaries, but rather we experience ourselves within it. When we say “it” rains, “it” is snowing, we are expressing our experience of something that is happening, a process that does not have tangible boundaries for our direct experience: it is happening over a large area, one that, as it turns out, encompasses the entire earth. Within this macro-process, there are spatial and temporal patterns, with interacting meso- and micro-processes embedded within these. One way to introduce this planet-encompassing realm is to look at images of the Earth where there appears³ near the theoretical line known as the equator a white girdle of clouds, a shining ring around the planet that is set against the dark oceans below.

What is creating this cloud girdle? The path of the sun, of course. When overhead, its rays warm the Earth more intensely than they do when passing through the atmosphere at a more oblique angle. The hot tropical air rises with vigor, which, in turn, draws air in to replace it. In this way, winds are pulled from the Northern and Southern Hemispheres toward the equator for several thousand miles. Laden with vapor swept up from the sea, these winds converge at the equator, causing them to switch direction from the horizontal to the vertical.⁴ Rapidly ascending, this hot tropical air cools as it rises. The moisture it carries begins to condense and clouds arise in an Earth-girdling ring of white. As it moves slowly along its westward path, this ring of moisture undulates north and south following the solar

seasons. Passing over land masses along the way, these clouds release great volumes of rain, giving birth in the process to the rainforests of the Congo, the Amazon, Southeast Asia, and Indonesia.

But the story does not end here. The rising air is not able to descend with the moisture it releases, since more air keeps pushing upward from below. At the top of its vertical ascent—where the upper boundary of the troposphere provides a barrier that keeps it from rising further—it streams laterally to the north and the south, creating a high-altitude *divergence* to complement the sea-level *convergence* below. Drying out on its poleward path, the air that rose up out of the Intertropical Convergence Zone (ITCZ) finally descends—bone dry—thousands of miles away at around 30 degrees north and 30 degrees south of the equator. This descending dry air is responsible for the desert belts—such as the Sahara, Kalahari, Mexican, and Australian deserts—that we find at these latitudes. Like “two circulating doughnuts around the earth” (Volk 2003, p. 69), this *convection loop*—which stretches from the equator one third of the way toward each pole—creates the wettest and driest regions of our Earth! The two cells of this loop are known as the Hadley Cells⁵ (see Fig. 2.3) (Ahrens 2012; Krump et al. 2009; Volk 2003).

³ When averaged over time on satellite maps.

⁴ This region of the earth is therefore referred to by meteorologists as the Intertropical Convergence Zone (ITCZ).

⁵ Three terms, in particular, highlight what is central in this context: *convergence*, *divergence*, and *convection loop*. *Convergence* indicates coming together; it often involves compression, compaction, concentration, contraction. Its converse, *divergence*, is centripetal in nature; it points to dissipation, dispersal, spreading out, expansion. The term *convection loop* makes evident that a connection exists between these extremes; it indicates that they are not separate phenomena, as such, but rather two poles of one and the same process.

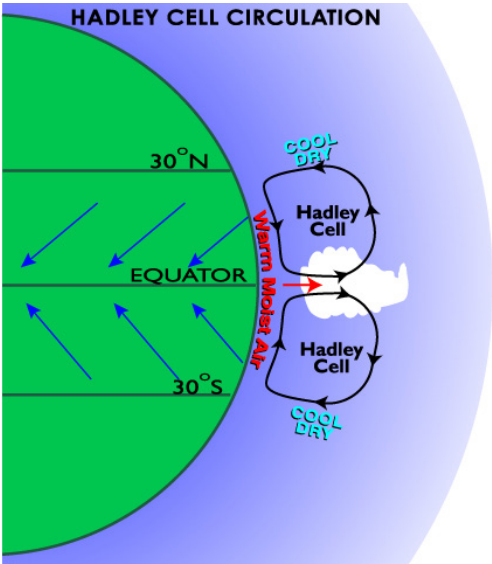
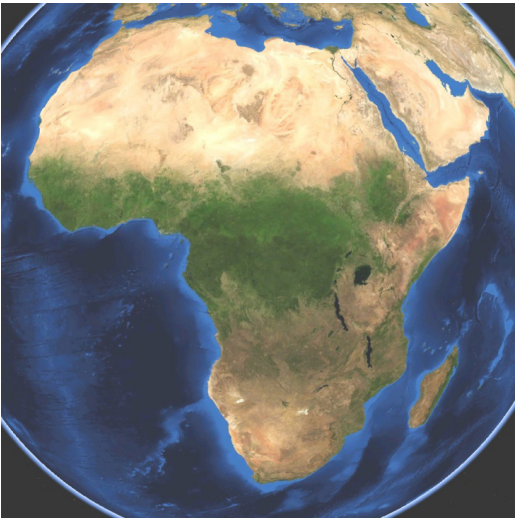


Figure 2.2. The Hadley Cells. (Retrieved from www.newmediastudio.org/DataDiscovery)

Beginning in this way, we awaken in the students an awareness of the central role that the sun plays, not only in the alternation of summer and winter, of day and night, etc., but also in the overall physiology of the Earth.⁶ Even a brief glance at a map of Africa, for example, reveals three disparate landscapes that show a powerful contrast between wet and dry that can be attributed to the Hadley convection loops. These are the tropical rain forest, the desert biomes, and the savannas that lie between them (James 1993; Henson 2002, Holdrege 2024).



Satellite map of Africa (Author: Koyos. Public Domain) (Screenshot from NASA's globe software World Wind)

⁶ The 10th grade meteorology block usually covers a broad range of topics pertinent to the 11th grade ecology block, including the carbon cycle, greenhouse gases, and fossil fuel consumption.

The pedagogical question for the Waldorf teacher now becomes: How can we help the students experience such a large-scale process, one that extends 2000 miles to the north and 2000 miles the south of the equator? One approach that has proved effective is to look at the convection loop as a movement gesture, one which—it soon dawns on some of the students—is very much like one they know very well: the “L” gesture in Eurythmy. The “L” does just what we see in the Hadley Cells: converging below, rising up, diverging above and circling around to converge again below.

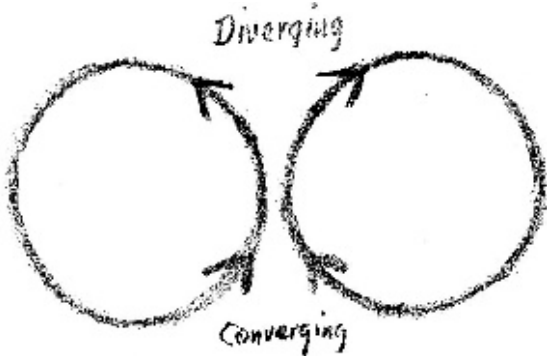
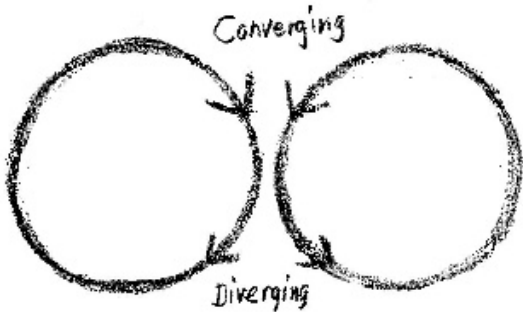


Diagram of “L” Gesture in Eurythmy

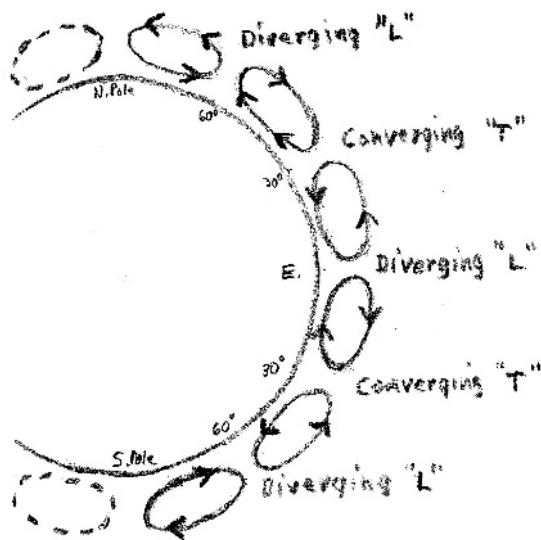
At this point, we can ask the students if they would expect there to be related atmospheric patterns north and south of the Hadley Cells. We have discussed how warm air rises through the intense heat of the sun at the equator, but what about cold air? It sinks, as they know. The next question is: Where might we expect to find descending cold air that would be the complement to the rising warm air at the equator? At the north and south poles, of course! If we imagine this concretely, it becomes clear that such descending air masses would have to diverge laterally when they reach the Earth’s surface.

This results in a gesture similar to what we found when the cool, dry air of the Hadley Cells descends at 30°, creating a gesture similar to the “T” in Eurythmy.



Converging and descending airflow patterns at the Earth’s poles and at 30° north and south of the equator

If we focus, for simplicity's sake, on the Northern Hemisphere for the moment, the next question we need to ask next is: What happens to the air that diverges southward from the "T" at the North Pole, and what happens to the air that diverges northward from the "T" at 30°? It soon becomes clear to the students that without interfering factors the southward flowing air will eventually converge with the air ascending from the northern boundary of the Hadley Cell, rising up and creating an "L" gesture similar to what we found at the equator—albeit under much cooler conditions. Indeed, if we imagine how this ascending air would—like in the Hadley Cells—need to diverge at the upper boundary of the Troposphere, we can now picture how it would circulate to the north and south, before descending again at the North Pole, on the one hand, and at 30° latitude on the other. What we have done in our imagination is create a second convection loop in the Northern Hemisphere (the same would be the case in the Southern Hemisphere). If we put this into a drawing, we'd see something like this:



The "Three-Cell Model" of convection loops converging and diverging from pole to pole

What has arisen following the dynamic discovered in the Hadley Cells and expanded to the entire Earth is known as the "Three-Cell Model" in Geophysics.⁷ We now attempt to recreate this dynamic in movement gestures (without, of course, being able to imitate the curvature of the Earth in this exercise). The students soon realize that they can demonstrate the

overall pattern of the Three-Cell Model by lining up five individuals side-by-side doing "L"s simultaneously, the outermost descending arm of the students at the two ends of the row representing the poles of the Earth, and the ascending gesture of the middle student representing the equator. They can also begin moving forward together, to represent how this pattern actually encompasses the entire Earth, not just in the N-S direction that they are representing, but also from East to West. The ring of clouds we began with is created by the middle person's ascending gesture, the descending gestures of that person and their neighbors create the desert zones at and south of the equator.

Various phenomena that underscore this three-cell atmospheric pattern are introduced to the students in this context. One popular example is the so-called "horse latitudes," where the air descending more or less vertically ("T"), at approximately 30° north of the equator, results in weak winds. History tells us that ships sailing to the New World were frequently becalmed in this region and, as food ran out, horses were thrown overboard or eaten.

After the students have developed a dynamic sense for the Three-Cell Model through Eurythmy-related movements, we explore further concepts (that can't be expanded on in this short essay) connected with those movements: the Coriolis Effect, Pressure Gradient Force, high and low pressure systems, etc. These lead them, for example, to an understanding of why the prevailing winds in the mid-latitudes of the Northern Hemisphere move from West to East, and why in the Northern Hemisphere the descending air in a high pressure system curves clockwise (seen from above), while a low pressure system curves counterclockwise. We look at weather maps to see how these systems move from West to East (while vacillating north- and southwards) in the mid-latitudes and then try to recreate such movements using our Eurythmy gestures again. Some students wander along doing "L"s while rotating counterclockwise (to represent low-pressure systems), while others near them create high-pressure system "T"s. With time, it becomes clear that these movements are even more complex. The students realize that the "T" gestures flow over into the "L" gestures when they diverge at the surface below, and that the "L"s flow over into the "T"s when they diverge up above.

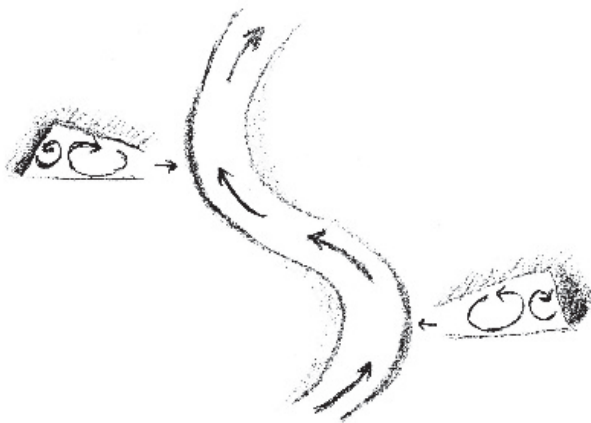
Doing the "L" (low pressure) movements, the students also experience how moisture is drawn up from the Earth's surface that will condense and create clouds and precipitation as it grows cooler, whereas the high pressure "T" spirals bring down the clear dry air from

⁷ This model creates an idealized picture of how the wind and pressure patterns would unfold around a rotating water-covered Earth that is not yet influenced by the warming, cooling, and other variables created by the presence of landmasses.

far above the Earth, resulting in the beautiful blue-sky days everyone loves. From there we move on to how tornadoes and hurricanes form out of spiraling “L”s and how warm and cold fronts arise.

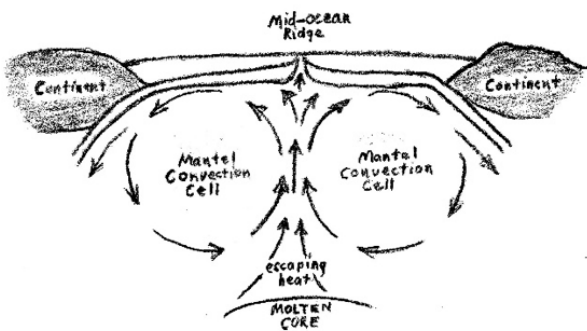
What has been described so far is only one example out of a multi-faceted inquiry into the geophysics of the Earth, as it is revealed by the dynamic lawfulness of atmospheric and ocean currents. The Eurythmy movements described above give the students a deepened sense for how dynamic—yet lawful—the Earth’s atmosphere is, and awakens in them a capacity for recognizing similar gestures in other realms of nature.

For example, when they learn about the way that water naturally meanders as it flows through wide valleys, the students discover that within the general winding course of the water downstream, a secondary spiraling circulation exists, one that is revealed by viewing the river in cross-section. Here they meet again the familiar “T” gesture. Briefly put: a double spiraling “T” dynamic gnaws away at the bank of the outer curves, while depositing sediment on the inner side of the curve, before crossing over to the opposite bank and doing the same thing on the outer curves there.



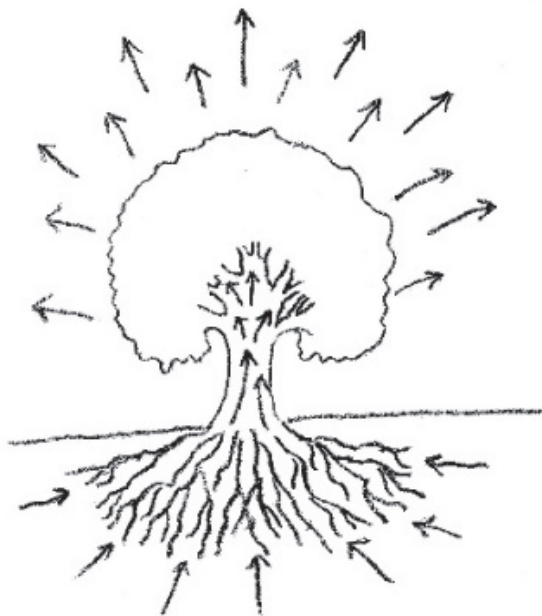
“T” Loops create the curves of a meandering stream

Thinking back to the 9th grade geology block, they now see the primary dynamic behind plate tectonics with new eyes. Looking at diverging and converging plate boundaries, which are considered to be the primary movers in plate tectonics, one sees the “L” (diverging) and “T” (converging) dynamic at yet another level of Earth’s existence.



Tectonic plate divergence (mid-ocean ridge) and convergence (plate subduction)

When they move into their ecology block in the 11th grade, the students will see how this dynamic is expressed in the seasons, in summer’s expansion and winter’s contraction, in the contrast between rainforest and desert, described above, and so on. They will begin to look at organisms like a tree from a more dynamic perspective. They will see, for example, how the expansive root system of the tree draws water from the dark and dense world of the soil below, brings it to convergence in the trunk of the tree, raises it up into the expanding network of branches and leaves above, before finally releases it (divergence) into the air and light-filled atmosphere above. On a hot sunny day, for example, a single mature maple tree will give off about 200 liters of water per hour into the atmosphere.⁸



Transpiration: water converges in the roots, diverges in the crown

8 90% of the water that reaches the atmosphere from land comes from plant transpiration. The Amazon basin rainforest transpires 20 billion tons of water into the atmosphere each day.

On the other hand, they see how the life of the tree encompasses a contrary gesture, one that moves from the light and air-filled atmosphere down into the darkness and density of the soil. The leaves that have released the water into the sky can also do the opposite. Reminiscent of the converging “T” gesture, they take in light, warmth, and air (carbon dioxide) from the expanses above⁹ and through photosynthesis create a much denser downward flow of organic compounds, much of which travel all the way into the subterranean darkness of the soil-entwined roots. There these substances (starch) are stored as a resource until the spring arrives and the tree’s primary growth period draws on them to unfold once more.

These examples are not meant to become fixed concepts of divergence & convergence, expansion & contraction, that are then sought out everywhere as a one-sided way of looking at things (cognitive bias), but rather—having been experienced in movement again and again—these Eurythmy-related gestures help the students become sensitive to the dynamic, yet lawful nature of living beings and systems. It helps them move beyond the static picture of a tree, for example, as a huge structure with a certain shape and yearly rhythm, into a sense for an organism that lives and unfolds in a never-ending process of expansion and contraction. They begin to experience the natural world less as one populated with “objects” (noun-like), and much more as a dynamic unfolding of lawful processes (verb-like) and patterns that we can develop a stronger sense for through dynamic movements such as the “L” and “T” discussed above.

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⁹ It is estimated that tropical forests remove 1.3 to 2 billion tons of CO₂ from the atmosphere annually.

Harlan Gilbert

One of the best aids to understanding the climate of the present day and to predicting its future is an examination of its past. In the following, I will examine how changes in climate appear over a variety of timescales. I hope that my readers will be as illuminated—and startled—as I was by the diverse images these present, for the particular timescales I have chosen exhibit almost every possible gesture: chaos, near linearity, periodicity, equilibrium, and, of course, at the finest

grain, the exponential warming of the present day.

It is my hope that comparing these diverse views will foster a consciousness of the complexity of climate as a dynamic system, open productive pedagogical avenues, and contribute to increased tolerance of complexity in the conversation around climate change.

Erratic Leaps

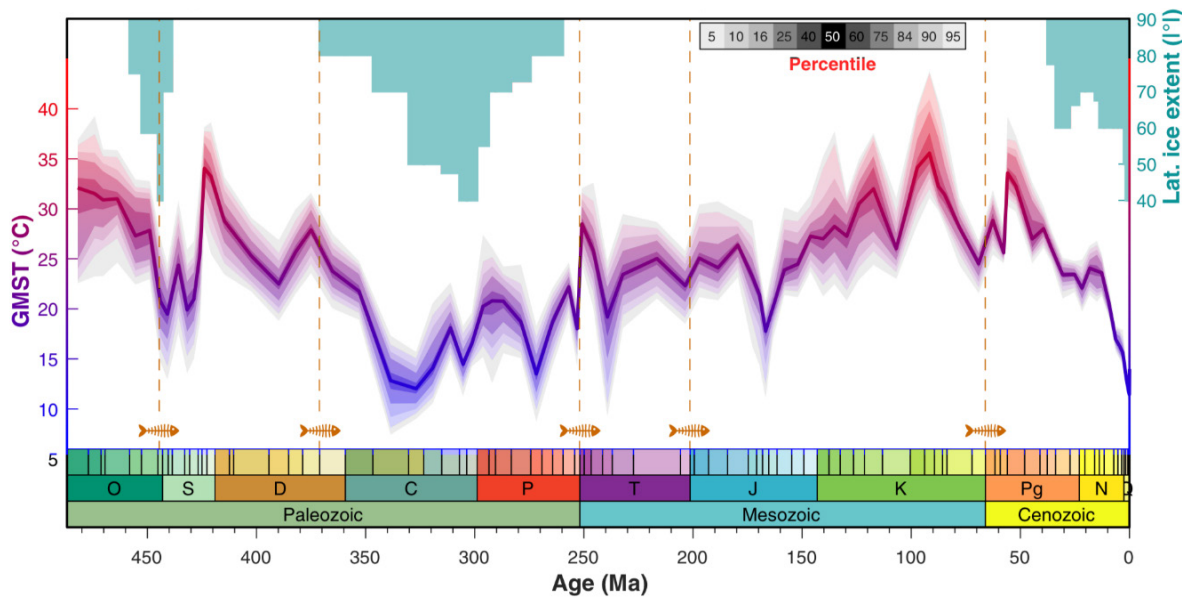


Figure 1: Temperature variations over the last half-billion years (shaded areas indicate uncertainty ranges)

In the above reconstruction of climate over nearly a tenth of the Earth’s lifetime (Figure 1),¹ we see the Earth’s surface temperature repeatedly undergoing dramatic and seemingly chaotic swings. At the hottest periods, temperatures averaged a remarkable 36°C (97°F) and even polar land was thickly forested, while the coldest periods saw temperatures close to those of the present day, with widespread glaciation.

Earth has been called a Goldilocks planet, referring to its conditions being “just right”—for example, neither too hot nor too cold—for life in general and for human life in particular. A comparison to the nearest planets of our solar system brings our good fortune vividly home: on Venus, water can only exist as steam, due to its average temperature of 464°C/867°F,² while on Mars, as the average temperature is -65°C/-85°F, water can only appear as ice.

There were even long-ago periods when the Earth’s surface was entirely or nearly entirely covered with

1 Credit: Emily J. Judd et al., “A 485-Million-Year History of Earth’s Surface Temperature,” *Science* 385, no. 6715 (September 20, 2024): eadk3705, <https://doi.org/10.1126/science.adk3705>. The darkened areas at the top of Figure 1 show the furthest latitude reached by glaciers.

2 It also rains sulfuric acid on Venus, so... less than ideal conditions.

ice. Each time such “Snowball Earth” conditions recur, only the simplest sea organisms survive. Fortunately, Snowball Earth conditions have not been seen for many hundreds of millions of years, and we can be grateful that for the last half-a-billion years, despite the apparent chaos, our planet’s climate has stayed within quite favorable limits, providing a beneficent environment for the evolution of ever-more-complex life.

While many of the erratic shifts visible in Figure 1 were driven by singular events—enormous volcanic eruptions, powerful meteor impacts, major changes in plate tectonics, and shifting astronomical influences—others arose as part of the naturally chaotic progression typical of complex dynamical systems,³ an erraticism familiar to us over shorter time frames in surprising weather events and unpredictable yearly variations. Should such very large swings in temperature recur—and there is no reason to suppose that either singular external events or internal dynamic swings are any less likely now than in the past—this would be devastating to vast swaths of life on Earth, and, of course, to human civilization in much or all of the planet.

To summarize: Though the climate remains vulnerable to unexpected twists and turns, we can be grateful that for the last half-a-billion years, Earth has really been an ideal environment for the evolution of complex land organisms: amphibians, reptiles, birds, mammals, and that most special mammal, human beings.

Dramatic Cooling

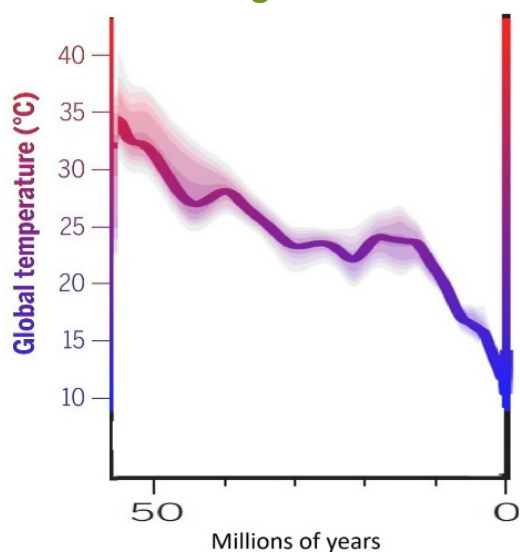


Figure 2: The cooling trend of the last 50 million years

3 E. N. Lorenz, “Can Chaos and Intransitivity Lead to Interannual Variability?,” *Tellus A* 42, no. 3 (1990): 378–89, <https://doi.org/10.1034/j.1600-0870.1990.t01-2-00005.x>.

Surprisingly, over a shorter timeframe, climate’s evolution tells a radically different story: for more than 50-million years, Earth’s temperature has been on a long, slow decline (Figure 2). In the course of this long, sustained fall, global temperatures reached some of the coolest conditions seen in nearly half-a-billion years (Figure 1), having dropped a remarkable 20° C/36° F. Just imagine if the Earth’s temperature were that much hotter today—and every day!

Nearly all of the fish, birds, and mammals familiar to us today evolved under these relatively cool temperatures.

This cooling correlated with and is thought to be the result of a dramatic tenfold drop in carbon-dioxide levels.⁴ Exactly why this dramatic drop occurred is somewhat speculative, but factors may have included geological weathering and interactions of the tectonic plates that increased the absorption of carbon-dioxide and changes in ocean currents that stimulated the growth of carbon-dioxide consuming plankton.

The initial cooling allowed the formation of a permanent ice sheet in Antarctica, the beginning of the *Late Cenozoic Ice Age*, 34 million years ago. As ice reflects most of the sunlight striking it, its formation tends to cool the planet further, which in turn leads to more ice forming, which in turn leads to further cooling. This positive feedback loop had further cooled the Earth sufficiently for glaciers to begin forming beyond the South Pole some 2½ million years ago. The *Quaternary Glaciation* had begun.⁵

To summarize: At this scale, the chaotic development characteristic of the longer-term picture is no longer in the foreground. Instead, we see initial cooling starting a feedback loop that lasted 50 million years, with any occasional rise remaining both slight and brief before the relentless descent in temperature continued. As a result, we, and the flora and fauna around us, are adapted to a relatively cool Earth.

Cyclic Glaciation

In surprising contrast to the chaos and continual descent seen dominating the first two timespans, over the last million years, the Earth’s climate has cycled periodically in a roughly hundred-thousand-year rhythm, while temperatures remained within a fairly narrow range (Figure 3).⁶

4 William H. Menke, “What Geology Has to Say About Global Warming – State of the Planet,” July 11, 2014, <https://news.climate.columbia.edu/2014/07/11/what-geology-has-to-say-about-global-warming/>.

5 We are thus living in the Quaternary intensification of the larger Late Cenozoic Ice Age.

6 Only part of this cyclic glaciation is shown in Figure 3; it extended more than a million years.

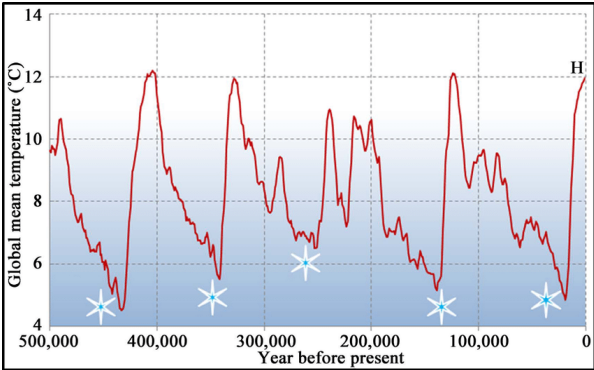


Figure 3 Rhythmic temperature variation over the last 500,000 years

During each cooling phase, the glaciers dramatically advanced, as temperatures dipped well below even the coldest averages seen in Figure 1. Most of northern North America, Europe, and Asia, constituting a quarter of the land surface, was enduringly frozen over as recently as 20-thousand years ago. During each warming phase, the glaciers retreated again but did not disappear.

A million years of humanity’s development has taken place against the background of this rhythmically cycling climate. That *Homo sapiens* (as well as its predecessors and relatives) repeatedly dealt with cooler and warmer temperatures and advancing and retreating ice must have stimulated considerable lifestyle flexibility. Nevertheless, the variations in temperature and ice-cover over this period were quite moderate compared to the Earth’s earlier swings in temperature and ice cover: no more Snowball Earths, no more tropical forests at the poles.

The early climatologist Milutin Milanković showed that this roughly 100,000-year cycle is the result of periodic variations in the axial tilt, orbital shape, and orbital orientation of the Earth. In Figure 3, it can be seen that we are now at the peak of the current Milanković cycle. Normally, a long, slow drop in temperature, accompanied by spreading glaciation, would follow.

How soon should we expect this? No one quite knows: current projections of the onset of the next cooling period vary between one- and 50-thousand years!⁷ This is because the factors that drive the Milanković cycles interact with each other, as well as with many other influences, in quite complex ways. These estimates may be irrelevant, in any case, as at current greenhouse gas

levels, a Milanković cooling cycle is unlikely to begin.⁸

Summary: The climate has been cycling quite regularly over a moderate range of temperatures for the last million years. Though astronomical factors will eventually tend to induce cooling, it is not known when this will begin, and greenhouse gases at current levels would likely counteract this influence.

Stability

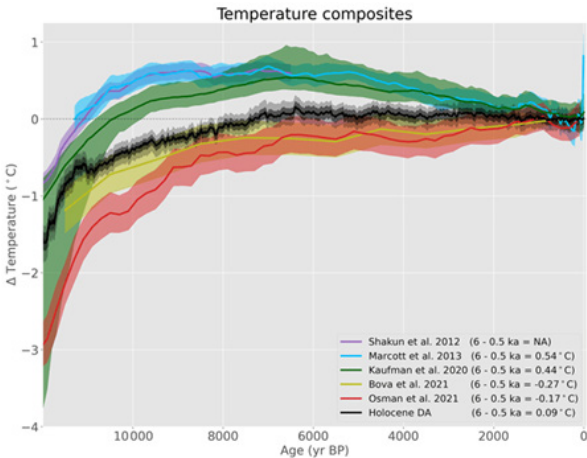


Figure 4: The remarkable stability of the Holocene era climate

The Earth’s average temperature has remained within a remarkably uniform range over the last ten-thousand years (see Figure 4).⁹ This era of climatic stability has seen incredible changes to human civilization involving radical lifestyle transformations, including:

- the rise of agriculture, the domestication of animals, and a widespread transition from nomadic to settled populations;
- the invention of writing, allowing greater transmission of culture between cultures and generations; and
- vast and extraordinary advances in arts, crafts, and technology.

Intriguingly, this period of quite stable climate conditions encompasses the entirety of recorded history. As we know very little of what human life was like when the climate was less stable, our expectations have solidified around this moderate climate regime. Yet, this stability is unusual and remains fragilely vulnerable

7 The high end projection is from A. Ganopolski, R. Winkelmann, and H. J. Schellnhuber, “Critical Insolation–CO2 Relation for Diagnosing Past and Future Glacial Inception,” *Nature* 529, no. 7585 (January 2016): 200–203, <https://doi.org/10.1038/nature16494>.

8 Richard Black, “Carbon Emissions ‘Will Defer Ice Age,’” *BBC News*, January 9, 2012, sec. Science & Environment, <https://www.bbc.com/news/science-environment-16439807>.

9 The various colors seen in this figure show reconstructions based on different phenomena (e.g. the composition of seashells or ice-core data).

not only to all the influences mentioned above—erratic events, long-term trends, cyclic variations, but also to a new factor: anthropogenic climate change.

Exponential Rise

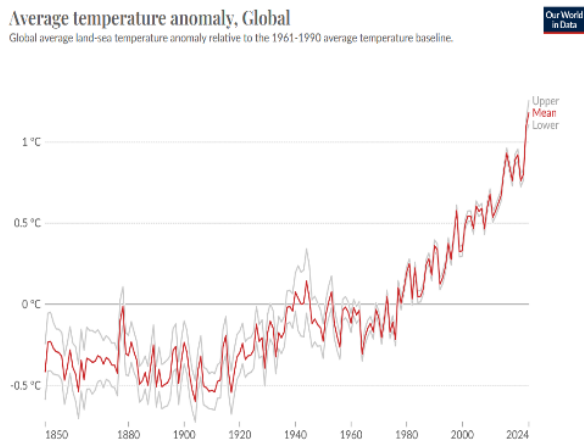


Figure 5: Rising temperatures over the Industrial Age

The stability of the Holocene climate appears to be coming to an end, as global temperatures have risen more than 1°C/2°F over the last century (Figure 5).¹⁰ We are living through a historical first, a dramatic shift in climate whose effects can be recorded in real time: glaciers melting, reefs dying, species becoming extinct at record rates, etc.

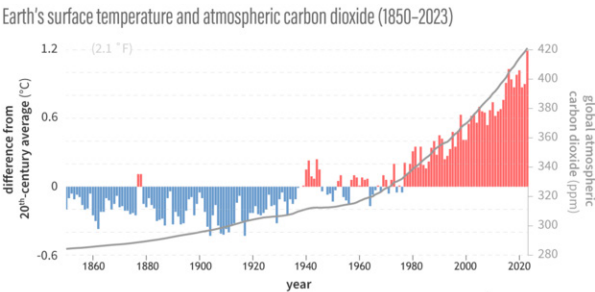


Figure 6: Temperature and carbon-dioxide levels

This rise in temperatures followed, and can with great confidence be attributed to, rising levels of greenhouse gases such as carbon-dioxide and methane (Figure 6).¹¹ Historically, a doubling of CO₂ levels has resulted in a temperature rise of 8°C/14°F, and carbon-dioxide levels

have gone up about 50% over the last 150 years.¹² The eventual effect can be expected to be far greater than anything we have yet seen, as the levels continue to rise rapidly; furthermore, temperature changes tend to follow greenhouse gas levels with a delay.¹³

In addition to this direct effect, a positive feedback loop is at work, accelerating these changes exponentially, as warming temperatures tend to release more greenhouse gases.

Summary: Temperatures are rising exponentially and will continue to do so until we tackle the enormous challenge of bringing greenhouse gases under control.

The Climate Run AMOC

At the same time, the Atlantic Meridional Ocean Conveyor, a massive flow in the North Atlantic Ocean, exerts a critical effect on the Earth’s climate. By bringing warm tropical waters up to the polar regions, this current reduces glaciation in northern latitudes, with a net warming effect on Earth. The Gulf Stream is one well-known manifestation of this oceanic phenomenon.

This current has repeatedly abruptly started up or shut down in the past and is currently weakening rapidly. If it were to shut down, glaciation at the North Pole would increase, starting a feedback loop of increasing ice cover leading to cooler conditions, leading to further increases in ice cover. The Woods Hole Oceanographic Institution foresees a “potential for cooling of 3 to 5 degrees Celsius in the ocean and atmosphere should a total disruption occur.... a third to a half the temperature change experienced during major ice ages.... Global warming can induce a colder climate.”¹⁴

The timing of the eventual tipping point that would shut down this circulation is very uncertain: estimates range from the year 2050 to 2100 and beyond.¹⁵

To summarize: In parallel with the warming tendency of greenhouse gases, there is the danger, at an unknown

10 Credit: Glen Fergus, Creative Commons license. Note that in Figures 5 and 6, the temperatures are shown relative to the late twentieth-century mean, approximately 14°C/57°F, whereas the previous figures show absolute temperatures.

11 Adolf Stips et al., “On the Causal Structure between CO₂ and Global Temperature,” *Scientific Reports* 6, no. 1 (February 22, 2016): 21691, <https://doi.org/10.1038/srep21691>.

12 However, any discussion of greenhouse gases and climate change should include both the positive correlations and the problematic areas that demonstrate the limitation of our current knowledge. There have been periods when temperature and CO₂ levels diverged inexplicably, as well as periods when they remained closely correlated, despite the presence of unrelated influences on climate that should have reduced this correlation significantly. Judd et al., “A 485-Million-Year History of Earth’s Surface Temperature.”

13 Credit: James H. Butler and Stephen K. Montzka, Creative Commons license.

14 Woods Hole Oceanographic Institution, n.d.

15 Stefan Rahmstorf, “Is the Atlantic Overturning Circulation Approaching a Tipping Point?,” *Oceanography* 37, no. 3 (April 10, 2024): 16–29, <https://doi.org/10.5670/oceanog.2024.501>.

time in the not-too-distant future, of dramatic cooling.

Taking Responsibility in the Anthropocene Epoch

Anthropogenic changes to the Earth’s atmosphere have, for the first time, become significant drivers of changes in the planetary climate. This is part of a larger picture: we have entered an era when human beings have become change-drivers comparable in power to the most dramatic natural phenomena. The entire planet’s existence is being shaped by human intervention on a scale never seen before. Humanly-generated material now likely outweighs the entire biomass of the Earth,¹⁶ human activity massively impacts virtually every location on the planet,¹⁷ and we may end up responsible for the sixth mass extinction event the Earth has experienced.¹⁸ The Earth could be said to have entered the Anthropocene age, a time when humanity is the dominant influence on ever-more phenomena on a global scale.

The central question of our age may well be: Will humanity take responsibility for the power it increasingly exerts?

Concerningly, despite many efforts to reduce the current production of greenhouse gases, there are strong

indications that this will continue to increase. First, ever more people are seeking and attaining the consumption levels of goods and energy typical of the most resource-intensive nations, entailing up to a thousand-fold increase in their energy consumption.¹⁹ Second, new, high-energy-consuming industries, such as cryptocurrencies, data analytics, and generative artificial intelligence, are rapidly accelerating the demand for energy. Neither of these tendencies is likely to slow in the near future.²⁰

In light of these challenges, perhaps it is time to recognize that the production of greenhouse gases is a symptom of a deeper problem: the desire to consume ever greater amounts of goods and information, to possess every greater wealth, to enjoy ever more extensive opportunities for travel and entertainment, and to exercise control over ever greater realms of nature. It is hard to imagine how the exponential rise in greenhouse gas production and thus in temperature will ever be brought under control without humanity learning to manage the ultimate driver: our exponentially increasing desires. Can we learn to be satisfied with a sufficiency of goods and capital, with relevant information, with living in and caring for our local environments, with community, and with a cooperative relationship with nature?

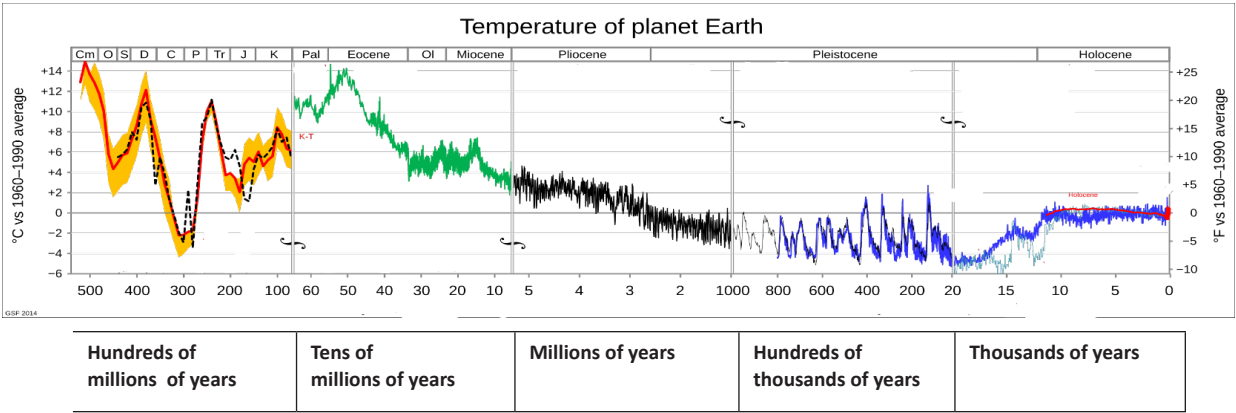


Figure 7: Temperature averages at five different time scales

16 Sandra Laville, “Human-Made Materials Now Outweigh Earth’s Entire Biomass – Study,” *The Guardian*, December 9, 2020, sec. Environment, <https://www.theguardian.com/environment/2020/dec/09/human-made-materials-now-outweigh-earths-entire-biomass-study>.
17 For example, microplastics permeate the entire ocean, artificial chemicals all the waterways, and pollutants the entire atmosphere.
18 Bob Yirka, “Anthropocene ‘Sixth Mass Extinction’ Event Predicted to Be Worse than Previously Thought,” May 24, 2023, <https://phys.org/news/2023-05-anthropocene-sixth-mass-extinction-event.html>.

19 Our World in Data, “Primary energy consumption per capita,” <https://ourworldindata.org/grapher/per-capita-energy-use>.
20 On the other hand, the search for new energy sources has shown some promising results; much depends upon success in this area.

Synthesis

When the diverse timescales and timeframes discussed above are placed on a continuous graph, their relationship can be more readily visualized (Figure 7). Here you can see the Earth's temperature **varying chaotically on the largest timescale**, **falling dramatically over 50 million years**, **cycling rhythmically over the last million years**, and **staying virtually uniform for the last 10 thousand years**. The recent surge in temperature is barely visible at the very end of this graph; it is still quite small in comparison to these other changes.

All of these tendencies are still active today. Volcanic action, the movement of the continental plates, asteroids, and other singular events continue to be potentially significant change agents in unpredictable ways. Any initial change—whether warming, e.g. from anthropogenic greenhouse gas emissions, or cooling, e.g. from the loss of the ocean conveyor—may start a feedback loop that can last 50-million years. The Milanković cycles continue to be driven by the rhythms of Earth's orbital path, axial tilt, and precession. The astronomical factors keeping temperatures level are expected to continue to do so for thousands of years. Anthropogenic warming due to greenhouse gas production is accelerating. Tipping-point events, such as the Atlantic Meridional Ocean Circulation shutting down, are tremendous vulnerabilities.

To imagine these as all simultaneously active is to comprehend both nature's complexity and humanity's rising responsibility. How will we ride the tide, involving as it does so many complex factors? Will we look within as well as outside of ourselves to find both the problems and their solutions?

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Climate Change and Global Warming

Balance and Perspective in our Middle and High School Classrooms

Caroline Martin



It is my observation that, in recent years, a disjoint has emerged between what we teachers imagine life holds in store for our middle and high school students and what they imagine for themselves. Rates of depression and anxiety in the teenage population are believed to be at an unprecedented high. Many attempts to explain this have aimed one glaring eye at smartphones and another at the existential threat that climate change poses. In our classrooms, we are uniquely positioned to offer inspiration to the youth of today, to empower them to take active part in the shared endeavor of making this world a better place for all.

There is scarcely an academic subject touching on a wider variety of areas than climate change. As a discipline, it has as equal a footing in university classrooms of sociology, politics, and philosophy as it does in those of engineering and the physical and biological sciences. And yet, it is amongst the newest areas of study taught in middle and high school classrooms, and with its inception has come a unique set of exertions for the teacher.

Diversity of subject matter in and of itself certainly puts an onus on the teacher to read more widely and experimentally than for the more established disciplines. For the latter there are available several decades worth of reliable curricular exempla replete with canonical textbooks, but climate change also stands aloof amongst these mainstay disciplines for the near impossibility of its being taught in the abstract, that is, for the near impossibility of teaching it without evoking a palpable feeling of threat. In fact, it is a striking feature of 21st century education that many middle and high schools are offering climate change courses designed explicitly to prepare the upcoming generations to understand and tackle a very real and somewhat imminent suite of catastrophes for humanity.

The mere catalogue of problems pertaining to this crisis is dizzying, ranging in dynamics from scorching temperatures or widespread floods in some reaches of the globe, to infectious disease outbreaks or failure of the cocoa bean in others. It might seem curious to list the potential loss of chocolate here, but for West African countries, such as Ivory Coast and Ghana, who produce up to two thirds of the world's supply, failure of the cocoa crop means economic disaster. Irrespective of

complex feedbacks, what is most alarming is the conviction with which these problems are propounded, their having been researched and ratified by the soundest scientific minds of our time, with the resounding argument being that there is a looming threat to the global civilization. It is undeniably helpful, and not just for the teacher, to know that there is a giant problem of global reach to be tackled, but what makes it exceedingly difficult, particularly for that teacher, is that the threat, in some form or another, is broadcast sub-daily, often in the personalized newsfeeds of our and our students' smartphones, causing goodness knows what degrees of alienation, subconscious panic, numbing, and attention wandering. We regrettably carry the threat around with us in our pockets, intermingled with our social lives, shopping lists, podcasts, photo galleries, and bank accounts. And thus it is that the shared experience of teachers and students alike results in our spending several waking hours immersed in a flood of information, no small part of which pertains to a "doomed" planet.

With an emphasis on STEM beginning in many kindergarten classrooms, the age of awareness of global threats is increasingly younger and younger. As is attested to by my public-school-attending nine-year-old's ready ability to recite the harmful effects of extreme weather events, climate change subject matter, sadly, in many an early-stage classroom is in no way sugar-coated for ease of children's digestion. Unlike the abstraction permissible for many other subjects, the problems that we are encountering because of climate change make it difficult for teachers to pose such problems as specific tools designed to teach the fundamental tenets of, say, scientific investigation. For example, it is too tempting, while teaching the logarithmic arrangement of the pH scale, to avoid informing students that ocean acidification could cause the collapse of the marine ecosystem – after all they will hear and see it on the news anyway. At least in Waldorf school classrooms, teachers can deliberately choose when and in what manner to introduce both conceptual and actual ramifications to children. Like most pedagogically appropriate lessons, at least through grade 9, a reflection of reality can sometimes be healthier than reality itself.

Providing ballast against this information overload, and plenty of complementary teaching tools and career incentives, is the treasure of positive initiatives, from

the steerings of intergovernmental policy to local grass-roots efforts (I'm especially grateful for the incredible Threefold campus, home to the Green Meadow Waldorf School, for its many Earth-embracing enterprises, and to the Rudolf Steiner School in Manhattan, for providing an abundance of nature and narrative in a jungle of concrete). The Paris Agreement, entered into force in November 2016, has promoted peace and positive growth among 196 or so often otherwise disparate nations. Many laudable organizations, such as the U.S. National Science Foundation, have funded incredibly innovative research endeavors, opening up avenues of collaboration and inspiring scientists, engineers, policy makers, farmers, local activists, authors, and children to work together for the greater good of our planet. In the middle ground, a host of formidable organizations, such as our universities, research institutions, and museums, offer high school students merit-based internships to train in research techniques specifically to tackle climate change. One leading organization for offering student internships is the Woods Hole Oceanographic Institution, in Cape Cod, MA, where a host of environmental projects are offered annually that help pave the way towards leading careers in science and engineering.

Contrast this picture with the final decade of the previous century, when, as a high schooler who elected to study geography, I was taught to avoid throwing my candy wrappers on the sidewalks (or "footpaths," as they are called in Ireland) and to preferably purchase "non-CFC" aerosol products because there was a hole, somewhere above the Southern Hemisphere, in something called the ozone layer, which is part of something with even remoter reaches called the stratosphere. In geography class, I also, among other things, learned about the meanderings of rivers, the ecology of the permafrost, the anatomy and action of glaciers, the economic contrasts across different regions in Italy, longshore drift, and the definition of "pig iron." Whilst I may have been cautioned as to how many cups of water it takes to make a carton of orange juice, our different modules in geography were taught to us as individual facts in isolation. We did not learn how steel production in China, and our consumption of that product in the

West, contributes deleteriously to a rise in greenhouse gases; nor did we learn that a melting permafrost does the same. Instead, we learned that groins and jetties would protect our beaches and not to build a house too near a cliff's edge. I was not taught to unite different complex geological processes and diverse human eco-

nomic activities into one global picture of critical concern. This I learned to do in the 21st century, as an adult, while reading for a PhD in geochemistry.

Back in the late 20th century, I and my adolescent pals, in our combined good fortunes of geographical isolation and geological ignorance, were free from any internalized weight of burden of responsibility, hence we were free from any consequent inertia. In contrast, we most assuredly rebelled a little during the early stages of the anti-litter and anti-CFC campaigns of the time, gaily throwing candy wrappers on the footpaths, precisely because we were told not

to, and unashamedly ignoring deodorant labels, choosing our purchases instead on the basis of scent or what was otherwise most fashionable. Whilst we did come around eventually to better practices and sounder judgements, it is important to acknowledge that such inane behavior is almost the birthright of the teenager, forming part of a series of blunders we all at that age make, one lending itself so favorably to correction and the healthy shaping into adulthood of the growing child. At no point during my perpetration of adolescent indiscretions did I internalize environmental threat or believe that I was the cause of any real harm to our planet. Nor, by the by, was I then capable of conceiving that my education and actions could be part of an adventurous solution to an environmental and existential crisis of the magnitude of climate change.

What I have learned from my healthy teenage experiences and from my research into the chemistry of Earth's thermostat is to offer balanced subject material in my science courses, to both my middle and high school students, with careful consideration as to when and how I introduce the current condition of climate change on Earth, and I am grateful that the Waldorf community actively encourages my and my colleagues' efforts to provide rich and varied experiential and theoretical contexts and perspectives.

Whilst neither climate change nor global warming can be directly or solely blamed for the observed decline in teenage mental health in the 21st century, the feelings of existential threat that teenagers today admit to ... tasks teachers of climate-change related subject matter with delivering pedagogically-resonant course material and activities.

One particular distinction I find imperative to uphold is the one between “climate change” and “global warming.” “Climate change,” a phrase evocative of much disaster to some, while giving much reason for sneering to others, has become synonymous with “global warming,” a choice and deliberate coinage introduced into the scientific lexicon in August 1975 by Wallace S. Broecker,¹ renowned geochemist who has spent 67 years researching Earth’s ocean-climate system at Columbia University’s Lamont-Doherty Earth Observatory. Climate change, a combined effect of many planetary and solar-system processes that shifts over varied and lengthy stretches of time in response to perturbations to, and oscillations within and between, these processes, has been the status quo on Earth for the entirety of its vast 4.543 billion year history (see my colleague H. Gilbert’s article, also in this issue of the *Research Bulletin*, about Phanerozoic climate change). Global warming, defined by the National Defense Research Council as the observed increase in global annual temperature since the Industrial Revolution,² refers specifically to the shifting that Earth’s climate system is experiencing today, and as such, is a sub-component of the discipline of climate change.

It is accurate and imperative to state that the climate change we are experiencing today, that is, global warming, is injurious to human civilizations, and it is vital that we, in our classrooms, arm the upcoming generations with the awareness, compassion, and skill sets, to further essential mitigation efforts. It is also probably accurate and nonetheless imperative to state that teenage mental health today is in a condition of notable decline compared to just a small number of decades ago. Whilst neither climate change nor global warming can be directly or solely blamed for the observed decline in teenage mental health in the 21st century, the feelings of existential threat that teenagers today admit to, combined with their experiences of isolation that is their screen-fueled reality, tasks teachers of climate-change related subject matter with delivering pedagogically-resonant course material and activities.

1 Broecker, W. S. (1975). Climatic change: Are we on the brink of a pronounced global warming? *Science*, 189(4201), 460-463. DOI: 10.1126/science.189.4201.460

2 See the online article “Global Warming 101: Everything you wanted to know about our changing climate but were too afraid to ask,” by Amanda MacMillan and Jeff Turrentine, first published on the Natural Resources Defense Council (NRDC) website in March 2016, most recently updated on December 2024: <https://www.nrdc.org/stories/global-warming-101>

It is therefore imperative that teachers instill in our students today a view of Earth that is robust in its ability to rebound against a backdrop of constant change. No catalogue of extreme weather events today can rival, at least in time, the knife’s edge that life has flourished on for the past several hundred million years. It is a comfort to young students, exposed as they are to newsfeeds that often coldly present only grim facts, to know that our history is one of persistent triumph. Given that teachers cannot shield even young students from awareness of a threatened world, we can instead

provide sources of inspiration to them in teaching them that there are many wonderful ways in which they can contribute to the success of our environmentally conscientious endeavors.

It is a comfort to our students to know that the planet and its lifeforms have persisted during such events as “Snowball Earth,” the “Permian-Triassic Mass Extinction,” and the “Messinian Salinity Crisis.”

Alongside the unavoidable prophecies of doom, such as are provided by extinction statistics, images of famine, reported death tolls following flashfloods and landslides, video footage of storm surges and hurricanes,

and so much more that pops up on smartphones, there should be showcased within this ever-changing landscape, the adaptability and resilience of life, the nothing short of triumphant and heroic travails that the ever-evolving cast of characters comprising Earth’s lifeforms have surmounted, and continue to surmount, as together we meet the demands of an ever-changing planet. In point of fact, merely teaching the blunt forecasts and grim deductions that arise from analyses of, say, graphs depicting rises in sea-surface temperatures, may be as directly injurious to the teenage population as global warming to human civilization.

Life on this planet is, and has been for eons, characterized by nothing short of miraculous adaptability and resilience. Teenagers today should be presented with not just the Keeling Curve,³ the painstakingly compiled daily record of atmospheric CO₂ concentration since 1958, but also with Sepkoski’s Curve,⁴ the vast record of diversity of marine taxonomic families over the course of the past 542 million years. Both graphs can serve to teach many interesting facts pertinent to chemistry and biology, and many interesting skills requisite for a career in data analysis, but only the latter graph

3 This is the daily record of global atmospheric carbon dioxide concentration, maintained and updated daily by the Scripps Institution of Oceanography at UC San Diego. See: <https://keelingcurve.ucsd.edu/>

4 Sepkoski Jr., J. J. (2002). A compendium of fossil marine animal genera. *Bulletins of American Paleontology* (363), 16 Sep 2002: 1-560. <https://strata.geology.wisc.edu/jack/>

will impress upon young minds that the diversity of life has been steadily increasing over the course of animal history amidst the full gamut of geological and climatic change. Books such as Stephen Jay Gould's *Wonderful Life: The Burgess Shale and the Nature of History*⁵ and E. O. Wilson's *The Diversity of Life*⁶ provide incredibly convincing reasons to embrace change on planet Earth and a host of innovative solutions to sharing Earth's resources, and should be considered staple readings when climate change is under study. In another inspirational text, S. C. Morris' *The Crucible of Creation: The Burgess Shale and Rise of Animals*, the author writes:

We live on a wonderful planet that not only teems with life but shows a marvelous exuberance of form and variety. In comparison with the size of the Earth, its living skin (the so-called biosphere) may be thin, but it is by no means negligible. From high in the atmosphere, where ballooning spiders wafted aloft on their silk-strings have been trapped at heights of more than 4500m and birds such as condors cross tropical storms at altitudes well above 6000m, via the oceans and the green continents, to deep within the Earth's crust where bacteria are known to live at depths of at least several kilometers, life is pervasive.

Whilst global warming does sadly define the state of change that Earth's climate system is experiencing today, and whilst climate change is a much broader topic that extends far beyond the current status of today's environmental crisis, it is vital that in presenting to students hazardous environmental scenarios that the broader features of an evolving and adapting biosphere be brought with equal force to the foreground. Again, it is a comfort to our students to know that the planet and its lifeforms have persisted during such events as "Snowball Earth," the "Permian-Triassic Mass Extinction," and the "Messinian Salinity Crisis", and to learn that after each of the "Big Five" mass extinction events, life radiated and diversified beyond the levels in each preceding period.

It is also vital in our teaching to ensure against the misuse of negative phraseology. The overall warming trend, attributable to the rise of greenhouse gas levels in the atmosphere, can be taught to students as an enhanced "greenhouse effect" with concomitant consequences

for the global ocean system. The rise in the concentration of greenhouse gases serves to explain the consequent rise in sea surface temperatures and thus the melting of polar icecaps, the rise in sea level, and the intensification of storms. With these come the terrestrial impacts that dramatic changes to the global system can wreak, such as flashfloods, droughts, and forest fires – what have come to be termed "extreme weather events." Major disruption to ecosystems, such as that which the decline in health of coral reefs can give rise to, is also attributed to the rise in greenhouse gases. Not only are corals sensitive to temperature, but also to the carbon chemistry of the ocean waters from which they source the material to build their skeletons. The reefs that they build provide nurseries for a multitude of fish and as much as 25% of marine lifeforms are known to spend at least part of their life cycles dependent on the ecology of coral reefs. Precisely

because of this cascade of intertwined hazards, it is always important to point out to students that without the greenhouse effect, conditions at the surface of the Earth would be too cold to support life as we know it. This is in no way stated to debunk claims that greenhouse gas emissions should be severely curtailed – they should, and our students should know as much – but rather to debunk the negative connotations of the phrase "greenhouse effect," which when used repeatedly and narrowly serves only to numb and alienate the student.

What we must achieve in our climate change classrooms today is a set of courses, conditions, and boundaries that promote the healthy spiritual growth of our teenagers and that preserve their rightful sense of adventure, whilst preparing and training them to understand and tackle problems that are global in scale and fundamental to the continuance of human civilization. No small task, but the worthiest of ones! Mastery of the mathematical and statistical tools needed to generate climate models will in no way compensate for deficiencies in creativity and gumption. Command of thermodynamics might convince a teenager that ocean temperatures are too hot to support the growth of coral reefs but will only poorly prepare them to understand and appreciate how the ocean behaves or how to demonstrate their care. Finessing one's academic skills (often recognized with "As" on tests) is only half the picture; without the human thirst for life to give good grades good meaning, that finesse will be unlikely to

It is always important to point out to students that without the greenhouse effect, conditions at the surface of the Earth would be too cold to support life as we know it.

5 Gould, S. J. (1989). *Wonderful life: the Burgess Shale and the nature of history*. New York, W. W. Norton & Company.

6 Wilson, E. O. (1992). *The diversity of life*. Cambridge, Mass., Belknap Press of Harvard University Press.

come to much fruition.

Young teenagers need not be lectured to as to why they're doing something, because their internal growth and development wither under such a surgical spotlight. Even in 9th grade, it is far more fruitful to have students observe outside of themselves, to busy themselves in laboratory work, for example, defining discretely what are the processes and phenomena they encounter there, than it is to have them labor inwardly as to how they feel about why the world is the way it is. In 10th grade, a more interconnected picture can emerge, one where, for example, the acidity that students measure in their test tubes during the Inorganic Chemistry block can be related to how healthy the growth of a coral reef might be. In that grade also, the students can be encouraged to bring over into their science work the skills practiced in the humanities classes of analogy and metaphor and irony, infusing their work with a human perspective that is approaching maturity. By 11th grade, the students are questioning who they are and why they are in this world. It is vital at this stage of their development that they be encouraged to feel they can take on vast journeys across our planet and that in doing so they can bring about positive change in themselves and in the world.

As a scientific, economic, political, and philosophical subject, climate change is rightfully positioned amongst the set of required courses in any middle or high school curriculum, and as such is frequently taught as individual units in as disparate settings as environmental science seminars and government policy lectures. The problems facing inhabitants of an Earth threatened by global warming are at the same time scientific, socio-political, and existential, which places an onus on middle and high school faculty to treat these subject matters from multiple inspirational perspectives.

Litter is bad for the environment, as is the mass production of candy wrappers, and chlorofluorocarbons attack the vital layer of the atmosphere that protects life from harmful ultraviolet radiation. This century's stockpile of digital photographs and videos from around the world has ensured that no classroom remains ignorant of the damage wrought by single-use plastics or extreme weather events. The triumphant fall from grace of CFCs, which can be—and in fact has been—summarized on a commemorative plaque at the University of California,

Irvine,⁷ is an almost quaint but no less forceful reminder that paradigms can shift. The testimony is in and the verdict is 'Guilty!' Humanity is the defendant, but it's not really clear who the plaintiff is. Perhaps she is Earth herself, but I take too much comfort in the geological perspective to fully believe she is not on humanity's side. Our children's imaginations should not too soon and too disjointedly have this potential for humanity's and Earth's working together be transformed into an untranscendable perspective of solidified hostile relations. Instead, I believe in Earth's rocky example, in the only history book that tells no lies, inadvertently or otherwise. I believe that she is kilometers-thick full of the answers we need to better prepare ourselves for a healthy future. I believe that we should encourage our teenage students to trust in the positive changes that their self-awareness, inquisitiveness, and critical thinking can bring about for the greater good of humankind. I believe that our students are the very light of this ever-changing world and that it is our job to ensure that they believe it, too.

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7 The American Chemical Society's commemorative plaque, recognizing the discovery of CFCs' harmful effect on the ozone layer, was issued at UC Irvine, April 18, 2017, designating the event a National Historic Chemical Landmark. It reads as follows:

At the University of California, Irvine, F. Sherwood Rowland and Mario J. Molina discovered that chlorofluorocarbons (CFCs) could deplete Earth's atmospheric ozone layer, which blocks the sun's damaging ultraviolet rays. When the scientists reported their findings in 1974, CFCs were widely used as refrigerant gases and as propellants in aerosol sprays. Rowland and Molina convinced skeptical industrialists, policymakers, and the public of the danger of CFCs. The scientists' advocacy — and the discovery by other researchers that the ozone layer over the Antarctic was thinning — led to worldwide phaseout of CFCs and the development of safer alternatives. For their work, Rowland and Molina shared the 1995 Nobel Prize in Chemistry with another atmospheric chemist, Paul J. Crutzen.

The story of the discovery and its effects is available from the American Chemical Society at <https://www.acs.org/content/dam/acsorg/education/whatischemistry/landmarks/cfcsozone/cfcs-ozone.pdf>

Ilan Safit

The senior year History main lesson at the Rudolf Steiner School is designated as a “Contemporary History” block. It offers an opportunity to teach the final History main lesson as a history of the future, when contemporary times will become a historical past. We are living in historical times, where what we do today would determine the course of a challenging future. It is a future in which Earth’s resources are insufficient for a human population that has grown beyond Earth’s carrying capacity. While the depletion of environmental resources and the deterioration of life-supporting ecosystems due to various forms of human-caused pollution have been projected since the late 1960s, a growing awareness of a transforming climate has entered world consciousness a decade or so later. The multiple scientific studies of the climate conditions that followed all come back with the same conclusion: the global climate is changing and the effects will be devastating for a variety of species, including the human species. “Climate Change” has since become the general caption for overall environmental degradation, a future crisis of existential proportions.

While it doesn’t make much scientific sense at this point to talk about “stopping” climate change, there is much to be done to mitigate and prepare for its impacts that spell nothing less than a different reality. Here, too, there is a catchall phrase, *sustainability*, which, most generally, aims at the long-term viability of Earth as humanity’s life-supporting environment, and a focus on climate change mitigation by reducing the levels of carbon and other greenhouse gasses released into the atmosphere by human production and consumption habits. The time for action is now—a protracted “now” that has begun several decades ago—rendering the current moment historical in its impact on the future.

Bringing this awareness to the senior class does not amount simply to a more detailed delivery of bad news they have been hearing through various filters throughout the years. It serves as the starting point of an arc, where well-informed awareness leads to clarity of purpose and resolve on action.

The awareness of a looming environmental crisis has given rise, starting in the early 1970s, to a new consciousness of humanity’s place and role in the world,

motivating a more intimate relationship with the natural world as well as a greater commitment to social responsibility and a shared purpose. A sense of urgency and necessity has been driving an impulse to restructure our material and social arrangement in this world. There is no better time than the senior year for our students to hear the call for a purposeful, peaceful revolution in which they have a part.

In many ways, even as the environmental crisis that came to a focus with climate change is projected to bring about devastating destruction to land and life, awareness to its approach has also served as an opportunity for humanity to come into its best. The greater the danger, the greater the responsibility, and with great responsibility comes great opportunity to turn from competition to collaboration, from exploiting to nurturing, from mindless consumption to mindfulness about all aspects of living in this world.

This is demonstrated quite beautifully in the internationally collaborated document known as the Earth Charter, sparked by the 1987 report by the UN World Commission on Environment and Development, initiated at the 1992 Earth Summit in Rio de Janeiro, and officially released in 2000 at the Peace Palace in The Hague. The Charter was composed from thousands of individual contributions under a multicultural, international editorship (see www.earthcharter.org for the document and its history).

In its Preamble, the Charter states:

We stand at a critical moment in Earth's history, a time when humanity must choose its future. As the world becomes increasingly interdependent and fragile, the future at once holds great peril and great promise. To move forward we must recognize that in the midst of a magnificent diversity of cultures and life forms we are one human family and one Earth community with a common destiny. We must join together to bring forth a sustainable global society founded on respect for nature, universal human rights, economic justice, and a culture of peace. Towards this end, it is imperative that we, the peoples of Earth, declare our responsibility to one another, to the greater community of life, and to future generations.

The fourth point of the Charter's Preamble outlines the kind of responsibility required of a global community confronting both danger and opportunity:

To realize these aspirations, we must decide to live with a sense of universal responsibility, identifying ourselves with the whole Earth community as well as our local communities. We are at once citizens of different nations and of one world in which the local and global are linked. Everyone shares responsibility for the present and future well-being of the human family and the larger living world. The spirit of human solidarity and kinship with all life is strengthened when we live with reverence for the mystery of being, gratitude for the gift of life, and humility regarding the human place in nature.

The final line in this declaration of universal responsibility resonates clearly with core impulses of Waldorf education and of the Waldorf educator: kinship with all life, facing life in its various forms with reverence, gratitude, and humility – isn't that what we guide our students to do? Doesn't it qualify how we aim to approach our students and the tasks of teaching?

Recognizing the sacredness of life, of all life, and of that which provides for life is at the core of Waldorf education as much as it is in the Earth Charter's commitment to revitalizing a global society and its home, the planet. In many ways, a senior year seminar on climate change, or on *facing* climate change, offers a unique opportunity to bring together the various strands of Waldorf education and guide students to come into their very best.

The findings and projections of climate change science, reviewed in the course, lead directly to questions of personal and collective responsibility, of the ways ecological problems are intertwined with social ones, and of the deep significance of the outlook provided by the science of Ecology: viewing the world and all its creatures as a web of interrelations, a holistic view that recognizes the connectivity and interdependence of all life forms in relation to each other and to their environments.

The utility of such an ecological outlook goes beyond an understanding of the natural world and offers insightful ways to view the social and the cultural spheres, as well as one's own relations to others, human and non-human alike. Indeed, the ecological paradigm, if

you will, has been making productive inroads in recent decades into the humanities and the social sciences, redirecting many fields of inquiry to view their subject matter through the prism of relationships or in relational terms, where elements define each other through dynamic interdependence and nothing exists in isolation.¹

Hence "Ecological Citizenship," as a main lesson block, while taking ecological degradation and restoration as its subject matter, also aims at nurturing in the near-graduation students a perspective in which each individual is an interrelated part of several material, social, and cultural ecosystems. The notion of "citizenship" explored in the block is conceptually and structurally ecological, in the sense that it is defined as active membership in a community, from the nearest—one's family, neighborhood, school, city—to the widest: humanity, Earth-dwellers. The questions, 'What does it mean to be a member of a community? What do we receive from and what do we give to the communities we belong to?', are applied in expanding circles, from one's own household to the broadest level of an informed and technologically advanced humanity living in the shadow of a looming ecological crisis.

The academic concept of Ecological Citizenship that informs this course has been developing in the past three decades or so, responding to the globalization of world economies, on the one hand, and the growing awareness of a worldwide environmental crisis, on the other hand, which recognizes a "common future"

for global humanity. Indeed, the 1987 report from the UN World Commission on Environment and Development (WCED), entitled "Our Common Future," has remained a central influence in the conceptualization of ecological citizenship. Not only that the very title of this pioneering report holds a fundamental

notion—a *common* future dictates common, collaborative, globally connected action in the present—but it also offers the definition of sustainable development that has been informing the thinking on the requisite transformation of human practices. This definition states:

There is no better time than the senior year for our students to hear the call for a purposeful, peaceful revolution in which they have a part.

1 Rudolf Steiner championed the ecological paradigm in its early stages in two appreciative essays on Ernst Haeckel, the "father" of Ecology. Steiner's reservations, of course, relate to the scientific reduction of life through a materialist, mechanistic perspective. Warning of such reductionism, Steiner's appreciation hints at the perfect match of a holistic paradigm of dynamic interrelations with a spiritual understanding of the world. See Rudolf Steiner, *Two Essays on Haeckel* (1900, 1905; GA 30, GA 54).

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.²

The term “sustainability,” which has come into frequent use in recent years, does not merely suggest long-term resource maintenance; it is also, as made clear by the above definition, grounded in a commitment to the *people* of the future and thereby to the world that environs them.

“Our Common Future,” also known as “The Brundtland Report,” in reference to the committee’s Chairwoman, Norway’s former Prime Minister Gro Harlem Brundtland, has been instrumental in tying together the material conditions of the planet and its resources with the wellbeing of the people, all the people, of the planet. It has made the case for the view that remedying social problems—poverty, access to education and other resources, gender inequality, economic inequalities in both regional and global settings—is not only a moral imperative but a necessary element in bringing about a livable future. Other seminal initiatives, like the UN’s Earth Charter, which responded to the Brundtland Report’s call for a “new charter,” or the “Green New Deal” proposed Resolution in the United States Congress,³ has followed suit in the alignment of material sustainability, social justice, and human flourishing.

So what kind of society, or what kind of citizens, or *citizenship* would form and inform this global project of revitalizing humanity and its home planet?

Ecological Citizenship – The Concept

Academic theories and concepts can be met with cynicism by twelfth-graders prone to suspicion of that which appears too detached from reality as they know it, or too complex to understand at first or second glance. Still, at twelve grade, the students are ready to begin grappling with theoretical concepts, and they will benefit from an introduction to the kind of reading and thinking they are likely to encounter in the next step of

their education. It also serves as an early indication of the role of academia as an incubator of ideas, considered historically, methodically, and in a well-informed manner, even if these might later transform into vague slogans or cudgels in political and cultural wars when they make their way into the wider public sphere. Finally, even a less than precise understanding of such concepts, specifically the concept of ecological citizenship, has the potential of igniting curiosity and inviting further inquiry and reflection.

The British political theorist, Andrew Dobson, has been a leading voice in the academic conceptualization of a new kind of global citizenship.⁴ Citizenship, Dobson offers, “is about activity with public implications” (Dobson 2007, 280-1). “From an environmental point of view,” he clarifies, “every act has public implications. As we live our lives, we draw on environmental resources and leave environmental waste” (281). This view underlines the ecological nature of human existence, i.e. as interdependent, interactive,

and inter-impactive (if I’m allowed to coin a phrase) creatures, even when living in assumed isolation or in remove from nature. In this sense, this kind of citizenship or community membership is to be *recognized* rather than conferred: we are already citizens of the Earth-dwelling community, whether we have a name for it or not.

Informed by the definition of sustainable development quoted above, Dobson narrows down the personal obligation of ecological citizenship to ensuring “*that ecological footprints make a sustainable, rather than unsustainable impact*” (Dobson 2003, 118-9). Echoing the language of “Our Common Future” and limiting himself to the most general terms, Dobson further explains: “the ecological citizen will want to ensure that her or his ecological footprint does not compromise or foreclose the ability of others in present or future generations to pursue options important to them” (119).

Dobson sketches out the defining characteristics of environmental or ecological citizenship as follows (Dobson 2007, 280-282):

1. It involves a greater commitment to the common good than to limited self-interest, recognizing

² Gro Harlem Brundtland, *Our Common Future: Report of the World Commission on Environment and Development* (Geneva: UN-Dokument A/42/427, 1987). www.un-documents.net/ocf-ov.htm

³ The proposed Resolution, introduced in the House of Representatives in February 2019, is available here: www.congress.gov/bills/116th-congress/house-resolution/109/text

⁴ For short review of the academic development of a concept of ecological citizenship see Michel Bourban, “Ecological Citizenship” in Nathaniel Wallenhorst and Christoph Wulf (eds.), *Handbook of the Anthropocene* (Cham, Switzerland: Springer, 2023). https://doi.org/10.1007/978-3-031-25910-4_168

that what is good for all is also good for me, and that environmental health or sustainability is a common good.

2. It follows the civic-republican model of citizenship, where one's responsibilities to the community at large are of greater concern than the rights and liberties the community or State owes the citizen.
3. If the goal of this citizenship is to ensure a sustainable future by embracing a sustainable life style, which can be measured by one's ecological footprint, fairness or *justice* would dictate maintaining an equitable ecological footprint. This means not allowing ourselves a greater draw on environmental resources (including energy) and a greater production of environmental waste than is allowed to others. The historical and current fact that the societies of the developed world have been drawing a far greater amount of energy and other resources than those in the underdeveloped or developing world makes it a case of justice, not charity, when we are called upon to adjust our ecological footprint for the sake of equity.
4. It is a mode of citizenship that is *international* – we, especially in the developed world, draw on environmental resources from abroad, and our environmental impact, especially in view of climate change, transcends national borders. It is also *intergenerational* – our actions today, especially in view of climate change, will impact future generations.
5. It is a citizenship that extends from the public sphere, where citizenship has traditionally been exercised, to the private sphere. My consumption at home, or in whatever setting I deem private, still has environmental, hence *public* implications.

In his work, Dobson, like other political theorists, is moving from principles to implications according to an established procedure of reasoning and in view of historical precedent. This might not be the language of spirit, but it is couched in the principles of justice, equality, and responsibility and recognizes causality as morally binding (“You” broke it, you are obligated to fix it). As members of the planet community, we have

historically been drawing on the planet's resources and making an impact on its local, now global environments. Advanced by the generations that came before us, we have an obligation to those who will come after us. Obligation to community at large (if you will: solidarity, responsibility) dictates that we would make it possible, or at least not impossible, for others to pursue their happiness, or at least their comfort, at a minimum: their conditions of existence. Measured by an ecological or “carbon” footprint, this obligation is measurably translatable to action, or rather to habits of ongoing action: the ways we conduct our consumptive lives. A principle of justice-as-equality offers a further measure on the limits we are called upon to impose on ourselves in living sustainably: an equal distribution of the impact we have on the planet and its resources.

For twelfth-graders, there is a challenge and a charm in the geometric construction of this concept. It is easily reduced by the impatient ones to the basics of ‘Reduce (energy use), Reuse, Recycle,’ but, as a term, “ecological citizenship” also resonates for many with their general instincts and inclinations: Yes! We are citizens of this planet, of an eco-system, and we are committed to its wellbeing!

Appealing to those kindling a revolutionary spark, and to a generation eagerly committed to social justice, we also explore a more fiery brand, dubbed “Sustainability Citizenship.” In this version, coming from political theorist John Barry, the required response to global warming and environmental deterioration is portrayed in terms of resistance to the existing order, a critical citizenship ready for civil disobedience. In this more broadly political version, a new, environmen-

tally committed model of citizen engagement goes far beyond habits of consumption and encourages activism aimed at a restructuring of industry, commerce, governmental policy, and global cooperation in view of the deep-seated causes of environmental degradation and global warming:

Sustainability citizenship, while of course centered on environmental issues, ... [will] encompass economic, social, political, and cultural spheres in its remit ... it includes human rights, democracy, equality, quality of life, participation, and good governance. (Barry 2006, 24)

This comes from the side of political theory. But if theory is neatly organized in axioms and their outcomes, what would the life of a committed ecological citizen look like in practice? For this we turn to a documented and well-publicized experiment known as the No Impact Project.

Ecological Citizenship in Practice

The 2009 documentary, “No Impact Man,” follows the yearlong project of author and activist Colin Beavan in his aim to reduce his household’s ecological footprint to zero. It is an experiential and experimental project, wherein Beavan aims to eliminate or replace all daily practices that contribute to a negative ecological footprint in order to eventually assess which ones of these practices is impossible to live without and which ones of the environmentally sound alternatives could be maintained.

Accordingly, Beavan, along with wife and their toddler daughter, discontinue use of all motorized transportation, including elevators; limit their food consumption to locally grown produce and dairy mostly purchased in a nearby farmer market; use only environmentally harmless or homemade cleaning products; forego use of all paper products, including disposable diapers and toilet paper; compost their food scraps; and, eventually, disconnect from the electric grid. In addition, the family volunteers at a local community garden and visit the Hawthorn Valley Farm, which practices bio-dynamic farming, and Ronnybrook Farm Dairy, both located in New York’s Hudson Valley, where much of the family’s food originates.

Beavan also actively engages in publicizing his project on his website and through participation in wide media coverage of the family’s experiment. He concluded the project with this documentary and with the publication of his book, *No Impact Man: The Adventures of a Guilty Liberal Who Attempts to Save the Planet, and the Discoveries He Makes About Himself and Our Way of Life in the Process* (Macmillan, 2010). The publicity activity, for which Beavan was criticized at the time as acts of self-promotion, is an important aspect of the project, as Beavan is aware that the impact of public advocacy is eventually much more significant than the actual reduction of the family’s ecological footprint.

The documentary offers plot and drama to the idea of ecological citizenship practiced at the extreme. At times, Beavan draws from the students generous servings of adolescent cynicism and scorn, especially

as the real-life complexity of the characters can make them unlikeable in certain scenes, but his project also forces them to confront wasteful consumption in their own lives.

The fact that Beavan and his family conduct their experiment and go through their various experiences just a couple of miles down the road from the Rudolf Steiner School in Manhattan is a source of pleasure for the students. They recognize the public settings of the action—

including the Hawthorn Valley Farm, located across the street from the Hawthorn Valley Waldorf School, and the location of several week-long Steiner School trips between grades three and ten—and realize the possibilities of sustainable living in the sites they know. They see the Beavans cross over from the private to the public sphere – to recall Andrew Dobson’s terms, often biking through the same public spaces the

students occupy, and experimentation in urban sustainable living comes a little closer to home.

This is also the assignment associated with the film viewing: adopting some of the sustainability practices observed in the documentary for the duration of the block. This, too, is meant to be both experiential and experimental: the students are invited to explore what is possible, what is inconvenient, and what is impossible – and why. When documented in journal writing and incorporated into the course’s final report, this experimentation proves impactful. Some students take up biking or walking as ways to get to school; others monitor their shower time; some become guiltily aware of their shopping habits; all become more aware of the food arriving to their dinner table. Awareness seems to be the first benefit of the exercise accompanying the documentary viewing; in education, awareness is often a primary goal.

The conclusion Colin Beavan arrives at by the end of his project is that the most effective action he could undertake to promote a sustainable future is to participate in environmentally oriented community work. Community, he realizes, is key; it enables him to have clear and direct impact on other people and he becomes accountable to specific, co-present others, the members of the community he is engaged with. The human factor, human interaction, reveals itself in this conclusion to be significant on all levels—immediate, binding, rewarding, and dually effective. Even if the work practiced in community is oriented towards land and air, towards the physical environment, it clearly,

Some students take up biking or walking as ways to get to school; others monitor their shower time; some become guiltily aware of their shopping habits.

and quite immediately, shows signs of benefitting the humans living in the environment. And here lies another conclusion: that it makes little sense to separate the beneficiaries of environmental work, that the ecological paradigm and the reality that it reveals demonstrate that all members of an ecosystem, actors and environment alike, benefit from a healthy ecological whole. It is with the hope that the students would be able through hands-on experience to sense and internalize this conclusion, which is a core idea of ecological citizenship and of this course on ecological citizenship, that we borrow another page from No Impact Man's playbook and pick up a communal "green" project, such as park cleaning or community garden work. The lessons learned by experience, as we all know, by getting one's hands dirty, are often internalized more effectively than those learned otherwise.

Climate Change: A Closer Look

Otherwise learning is also practiced in the study of climate change science, taken in a collaborative effort straight from the scientific sources.

There are various online resources available today for learning about climate change through current measurements, documented trends over the past decades, and future projections.

For example, though there is a substantial doubt that this resource will still be available by the time this article appears in print, the U.S. Environmental Protection Agency (EPA) has a rich and highly informative website, with a detailed presentation of current climate change science and resources for educators (www.epa.gov/climate-change). The same goes for the U.S. Global Change Research Program and its Climate Science Special Report and National Climate Assessments (www.globalchange.gov, nca2023.globalchange.gov). NASA, too, offers a short, helpful, and comprehensive presentation of scientific findings and satellite imagery (science.nasa.gov/climate-change/). And the National Academies of Sciences, Engineering, and Medicine, offers detailed reports and overview publications on its "Environment and Environmental Studies: Climate Change" tab (nationalacademies.org; nap.nationalacademies.org).

A resource that we need not fear would be altered soon by a science-hostile U.S. administration is the United Nation's Global Environment Outlook, which,

since 1997, has been publishing methodic assessments of the state of the global environment, evaluations of policies and actions enacted to address environmental concerns, and projections of future trends (www.unep.org/geo/).

However, the most comprehensive scientific report on climate change, and the source for many of the other resources available to the public, is the Intergovernmental Panel on Climate Change (IPCC), which collects and assesses climate research from around the globe.

Here is how the IPCC describes itself:

The IPCC was created to provide policymakers with regular scientific assessments on climate change, its implications and potential future risks, as well as to put forward adaptation and mitigation options.

Through its assessments, the IPCC determines the state of knowledge on climate change. It identifies where there is agreement in the scientific community on topics related to climate change, and where further research is needed. The reports are drafted and reviewed in several stages, thus guaranteeing objectivity and transparency. The IPCC does not conduct its own research. IPCC reports are neutral, policy-relevant but not policy-prescriptive. The assessment reports are a key input into the international negotiations to tackle climate change. Created by the United Nations Environment Programme (UN Environment)

and the World Meteorological Organization (WMO) in 1988, the IPCC has 195 Member countries. (www.ipcc.ch)

The students spend time with the various pages of the IPCC website before we turn to the latest Assessment Report, focusing further on the Synthesis Report and Summary for Policymakers, which condense thousands of pages of scientific findings into shorter, data-rich versions. These reports, along with an assortment of fact sheets and the site's Frequently Asked Questions section, are divided between two or three groups of students, each of which assigned the collaborative task of studying, summarizing, and sharing the information with the rest of the class through an oral presentation and a written group-report. This means that the students get to exercise collaborative work, not entirely

dissimilar to the one that produced the original IPCC report or that is needed as the world community turns to address adaptations, mitigations, and solutions.

Solutions: Drawdown

In the final week of the course, we explore climate change “solutions” through Project Drawdown (www.drawdown.org). The project is the brainchild of decades-long environmental activist, innovator, and author, Paul Hawken, with whom we start the course by reading his 1993 “Declaration of Sustainability,”⁵ an early call for a restructuring of industry and commercial practices in ways that would make the sustainable choice an easy default rather than an activist effort.

Project Drawdown studies technologies and social practices that reduce or remove climate-change-generating greenhouse gas emissions from the atmosphere. An implementation of multiple practices and technologies, according to the Drawdown Project, would steadily bring down the atmospheric levels of carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, and other greenhouse gasses and reverse the trend of global warming. The project has so far studied close to 100 solutions, assembled in sectors of Electricity Generation, Agriculture and Land Use, Industry, Transportation, Buildings, Carbon Sinks, and Health and Education. Each solution is studied and modeled to project the amount of greenhouse gas reduction it will achieve over 30 years, alongside the costs in initial implementation as well as savings in lifetime operation. The solutions are presented on the Drawdown website with a short, ca. 1,000-word overview, presenting the methodology used to study and model the solution, scenarios of efficient implementation, discussion, conclusion, and relevant numbers of emissions removed and dollars to be invested or saved.

The solutions range in alphabetical order from Abandoned Farmland Restoration to Water Distribution Efficiency, with a variety that includes Bamboo Production, Building Retrofitting, District Heating, Electric Cars, Bikes, and Trains, Improved Cattle Feed, Methane Digesters, Plant-Rich Diets, Refrigerant Management, and Seaweed Farming – a random sample.

No single or cluster of solutions would reach the desired

effect of drawing down the level of atmospheric greenhouse gasses, but a combined implementation of “all available solutions,” according to the project’s website, should get us there.

Interestingly, Project Drawdown, in its measured and calculated methods, confirms the claim made since the early stages of organized attempts to address environmental degradation and climate change. Namely, that social problems and environmental damage go hand in hand, that plans to redesign global patterns of production, consumption, and resource use must

include plans to remedy social inequalities on both local and global levels. (In the course, we study this connection by reading “Environmental Problems Require Social Solutions,” the Introduction chapter to an anthology of studies in the newly established field of Environmental Sociology.⁶) This is made clear, for example in the Health & Education sector, which is focused on family planning and is projected to remove as much greenhouse gas emissions from

the atmosphere as all the technological innovations of the Transportation sector combined. More accurately, implementation in underdeveloped or developing countries of high-quality, 12-year education, especially for girls and young women, and the practice of voluntary family planning will not only benefit gender equality, health, well-being, and economic development, it would also curb population growth, with a projected reduction over 30 years of 68.9 gigatons of CO₂-equivalent greenhouse gas emissions. Implementation of the ten technological innovations contained in the Transportation sector (the other three have to do with carpooling and redesigning cities so biking and walking would become preferable to driving) is projected to reduce a combined amount of 47.08–69.38 gigatons of CO₂-equivalent greenhouse gas emissions.

The Project Drawdown website further explains:

Climate and social systems are profoundly connected, and those connections open up solutions that are often overlooked. Some initiatives, designed first and foremost to ensure fundamental human rights and foster equality, also have cascading long-term benefits for climate change. These include rights-based, voluntary family planning

5 Paul Hawken, “A Declaration of Sustainability: 12 Steps Society Can Take to Save the Whole Enchilada,” *Utne Reader* 59, 54-61, 1993.

6 “Environmental Problems Require Social Solutions” Introduction to *Environmental Sociology: From Analysis to Action* (by Leslie King & Deborah McCarthy Auriffeille (Rowman & Littlefield Publishers 2014.)

and high-quality, inclusive primary and secondary education. Family planning and education are not in themselves climate mitigation solutions. Rather, one outcome of family planning and education, slower global population growth, can contribute to reduced carbon emissions over time.

(<https://drawdown.org/sectors/health-and-education>)

Another important resource included in the project's website is a "Climate Solutions 101" course – a set of six video presentations, ranging in length from 10 to 25 minutes, in which the reality of climate change is reviewed and explained, the solutions approach is laid out, specific solutions are explored, and the road to action is designated. The caption to the final section of this video course asks: "What role will you play in building a better future?"

This question is also implicit in the Ecological Citizenship main lesson, a question made more explicit with this final unit focused on future-oriented solutions and action. The students are nudged closer to confronting this question – What role will you play in building a better future? In securing a future for humanity in a thriving world? – with their last assignment for the block: Studying more closely three of the solutions on the website's menu and presenting them to the rest of the class. In a class of 20 students, this offers an opportunity for a collaborative effort to acquaint each student with 60 of the Drawdown solutions. The students are also instructed to research on their own what kind of professions are needed for developing and implementing their selected solutions. Then, and here we come closer to the students' own life path, they have to find out what course of study, what major in college, or what training a person needs to follow to prepare for such professions.

Last Words

This closing of the course is set up as an opening for the students to start thinking about the role they will be taking in protecting and reshaping the future of humanity. The roles and positions—this is hopefully made clear throughout the second part of the block—are endless and range from science, technology, and entrepreneurship to education, art, journalism, advocacy,

social organizing, law, and politics. The message is that the students can and should discover their individual path in life and follow it to self-realization. But with the knowledge that has been solidified in the course, of the challenges, dangers, and even existential threat that awaits in the future, the students are now encouraged to find ways to merge their personal aspirations with the communal need, to find their way into a common future to which they will be contributing and from which they will be benefitting as citizens, ecological citizens, members of the ecosystem, whose ecological health they will have helped secure.

The idealism promoted in this main lesson has been in preparation throughout the four high school grades, if not earlier. In many ways, the Ecological Citizenship main lesson is designed to serve as the capstone of the History and Social Studies curriculum, where diverse trajectories of civilization are introduced, the arc of justice is traced through a history of injustices, humanity's spiritual and material unfolding is explored through the stories of various religions and technological innovations, and contemporary social issues are researched and discussed. If the common thread that runs through these explorations is the place and role of humanity

in the world throughout the ages, this final focus on facing climate change confronts the reflective question with a concrete task. If the idealism of self-realization in the service of collective wellbeing has been an implicit resonance throughout the years, it now comes to the fore with the urging of a necessity, an existential necessity. Idealism, in this context, turns out to be also utilitarian.

Will we have succeeded in nurturing such an idealism in

our students? I'll let them speak for themselves with a selection of final reflections from the past several runs of the Ecological Citizenship main lesson:

It is difficult to conceptualize the impending danger of climate change because its impact is mostly seen on a global scale. Therefore, I notice that my job, as an individual, is not to revert carbon dioxide levels back to pre-industrial levels or restore the icecaps and glaciers that have melted, but rather be a force for good, by making sure that my choices as an individual contribute to the global mission of protecting our world. Understanding my position in the battle against climate change is an important step towards becoming an ecological citizen.

I hope to make small changes in my own daily life that are helpful to the environment as well as become a more active community member. I plan to share with others the power of being ecologically minded citizens with the intention of bettering the world. I believe it is important to promote the idea that ecological citizens are holistic in their view of climate change, allowing for meaningful growth in the social, economic, political, and natural spheres. Now that I have awareness over the ever evolving nature of climate change, I feel better equipped to live as an ecological citizen in order to make choices that support our environment and the prosperity of our world. I hope to be a force for good in achieving this collective goal, by following sound actions and disseminating valuable information.

Camila Grunberg, Class of 2021

The notion of ecological citizenship pertains to the very purpose of our lives and questions humanity's role in the world. And if so, what does it entail? Although there is not one single, all-encompassing answer that has been proven true, it is one question that is quintessential to human existence. The rise of Humanism resulted in the shift from God to God's creation of man, and yet we are now left with understanding humanity's place in the universe. It is my personal belief that our purpose lies within the striving to understand oneself, the world, and the complexity of being. In our existence, we have the unique opportunity to question everything and transform ourselves and therefore our society. The possibility of opportunity is linked with goodness, and so, to improve our lives, it is imperative to understand the meaning and consequence of our actions. While this question remains unanswered, it is of the utmost importance that we ensure human existence will have the possibility to continue so that future generations will have the potential to search for such truths as well. There is an additional urgency to this as we are running out of time and cannot afford to continue postponing fundamental change.

Leah New, Class of 2021

Personally, this main lesson has affected my mindset towards the environment around me, especially towards consumption. Shopping has become a minefield of moral dilemmas and energy feels wrong when used. A conversation about ecological citizenship is only the first step to contributing your duty as a citizen. The world is one big organism, and whether it's for better or for worse, we humans are a part of it. It is our duty as citizens to work together with the environment to not

let our future generations reap the consequences of our 'consumption without consideration.'

Laura Madhu, Class of 2022

Coming out of this course, I feel like I have a much better understanding of what climate change will lead to, and what needs to be done. It is no longer a concept I am ignorant of, and by having this knowledge I feel a moral obligation to put it to use. Personally, I now find myself more conscious of my daily actions/purchases and think about the real cost when it comes to the bigger picture. Going forward in life, I will make decisions in a new light and hope to only decrease my personal contributions to climate change in the future. I also recognize the wider problem at hand and the necessary change that needs to be done on a larger scale. A part of me wants to say that I am hopeful that the new generation will take matters into their own hands and make the needed change, but I am worried. [...] I hope to use my voice to spread climate awareness and find other ways to get involved more hands-on. I can not ignore the problem at hand because doing nothing tells me that I am ok with where our future is headed, which I am not. Climate change is no longer a passive problem we can continue to sweep under the rug, it's a detrimental problem that is actively destroying our home, and if we continue the way we're headed future generations will struggle to survive and our species would be jeopardized.

Susan Santiago, Class of 2023

I leave this block with a new sense of responsibility, and with it unrest. I intend to use this unrest to make changes in my own personal life, along with setting an example for my community, because we are all ecological citizens of this planet.

Danica Sastra, Class of 2025

Appendix I

Ecological Citizenship – Course Outline

Week 1 Introduction of themes: Environmental Crisis and Climate Change; What is Sustainability? What is a Carbon Footprint? Variations of Citizenship.

Questions and activities: Where do our groceries come from? Where does our garbage go to? What happens after we flush the toilet? How and from where do water, electricity, heat come into our homes?

Readings:

- Excerpt: “Our Common Future” – Report from the UN World Commission on Environment and Development (1987).
- Paul Hawken, “A Declaration of Sustainability” (1993)
- The Earth Charter

Week 2 Ecology: A natural science and a way of viewing the world. Introduction to Intergovernmental Panel on Climate Change; Resistance and Sustainability Citizenship; What’s in the News? – tracking climate change related reporting in the *New York Times*.

Readings and Resources:

- Ecology: Textbook chapter
- Excerpts: Jaboury Ghazoul, *Ecology: A Very Short Introduction* (2020)
- John Barry, “Resistance is Fertile: From Environmental to Sustainability Citizenship” (2006)
- Naomi Klein, “We Have a Once-in-Century Chance”
- IPCC – The Intergovernmental Panel on Climate Change Website (www.ipcc.ch)

Week 3 Environmental Sociology: Environmental Problems are Social Problems; IPCC study and class presentations; *No Impact Man*. What’s in the News? – tracking climate change related reporting in the *New York Times*.

Readings and Resources:

- IPCC – Assessment Report: Summary for Executives; Fact Sheets; Frequently Asked Questions
- Leslie King & Deborah McCarthy Auriffeille, “Environmental Problems Require Social Solutions”
- In-class viewing: *No Impact Man* (2009)

Week 4 The Concept of Ecological Citizenship: Academic Readings

Readings:

- Excerpt: Andrew Dobson, “Environmental Citizenship: Towards Sustainable Development” (2007)
- Excerpt: Andrew Light, “Ecological Citizenship: The Democratic Promise of Restoration” (2006)

Week 5 Solutions: Project Drawdown: Study and Class Presentations; student reporting on their experience with the No Impact challenge; fieldwork: working in the community garden; day trip: a visit to Governors Island.

Resources:

Project Drawdown: www.drawdown.org

Appendix II

Recitation – Our Purpose in Poetry

Teaching this course opens multiple avenues for working with the students’ soul faculties of thinking, feeling, and willing. Complex scientific data and theoretical constructions are offered as an advanced challenge to the students’ thinking; the will is exercised in taking on the “No Impact” challenge of reducing consumption and waste, as well as the demanding academic challenges of the course; feelings of dread, anger, inspiration, hope, and responsibility swarm through the classroom during this block, where the pedagogical intention is to guide the course of this flow from dread or alarm to a sense of responsibility and resolve.

As any Waldorf teacher knows, it is through the feeling channel that we are able to get to the students in the most effective and lasting way. A classroom felt experience will stay with them long after the content of a course is forgotten.

Speech work offers a highly effective way to activate and exercise the feeling channel in the classroom. In recitation, speech becomes the matter of breath; ideas, verbalized, resonate through our lungs and larynx; emotion binds itself to semantic structure and oxygen; words composed by others flow through our bodies like a melody through a flute – we are the instrument and the player, too. In group recitation, the individual is one with others, participating as a part in a whole. Deliberate recitation tunes the students to be like members of a choir, a dance troupe, a eurythmy group. Rhythm, musicality, inflection, vocal turns of phrase are the tools of soulful recitation.

Amanda Gorman’s long poem, “Our Purpose in Poetry: Or, Earthrise,” offers excellent material for this course’s speech work. It states in short lines many of the messages delivered in the course, leaving to the teacher the roles of arranging and conducting the verbal notes into musical speech.

Our Purpose in Poetry: Or, Earthrise

Dedicated to Al Gore and The Climate Reality Project

Amanda Gorman

On Christmas Eve, 1968, astronaut Bill Anders
Snapped a photo of the earth
As Apollo 8 orbited the moon.

Those three guys
Were surprised
To see from their eyes
Our planet looked like an earthrise
A blue orb hovering over the moon's gray horizon,
with deep oceans and silver skies.

It was our world's first glance at itself
Our first chance to see a shared reality,
A declared stance and a commonality;

A glimpse into our planet's mirror,
And as threats drew nearer,
Our own urgency became clearer,
As we realize that we hold nothing dearer
than this floating body we all call home.

We've known
That we're caught in the throes
Of climactic changes some say
Will just go away,
While some simply pray
To survive another day;
For it is the obscure, the oppressed, the poor,
Who when the disaster
Is declared done,
Still suffer more than anyone.

Climate change is the single greatest challenge
of our time,

Of this, you're certainly aware.
It's saddening, but I cannot spare you
From knowing an inconvenient fact, because
It's getting the facts straight that gets us to act and
not to wait.

So I tell you this not to scare you,
But to prepare you, to dare you
To dream a different reality,

Where despite disparities
We all care to protect this world,
This riddled blue marble, this little true marvel
To muster the verve and the nerve

To see how we can serve
Our planet. You don't need to be a politician
To make it your mission to conserve, to protect,
To preserve that one and only home
That is ours,
To use your unique power
To give next generations the planet they deserve.

We are demonstrating, creating, advocating

We heed this inconvenient truth, because we need to
be anything but lenient
With the future of our youth.

And while this is a training,
in sustaining the future of our planet,
There is no rehearsal. The time is
Now
Now
Now,
Because the reversal of harm,
And protection of a future so universal
Should be anything but controversial.

So, earth, pale blue dot
We will fail you not.

Just as we chose to go to the moon
We know it's never too soon
To choose hope.
We choose to do more than cope
With climate change
We choose to end it—
We refuse to lose.
Together we do this and more
Not because it's very easy or nice
But because it is necessary,
Because with every dawn we carry
the weight of the fate of this celestial body orbit-
ing a star.
And as heavy as that weight sounded, it doesn't
hold us down,
But it keeps us grounded, steady, ready,
Because an environmental movement of this size
Is simply another form of an earthrise.

To see it, close your eyes.
Visualize that all of us leaders in this room
and outside of these walls or in the halls, all
of us changemakers are in a spacecraft,
Floating like a silver raft
in space, and we see the face of our planet anew.
We relish the view;
We witness its round green and brilliant blue,

Which inspires us to ask deeply, wholly:
What can we do?
Open your eyes.
Know that the future of
this wise planet
Lies right in sight:
Right in all of us. Trust
this earth uprising.
All of us bring light to exciting solutions never
tried before
For it is our hope that implores us, at our uncompromising core,
To keep rising up for an earth more than worth
fighting for.

Amanda S. C. Gorman (born March 7, 1998) is an American poet. She was the first National Youth Poet Laureate (2017) and is remembered for her delivery of her poem “The Hill We Climb” at the inauguration of President Joseph R. Biden, when she was not quite 23 years old.

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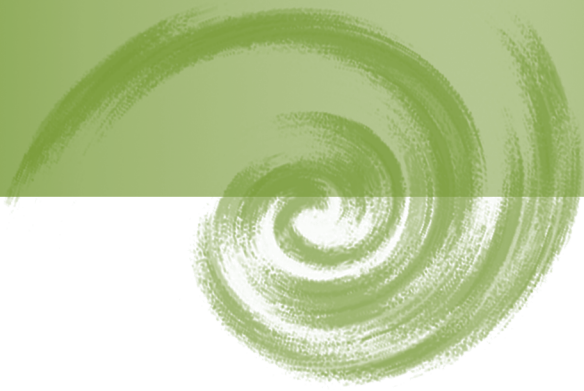
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Environmental Crisis

The Quality of Life on Earth*

John F. Gardner

*We are destroying nature.
We don't destroy what we love.
We don't love nature.
Why don't we?*

The high school juniors at the Waldorf School of Garden City were asked one spring, as a project in English and as a way of increasing their grasp of problems connected with the environment, to interview concerned citizens of their own communities. As a trial run, some of the students interviewed me. The course of several such interviews is pretty well summarized in the following interchange, though a few of the questions are such as I have received from parents and teachers.

Q. Mr. Gardner, I wonder whether you have been following the material that is coming out about our abuse of the environment?

A. I have read enough to convince me that we are well into the greatest crisis humanity has ever faced.

Did you already know of the conditions that are now coming to light?

One learns something new every day, but the general picture has long been clear to those who love nature. This trend towards abusing the Earth has been noticeable for centuries. Thoreau saw it. Blake saw it. Maybe the Greeks foresaw that the Age of Iron would end this way. So long as only the Earth and the lower kingdoms of the Earth were suffering, most people didn't care too much. But now the question begins to be one of life or death for humankind. That makes it serious!

Do you think there's any hope of solving the problem?

We must try, or see the Earth destroyed. Teachers have possibly the most important job to do. They influence the way the next generation will think. That determines how they will feel, and therefore act. Teachers are in a position to dig down to the beginnings of attitudes.

What attitude, in your opinion, causes abuse of the environment?

I think our attitude towards nature starts, as do all attitudes, with certain ideas, certain inadequate conceptions. Modern souls have become estranged from nature. This means they are partly blind and partly don't care. Few of us are grateful to the world that sustains us. It rarely occurs to us that we should look to nature with thanks. This ingratitude has many causes. For example, the nature most of use is already sick; the freshness, the beauty it has to give are under a pall. Then, too, our very conception of nature makes reverence or gratitude seem inappropriate. We have been schooled in the mechanics, the dynamics, the mathematics, and the economics of natural processes, but less and less do we hear of the morality, the spirituality, the divine life. How can we love a mechanical nature?

We have been taught that all beings are engaged in a competitive struggle for existence, each locked in kill-or-be-killed, eat-or-be-eaten combat with others. Why should we be grateful to those who contest our very existence, who want to do us in? We are also taught that our rationality, esthetic taste, and moral idealism operate within a universal context that is ignorant of them, indifferent to them, and in the end hostile to them. We are shown human beings pitted against an all-powerful but basically inhumane world-process. Many believe that as humans we are born accidentally, survive precariously for a brief moment, and then are ignobly extinguished. If we conceive the natural process in this way as our ultimate enemy, will we not feel at least put off, probably aggressive, and eventually cruel in our dealings with nature?

Do you think modern science's idea of the world is false?

In details it is true, but the trouble is that scientists don't claim any longer to go beyond details. They leave it to others to formulate "world conceptions." But people need an idea of the whole; and when they look for the implications of the technical data supplied by science, they come to the discouraging ideas I have mentioned. These ideas are very widespread. They are being given by well-meaning teachers to children in the earliest grades of elementary school throughout our land today.

* This article appeared as Proceedings #24 of the Myrin Institute in 1971 and is reprinted here, with minor editing, with full permission of the Institute. Other Myrin publications including several by John F. Gardner are available at www.myrin.org.

Do you see any signs of a change?

It seems to me we are at the beginning of a profound change; otherwise we should not be suddenly aware of how estranged from nature we have become, and of how hazardous our condition is.

The new interest in nature is clear enough, but some of us have wondered whether it is not mostly fear – fear of the consequences to ourselves of what we have been doing wrong. How do you account for this new attitude?

The crisis of the environment has been preparing for a very long time: at least hundreds of years, probably more. The only thing new is the awakening. More and more people are beginning to see what has hitherto been systematically overlooked. Our consciousness has begun to change.

What do you imply by a change of consciousness?

I mean a different way of thinking, one that concerns itself with whole entities more than with collections of details. To see things this way requires intuition. It means learning to read words as well as spell letters. When you do this, the world changes. It begins to light up.

So you think we have been living mostly in darkness?

In so far as we are bright people, strong on critical thinking, trained in scientific method, I believe we negotiate with the world from the outside. We are outsiders. When you are on the outside of anything, you are in the dark about it. Much of the technical knowledge about nature today is still being gained by methods that are called experimental, but could better be called assault and battery. From an approach of this kind life retreats and meaning conceals itself. But life and meaning are what give light! The more we have learned about nature as matter and energy, the more we have lost touch with it as intelligence and beauty. In other words, progressive enlightenment of one kind has been deepening darkness of another. But I hope we are beginning, as Martin Buber said, to “turn.”

Can you apply this “turning” to the crisis of the environment?

Any turning away from intellectualism towards intuitive understanding will lead to a renewal of warmth and of conscience towards nature. If we can find again what the people of long ago found in the natural environment

– namely, values that match what is intimate and basic in ourselves – we shall find ourselves at home again in the universe.

But is it not characteristic of the scientific view that human beings consider themselves very much as belonging to nature and being inhabitants of the universe?

So they do, but since most of us still regard nature materialistically, we tend to see ourselves in the same way. We ourselves are but facts among facts, organisms among organisms. But it is impossible for a human being to develop respect, much less affection, for mere objects. Therefore, though we indulge our appetites, we do not basically respect ourselves. And this disappointment in ourselves, however unconscious, tends to become resentment against nature. We become destructive.

You feel that the turn towards intuitive thinking will bring a whole new mood, so that people will again honor and love nature?

Yes. What we honor and love and take joy in, we do not exploit or degrade.

I think I follow you, but most of us are still not sure we would know either intellect or intuition if we saw it. Can we get down to examples?

We don't lack for examples of intellectualistic thinking. It is the basic tool of our day, in every walk of life. It is spelled out formally in the so-called scientific method:

1. Use the physical senses to perceive the physical facts. Use machines to extend or refine physical perception. Dissect and sub-dissect; lay everything open to perception.
2. Measure, count, and weigh. Describe and name all parts, and parts of parts. Classify. Correlate.
3. Develop a generalization. Formulate a hypothesis.
4. Test this hypothesis by physical experiments.

By such procedures we can identify only material facts, and establish only abstract laws to explain them. Any attempt to pass beyond dead matter to what enlivens or inhabits matter can go no farther than the making of inferences. Inferences lack substance. They hardly carry conviction and rarely kindle enthusiasm. If we are to know realities of the inward dimension, we shall need

an inward form of perception as the basis for a higher kind of science.

Basis for a Higher Kind of Science

You seem to be stating a belief that it is possible to perceive with higher senses. How are these acquired?

They appear as the transformation of the power of thought, when love and patience are added to it. Thinking that is concentrated and strengthened by love begins to become a higher kind of perception. This begins as imagination. I have come to realize that imaginative thinking, or spiritually-perceptive thinking, does not need to guess about life. It can participate consciously in living realities.

What are we actually talking about? Suppose I'm looking at a rock, or a pool of water. Is an imaginative approach to these open to the ordinary person?

Yes, even though neither of these things is directly alive. The analytical and the imaginative kinds of thinking would *begin* with the same physical observation of the water. But then the two paths would diverge. Analysis would seek useful information by testing the water for weight, mineral content, boiling point, and so on. It would break the water down into two parts of hydrogen and one of oxygen. Imaginative thought, on the other hand, would abide with the unity of the water just as it appears. The observer would let the buoyancy, transparency, or fluidity of water become a matter of inner experience. This outer-inner experience would no doubt be pale at first, but through repeated effort it would become strong. To experience the *quality* of water in the *substance* of water with complete objectivity is a good enough example of what I mean by real imagination.

You believe, then, that the untrained observers can become more at one with the things they see, and that when they do this, they come to know these things from the inside? Penetrating them in this way, they find more than matter?

Yes. And this “more” is the only thing that can make them feel at home in the world, or deeply interested in it.

But I must ask again how can we apply practically what you call imagination to the present crisis of the environment?

When people are educated to *participate* in the life of

nature, they will not want to injure her; and they will not be easily fooled about whether they *are* hurting her by seemingly clever actions of one kind or another. They will see things in context, and alive. Out of the sense of the living whole we shall gain the instinct to distinguish between deeds that favor health, beauty, and sanity, over those that are destructive. This instinctively sound judgment will then serve as the control for practical undertakings.

Could you apply what you have said to some contemporary scientific or engineering problem?

Yes. Let's take a problem facing the Soviet government: Should Russia try to irrigate parts of central Asia and replenish the dying Aral Sea by reversing the course of certain rivers that now flow north into the Arctic Ocean, making them flow southwards? It appears that some scientists think this feat technically possible. Or better yet, consider the proposal on which our own government has already spent millions in preliminary studies: Should lakes be created by dams in Alaska, where there is heavy rainfall, and this water be piped down to irrigate several Western states, raise the level of the Great Lakes, and supply power as far south as Mexico?

I believe technical science cannot answer such questions. Scientific method as we know it depends upon experimentation, and there is no way to experiment with either of these vast projects. The wisdom required to foresee results without experiment goes beyond human compass. My question is: Have we any hope of access to a wisdom higher, more comprehensive, than our own?

Some kind of inspiration? Do you believe in that?

I must admit that I do. All the poets, saints, and seers who have cultivated imaginative forms of thought during the past millennia would agree that there is such a thing as inspiration, and that it brings practical wisdom. In former times inspiration was for many not a belief, but an experience. They asked, and they were answered: perhaps by the very mountains and rivers, and out of the air and light themselves. It lies in the nature of imagination that its objects all tend to become subjects at last; its facts become beings. Every being has wisdom to reveal. That is inspiration.

One hesitates to say what one really thinks about these things, because people become either bewildered or angry when they hear it suggested that religious traditions may not be all superstition. These traditions tell us that within and behind the external appearances of

nature lie divine will and wisdom. These rule through all levels, living and dead, above and below us. All beings have something to tell, about what is wise and what is foolish, to human beings who are humble enough to ask them and pure enough to hear them. To some who have prayed, the inspiration may come as a new thought when they waken in the morning. In some it grows as an obscure but persistent instinct for the right way. For seers it becomes a clear and conscious colloquy. But all who care, who seek to see life whole, who are not cut off by pride in their own cleverness, can find guidance that goes beyond human limitations.

Questions of Overgrowth

Leaving aside the possibility of divine guidance, I'd like to hear your own ideas about several of the difficulties now confronting us.

For example?

I'm thinking of two developments. The first is the geometrical increase of population; the second is our insatiable demand for goods that can be supplied only by plundering the Earth.

I do not believe in abstract extrapolations of the kind now being applied to the population problem. Mark Twain once observed that since the Mississippi River had shortened itself a mile or more every year by forcing a more direct channel through some of its bends, we could look forward in a thousand years or so to a Mississippi River only a mile long!

It is true, however, that we now have an overgrowth of population that is tending to overtax the natural environment. We do need to find a way to control this overgrowth. The only measures being proposed are contraceptive, and they must doubtless be worked on. But I am not persuaded that contraception goes to the root of the problem.

If procreation is not the root of overpopulation, what is?

Since I have said other strange things, perhaps you will forgive one more. One has the impression that although procreation obviously accounts for more babies being born, it does not account for any of the other forms of overgrowth that characterize our Western Civilization. Consider, for example, the explosion of scientific knowledge, the drive toward mass production, the extravagant consumption, the monetary inflation, the speed-up of our whole way of life, the phenomenon of megalopolis; and, above all, the prevalence of cancer

as the disease of our time. Undoubtedly each of these examples of hypertrophy has its own explanation, yet they all have something in common, and I believe at some level they have a common cause.

You think things in general today are getting too big and too many, and that what would control one would control all.

That may be overstating the case, but I am certainly interested in that line of thought. Hypertrophy seems to me to be an increase of gross *substance* unlimited by form. Formless growth, anarchic growth, growth for its own sake, is the problem. But the part should always remain subordinate to the whole. The single part's growth is healthy and serves its function well only when it remains proportional to the growth of all the other parts. Thus, we must look to the health and beauty of the whole if we wish to find the formative principle that should dominate the growth of the parts.

The analogy of other forms of overgrowth to that of cancer has been made before. But how does it help?

In cancer, as I understand it, the formative, proportion-keeping principle that should rule the whole organism is somehow broken through. In a certain area, then, the forces of sheer growth run rampant. The part takes for itself what should belong to the whole organism. As a result, the organism undergoes deprivation, distortion, and eventual destruction. I think of the overgrowth of cities and of scientific knowledge and of our appetite for material goods as being "cancerous" in this sense. In each case, there is unbridled expansion of the part at the expense of the whole. This can happen only when the mysterious *ruling idea* that should dominate the whole has been weakened. I admit I have hardly a clue as to what the ruling idea might be that would control such a phenomenon as overpopulation. But I should try to find it by looking at matters macroscopically rather than microscopically. Too much analysis leads away from the solution.

I believe, as I have said, that since we do not understand what we know, do not feel what we do, and develop powerful drives that threaten rationality, today soul and body are divorced from one another. I can well imagine that the body would become anarchical.

Are you suggesting that the metabolism of someone who thinks feelingly and feels thinkingly, who acts from harmony of feeling and thought, will be different, and that cancer will therefore not develop in such an individual?

In medical questions I have only the layman's right to use common sense. I am ready to believe that when individuals are at one with themselves, they will tend to hold their bodily form intact. Such individuals will be hardy enough to resist anarchic breakthroughs. And I feel there must be an analogy possible between what checks the overgrowth of cells and what, *apart* from contraception, would prevent a population explosion. Maybe one of these days someone will be able to complete this notion, which I cannot.

Agriculture, Industry, Politics

If you don't mind, I'd like to broaden our conversation about the crisis of the environment. After all, this is a total problem, yet we've been speaking of solutions chiefly from the viewpoint of education. Surely other social agencies should be able to do something helpful. You have pointed to where you think education is making its big mistake, but do you have any ideas about what has gone wrong with agriculture, or industry, or politics, that they could not foresee and forestall what is happening to the Earth?

I must repeat that my competence lies in education. While I am interested in other fields, my ideas about them are quite general.

I'd be glad to hear of any change that you think business might make to improve the health of the environment, so that we could all look forward to a happier life than now seems likely for the future.

I once heard it said that there is as much suffering in the world as there is egoism. I also remember that Rudolf Steiner, the founder of Waldorf education, made this point long ago.

It seems obvious that self-interest is the source of the trouble between our economy and the world of nature. Self-interest permits us to ruin nature without even noticing what we have done, much less feeling sorry about it. We each seek our own interest, and feel quite righteous about doing so. The hired worker works for a living; the enterpriser works for profit. The accepted theory in America is that the profit motive is what has made capitalism great. "Profit makes the wheels go round, produces wealth for all, brings about the affluent society..." and so on. Yet it seems obvious to me, despite Adam Smith, that when each worker seeks first and last self interest, the economy will lack overall foresight and prudence. It will also lack the spirit of service. And before long it will tear the environment to pieces just as a school of minnows tears to shreds a piece of bread cast into the water.

But if an activity becomes harmful, won't it be stopped for selfish reasons because profit falls off?

Not where nature is concerned – not until a resource has been exhausted, or a major catastrophe is practically unavoidable. The depletion of soils and of food values due to chemical forcing, the multiplication of insect hordes due to monoculture in farming, and so on, have long been well known. Yet they do not check present practices in agriculture, which is surely headed for disaster. When human beings are displeased by a product, they will eventually do without it and so change the producer's mind. They can and do speak to some extent for themselves. But no one speaks for nature.

You are suggesting that a farmer who cares less for profit and more for the soil, for the animals, and so on, would not exploit them. But won't these products be expensive, at least in the short run, when the neighboring farmer can produce more, and do it more cheaply, by forcing their growth?

Obviously, and that is why agriculture and animal husbandry cannot follow wise practices so long as the farmers who truly care for nature are at the mercy of those who aim primarily at short-term profit. The same thing applies to industry.

You mean that manufacturers who took adequate measures to protect the environment from pollution by their factories, who did not want to sell more than people really needed, who wanted to avoid waste by making products last as long as possible, might soon be out of business?

Doesn't it seem likely? One altruist among many egoists in business can find himself a sheep among wolves.

If that's the way things are, what do you propose? Even if people are selfish, we can't start with a different human race, or with angels!

No. I contend that people are no more selfish than they are unselfish. At least there is a world of sympathy and concern in most of us as we now are. The trouble lies in our ideas, not in our feelings. There is a false idea abroad that tyrannizes our economy. This is the idea of profit as the ultimate motive of economic enterprise. This idea sanctions selfishness in economic life, even when mankind recognizes clearly in all other areas that unlimited selfishness is destructive. It keeps businessmen from allowing their natural inclination towards compassion and fellowship, their gift for teamwork, to function. I believe that this form of the idea of profit

should be set aside. Regular business people could perfectly well replace self-seeking by a very different motivation – one that is more exciting, more satisfying, and far more appropriate to the situation in which we find ourselves on this planet.

What would such a motive be?

Service. Friendly collaboration. Care for the national future!

I agree with you that even as ordinary folks we do at times care! We do take pleasure in serving some people on some occasions, and perhaps what we call service activities are on the increase. But can service really become the motive for economic undertakings? One could imagine such a change if our whole society were engaged in an enterprise with a goal that could inspire all of us, and with leadership in which we had confidence. Then each of us would perhaps feel the importance of doing our best for the common cause. But that is hardly true of our present society. No one seems to grasp where we are going, or why; so most of us fall back upon looking out for ourselves.

I don't object to looking out for oneself. But we will succeed only when we are interested genuinely in the rest of the world. Otherwise, we will be self-defeating, no matter what we do. It is the essence of human nature to look beyond the self. We are happiest when we are caught up in the pursuit of truth, or are adorning the world with a new creation, or are enjoying friends. Looking outwards from ourselves, we are amused and inspired; we find work to do. It is the objective world that gives us our task; and if the world is pleased, we are pleased.

But I should like to return to your valid objection that one can hardly work for society as a whole when it has no common sense of purpose. This seems so often to be the case. We unite to some extent in a war, but in peace we fall into disunity. We look to peace as the time when all can prosper and experience pleasure without interference, and such an aim hardly encourages the spirit of service.

I don't think it is only because I am a teacher that I come back to education. If education does not give any sense of the higher meaning of life on earth, or even a little inspiration to moral development, or a small desire to protect and enhance nature for its own sake, then obviously we shall have no common goals for our peace, and we shall not know how we may best serve society.

But you believe that if the schools can awaken

imagination and intuition, we shall be able to do these things, and that business will then fall into the right perspective?

Precisely. I know we are far from where we should be, and it will take an immense force to rouse the nation out of egoism and materialism. But such an immense force is beginning to make itself felt.

What do you have in mind?

I mean the sense of the catastrophe that we will face if we go further in despoiling this planet. Substantial numbers of people are at last beginning to see that we cannot go on making physical production and consumption the aim of life. The earth can no longer stand it. If we are to find a goal other than material goods, it can only be goodness itself. As Plato said, humankind's real goal is not goods but goodness. Goodness can be achieved only by the free choice and effort of each individual, but it can also be achieved only when the spirit of the whole awakens in each of us.

I imagine that what you are proposing for economic life would sound communistic to many people.

Perhaps it would. But every 'ism' has its right application somewhere. Though Communism in the Marxist sense has been shown not to lead to it, communal purpose and effort are worthy aims. It was St. Paul, not Marx, who said, "Ye are many members, but one body."

I take it that your idea of communal effort has nothing to do with political communism as state ownership of the means of production, the rule of economic processes by bureaucrats, and so on?

I am certainly not in favor of political communism.

What I have in mind is an economy in which individuals are free to act out of their expertness and initiative, in which they associate and collaborate by choice, but in which their economic motive is the public welfare.

While one can sympathize with the social idealism that still draws people into the orbit of communism, the idea of having the state own and run business is surely ineffective. State-run operations have always seemed to me either musty and mousy or unduly grandiose and extravagant. The state has no economic sense. It takes no account of personal preference; it smothers personal initiative. There is surely a rightful sphere of activity for the state, but it has nothing to do with running the economy.

The Role of Government

I'm glad you mentioned the question of government, because I should like your opinion on what the government has done to bring us to our present state. Many people are saying that only big government can now force the economy into line by passing stringent new laws and releasing vast sums of money for reclamation of the air and water. Even conservatives appear to be asking the government to move in on business.

I have to remind you that I know still less, if possible, of politics than of business. There is, however, a certain advantage in ignorance. It simplifies questions greatly! I have a single strong conviction about what government has done wrong and what it could do right in regards to our treatment of natural resources and the Earth environment in general.

What would that be?

I believe that human beings should be able to express their preferences in certain matters and make them stick. If people want their children to have a healthful environment in the future, they should be able to say so. After they state their will in the matter, it should be absolutely binding on all economic activities that affect the environment. It should be the absolute limit within which these activities operate.

You believe that government exists to bring about such consensus and give force to it. By passing laws?

Yes, by passing and enforcing laws.

Is there anything new in your idea? Do we not now pass the laws we think necessary?

We pass many more laws than we enforce, unfortunately. And a massively broken law seems to me worse than no law at all.

But do we really pass the laws we want? I doubt it. The issues that come up for vote are often so remote from our experience, or so complicated, that most of us can hardly remember being asked the kind of direct and plain question we should feel competent to judge out of common sense and from the heart. Why were the voters not asked, long ago, to state unequivocally their desire as regards fresh air, clean water, and so on?

Do you think people really want a wholesome Earth more than they want nylon stockings, plastics, cars, and airplanes? Would they vote for the former, if it meant curbing the latter?

I don't know. Admitted that Americans have willfully closed their eyes to the cost of many processes in industry, mining, forestry, and agriculture. Admitted that, because of their schooling, they are insensitive to the higher Nature of nature, and so do not feel strongly about the ugliness and cruelty of what technology is doing. Still, they are not altogether dead to these concerns, and they are certainly alive to the issue of the survival of themselves and their children. They could have faced certain issues long since.

Why didn't they, then?

A. Partly, I think, because there are powerful economic lobbies busy in political life, where they don't belong. These interests would find it inconvenient if voters were to decide in purely human terms—spiritually envisioned and understood—how the Earth environment should be used.

But isn't that democracy: The interplay of pressure groups?

I think not. Economic pressures there must be, but their adjustment should take place not through politics but in the economic realm itself. If business people – consumers and middlemen, as well as producers – can get together for the purpose, economic questions can be judged by those who have experience, and managed by those who have ability, so long as their overall purpose truly, in the highest sense, is to serve the common welfare.

What I am advocating is a few simple but comprehensive standards of decency and common sense to be established by an electorate voting as equals. Don't forget that the essence of democracy is voting *as equals*. Individual persons are not the equals of pressure groups.

It is also foolish to have people vote as equals on questions concerning which they are not equal. The kinds of questions on which one person's feeling is as good as another's are bound to be elementary, unspecialized, simply human. They are neither economic questions, nor science questions, but matters of fair play, of conscience, of instinctive/intuitive consensus. Examples would be: "Shall we arrange that all children may have the opportunity for education independently of their parents' bank account?" "Shall we forbid the economic exploitation of human labor?" "Shall we guarantee support of the aged, infirm, and indigent?" "Shall we protect ourselves against hostile and criminal agents?"

I believe that were economic interests not diverting and confusing the electorate, and had these interests not the power to block legislative and police action, Americans today would almost be ready to come to a resolution that could be expressed somewhat like this: "We want laws to be passed that absolutely limit all forms of production and consumption that show signs of further ruining the Earth environment." And I hope they would be ready to vote a positive resolution to match the negative: "We want some kind of national policy that will give citizens, especially when they are young, the chance to work actively at the task of restoring and enhancing the health and beauty of nature."

I wonder if you realize how unconcerned most people still are? In any case, who can know, first of all, just how much production or consumption will ruin the Earth? Second, who can enforce the chaining or the transformation of technology, when Americans are accustomed to material affluence and look to machines to save them work? Remember, there will be millions more people every year to present their demands.

You are right, but so am I. Regardless of improbabilities and even impossibilities that derive from bad habits, bad education, and even trends beyond our control, the chance must exist for citizens to establish ideals and standards on matters in which the only interests are purely human interests in the best sense. At present, economic interests play forcefully into the legislative process, and in my opinion government must purge itself of these interests.

You want the government out of business entirely?

Right. If government tries to manage the economy, it must expect that economic forces will eventually manage it, which is everywhere happening. The true business of government is the safeguarding of simple standards for our communal life.

Separation of School and State

There is still another area that I think the state should retire from. This is the most important change of any I have to suggest. As it touches what I know most about, I propose it very strongly.

What do you have in mind?

The so-called public school system.

What advantage do you see in a move of this kind?

I have tried to state some of the advantages in a couple of articles on the subject. In them, I answer a few of the questions that arise whenever one suggests dismantling the public school system and replacing it by independent schools. The point I'd like to make now, however, is specific to the environment and to the discussion with which we began.

We started with your idea that we abuse the Earth because we don't love it. And we don't love it because we look at it as strangers. What we need is to be educated in intuition, you said. Right?

That is the very point I want to emphasize. There are many reasons for the fading of imagination, inspiration, and intuition in our day. [The Irish writer] Padraic Colum [1881-1972] says that the imagination used to be exercised in every home, every evening, by the telling and hearing of stories. The advent of the electric light bulb ended that with a single stroke. Many changes will have to take place in education if real imagination is to come alive again despite electric lights; but the step that could make all the difference would be granting education full independence.

It's hard to see how freeing schools from state control would work to develop intuitive kinds of knowledge. Why wouldn't it have the opposite effect, or other effects?

In the single case, an independent school may well ignore or even stultify the intuitive side of its children. Yet there is good reason to believe that the mere fact of freedom in education would, on the whole, move most schools towards qualitative, inward values.

Just imagine what it would mean if *all* students, or their parents, were in a position to seek out a school purely because of the values it stands for! Their personal *interest* would become actual *involvement*. This involvement would lead to enthusiasm and initiative among the parents as well as among the students. And then picture the teachers who are freed from externally imposed objectives and standards. They confront a particular student with but two goals: to find out what lies in this student, and to draw it out. Their task is to bring their own best to meet what is best in the student. Under these conditions, education can develop according to intrinsic rather than extrinsic motivations. Curriculum and methods will come alive. Not only will subject matter be more imaginatively and intuitively taught; the students will become far more creative.

Freedom stirs the will. The will is the creative part of us. When our thinking is willed through and through,

it no longer plays upon the surface of things, but penetrates. The surface of the world is matter; the depth is spirit. When thinking becomes active, *because it is free to care for what counts most*, it gains strength to pass beyond matter to what enlivens matter. It finds the creative spirit in all things. Should this spirit come alive in schools, we'd enter a new era. Our relation to nature would change radically, and wisdom would begin to replace cruelty in our treatment of the environment.

You hope a great deal from the freeing of education!

I do, indeed. It seems to me that when teachers can settle down to the real business of education—to awaken, empower, and improve human beings—they will be glad to do so. When children are so taught, they will respond. When external goals and pressures are removed, teachers and students will begin to listen to what life says to the heart and to the conscience. And this concern will bring to pass what we need more than anything if we are to stop the ravaging of the Earth.

At present we expect nature to serve our human purposes; we bend it to our pleasure. Yet we feel no lasting pleasure, and we have no real purpose. That is why our justified mastery becomes unjustifiable exploitation. Our emptiness craves to be filled. Joy would fill it. Meaning would fill it. Grateful love would fill it. But the external way of looking at things does not permit joy, or meaning, or reverence, or even gratitude. So, because of our emptiness of soul, the ignorant desire for material goods and services becomes insatiable. As long as this displaced craving rules in us, we shall not curb the suicidal mania to consume. To continue in this way would be to destroy this planet of unbelievable loveliness, which for mankind should be so full of hope.

John F. Gardner (1912-1998) served for a quarter-century as Faculty Chair and teacher of literature and life sciences at the Garden City Waldorf School on Long Island, NY, during which time the school grew from three grades to an established K-12 institution. In 1964, he launched the Waldorf Institute for Liberal Education at Adelphi University, which awarded him an honorary LittD., in 1974. John was a life-long lover of nature, especially of trees, and was known as an expert logger during his youth as a lumberjack in Washington State. A prolific writer and dynamic speaker, John authored three collections of essays on education. A fourth volume of his articles is currently being prepared for posthumous publication, and should be available in the coming year.

Qualitative Meta Research in Current Educational Practices

An Ongoing Project at the Research Institute for Waldorf Education

The goal of RIWE's qualitative Meta Research project is to compile contemporary research for teachers and parents on topics directly related to the pedagogical approaches that have been practiced in Waldorf schools for more than a century.

With generous support from the Waldorf Educational Foundation, RIWE has launched this research project by commissioning seasoned Waldorf teachers to begin sifting and sorting through voluminous contemporary studies and discoveries in human physiology and neurology and on innovations in teaching. Summaries of the most compelling insights and empirical studies are then to be compared with longstanding Waldorf practices.

In contrast to previous studies of this nature, the intent of this research project is not simply to sound the customary refrain, "Waldorf education is effective and here is the research to prove it!" but rather to start, so to speak, at the other end of the telescope by focusing on the finding of recent empirical studies of child development and educational practices. Out of this research, we will be able to inform teachers and parents about current studies, underlining their relation to established Waldorf practice and how they confirm or diverge from what we have been doing in Waldorf education for the past century.

For example, the introduction of sophisticated fMRI equipment makes possible as never before advanced and highly specific studies of electro-chemical brain activity and its inferred relationship to cognition. Studies following these recent fMRI-driven observations tend to verify many hallmark Waldorf practices.

In founding the first Waldorf school, Rudolf Steiner suggested that science would eventually "catch up" with these practices. The prediction did not, however, anticipate the sheer volume of information produced since then by contemporary science, which can simply overwhelm the wider audience or hide newly gained knowledge from view due to information overload. The RIWE research project aims to collect, evaluate, and digest a range of studies by topic, so these can be of service to schools, teachers, and parents who wish to further understand the efficacy of Waldorf practices in the idiom of contemporary science.

By recruiting long-time Waldorf educators to conduct this research project, RIWE also hopes to capture the insights, experience, and unique perspective of such seasoned teachers, as they begin to retire from the classroom.

Topics completed or underway:

- Impact of sleep on learning
- Effects of unrestricted play on learning
- The influence of race on the Waldorf experience
- Cursive handwriting in elementary grades
- Cognitive benefits of performing (rather than just listening to) music
- Immersion learning or "block teaching"
- Sensory and motor nerve activity in learning
- Virtual vs. actual experiences in retention, comprehension, and learning

Topics still to be explored:

- breathing and its impact on learning and retention
- learning through direct experience of the outdoors and in nature
- homework in school, schoolwork at home (experiential learning)
- project learning
- portfolio assessment
- site-based-management of school administration
- teaching theoretical sciences through artistic practice
- looping (keeping same class teacher for multiple years)
- learning from making mistakes
- exercises across the mid-line; learning through use of proprioception
- 2-D and 3-D learning
- comprehension and retention from back-lit versus front-lit displays
- screen time and its behavioral results
- eurythmy and spatial 360-degree awareness
- effects of competition on learning

Readers of this journal who are interested in any of these topics—or in exploring other topics not listed here—are invited to contact RIWE and become part of this ongoing and far-reaching research.

The Non-Musical Outcomes of Casual Music Participation

A Research in Progress

Jason Child

Rudolf Steiner's later lectures on education are a treasure trove for any teacher in a Waldorf school, as they represent the ideals of anthroposophical education as refined and distilled by those first years of actual implementation. The lecture series GA 302a, known as Education for Adolescents, has many such insights; at one point Steiner makes some comments about participation in music that hint at the distinctive benefits of both singing and playing instruments: "Playing musical instruments is recommended for children with poor imagination and memory... Singing is more suitable for children with a vivid imagination... It would be ideal—if we had the necessary rooms—to teach both groups simultaneously, one in singing, the other in instrumental music." In these statements, among others, Steiner makes it clear that music is a part of the Waldorf curriculum not because of some aim toward developing future orchestral musicians or stars of the opera stage, but because music develops and balances key human capacities.

Unfortunately, much of the modern research into the benefits of participation in music is written in support of music education as it exists in the United States today, in other words, as an elective for those dedicated and driven students who passionately study and practice music in a disciplined, focused way. Waldorf schools offer a different approach. Inspired by Steiner's original interest in the qualities that music can develop, Waldorf music educators continue to provide experiences in both singing and instrumental music for all students. In providing a broad and universal music education for all students, Waldorf schools often do not offer what is available in more intensive, exclusive music programs found in some other schools. Although some Waldorf alums do go on to conservatory and distinguish themselves in music, most Waldorf students are what could be called "casual" or participatory musicians. They most likely do not pursue music after graduating and may not continue to participate in any way.

Regardless, is there still some benefit to casual music participation? What does the research show about its benefits? Are the extra-musical benefits limited only to the disciplined, rigorous students of music, or are there still benefits to informal, participatory, and community-oriented musicianship?

What is the significance of Steiner's comments on the differences between instrumental music making and singing?

Here is a brief summary of some findings in the literature so far. Each bullet point represents the findings of a study (or one of the findings). The research consulted so far mainly represents meta-analyses, although there are some intervention studies included.

I. Cognitive Benefits

1. Rigorous instrumental training improves memory and cognition (but not general intelligence).
2. Instrumental vs. vocal music: studies suggest instrumental training may have stronger effects on cognitive development.
3. Casual music participation is linked to higher reading achievement, improved attention, memory, and executive functions (if enjoyable and engaging).

II. Social and Emotional Benefits

1. Sense of belonging and teamwork: Group music activities foster collaboration and social connection.
2. Emotional well-being: Music provides a means for self-expression and emotional regulation.
3. Essential life skills: Music participation teaches children cooperation, respect, empathy, and self-discipline.
4. Inclusivity and acceptance: Exposure to diverse cultures and abilities through music.

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The Role of Cursive Writing in Education

Nettie Fabrie



Introduction

The preamble to the U.S. Constitution opens with the words “We the People” in a flourish of steady, flowing, elegant cursive writing. Will future generations of Americans be able to read this and many other historical manuscripts in years to come?

Writing by hand, let alone cursive writing, is slowly disappearing and with that the possibility of reading cursive writing. What is lost when printing replaces handwriting? This question prompts many questions related to cursive writing:

- What are the benefits of cursive writing beyond the possibility of being able to read it?
- What is the relationship between cursive writing and brain development?
- How important is cursive writing to child development?
- What are the benefits beside the ability to write?
- Is teaching cursive writing still relevant in the 21st century?

- Does cursive writing improve our memory?
- Are there disadvantages to writing cursive?

A host of studies and articles related to these questions have appeared during the past quarter-century, even after the federal Common Core State Standards (CCSS), published in 2010, recommended letting go of cursive writing and giving more time to teach keyboarding. However, since then, virtually half of the state governments have reinstated this practice in their curriculum. Why did they do this?

Cursive Writing and Brain Development

What is the relationship between cursive writing and brain development? Over the past several years, many articles and research papers have drawn attention to the link between cursive writing and brain development. In one of the most elaborate research projects on this subject, three authors document which parts of

the brain are activated by writing. They also describe the difference between writing by hand and typing in relation to brain activity:

These results add to growing evidence that writing, either copying or tracing, leads to significantly more activation in the brain network associated with letter perception and reading than does typing, or no practice. Thus, writing seems crucial for establishing brain systems used during letter perception and, by extension, reading acquisition; typing may not be an advisable accommodation for students who struggle with handwriting in the early grades and who need handwriting instruction.¹

Through this research it becomes clear that there is a relationship between brain activity and writing by hand, but it goes even further: it demonstrates there is also a relationship between writing by hand and the process of reading.

The act of writing a letter enhances the perception of letter forms, as shown by activation of both premotor and fusiform cortex, which supports reading acquisition.²

In another extensive brain research project, it becomes clear that in several areas of the brain cursive writing produces more brain activity than does typing.³ This research inspired several other researchers to investigate this activity further. One of them concluded their research by stating:

Handwriting but not typing leads to widespread connectivity in the brain. As increased connectivity in the brain was observed only when writing by hand and not when simply pressing keys on the keyboard, our findings can be taken as evidence that handwriting promotes learning. Interestingly, the increased connectivity between the various brain regions seems to be linked to the specific sensorimotor processes that are so typical in handwriting.⁴

In a related study, the writers present neuroimaging

studies performed to identify the neural network involved in handwriting. These studies suggest that the mastery of handwriting is based on the involvement of a network of brain structures whose involvement and inter-connection are specific to writing alphabet characters. “These skills are also the basis for the development of more complex language activities involving orthographic knowledge and composition of text.”⁵ This research not only shows that handwriting is a great benefit in motor development, but it also demonstrates that in writing by hand we activate several other language skills. The researchers show some interesting brain pictures in which one can see which parts of the brain are specifically activated — specifically how the dorsal part of the premotor cortex, together with two other brain regions involved in phonological processing, is more strongly activated when producing letters than digits. They conclude that, “contrary to a popular belief, handwriting is not just a motor- or movement skill, it also involves written language at the letter form level.”⁶

It is encouraging how much brain research has been done so far on this particular subject. The results are promising and they support the importance of keeping cursive writing in the curriculum for elementary school students.

All of these articles stress the importance of constant and continued “training.” Practice in writing is really necessary in order to activate all regions in the brain; however, this advice is not always taken seriously in the classroom setting. As a result, students don’t get enough time to fully master cursive writing.

Several other researchers have documented the difference in brain activity between writing by hand versus typing. Their conclusion:

Our work clearly demonstrates that the easiness of the motor program associated with typing on digital devices does not facilitate written language acquisition compared with handwriting training. In none of the test tasks, children of the typing training group showed superior letter recognition, reading, or writing performance compared with children who received writing training based on handwriting. Most importantly, we found that children of the handwriting training group performed better than those of the typing group, particularly

1 K. H. James, R. J. Jao, & V. Berninger, “The Development of Multi-Levelled Writing Systems of the Brain,” in *Handbook of Writing Research* (New York: Guilford, 2014), pp. 11-12.

2 Ibid., p. 19.

3 E. Ose Askvik et al, “The Importance of Cursive Handwriting over Typewriting for Learning in the Classroom: A High-Density EEG Study of 12-Year-Old Children and Young Adults,” in *Frontiers in Psychology*, Volume 11, July 27, 2020.

4 R. Van der Weel and A. Van der Meer. “Handwriting But Not Typewriting Leads to Widespread Brain Connectivity: A High-Density EEG Study with Implications for the Classroom,” in *Frontiers in Psychology*, Volume 14, 2023. These authors conducted an earlier study in 2017 under the title, “Only three fingers write, but the whole brain works: A high-density EEG study showing advantages of drawing over typing for learning,” *Frontiers in Psychology*, Volume 8, 2017.

5 M. Longcamp, L. Richards Todd, J.-L. Velay, & V. Berninger, “Neuroanatomy of Handwriting and Related Reading and Writing Skills in Adults and Children with and without Learning Disabilities,” in *French-American Connections*, Dec. 2016, 171-172:3175.

6 Ibid.

in tasks involving reading and writing at the word level.⁷

It is important to notice that the researchers stress that “superior writing performances after handwriting training can only be obtained when training is sufficiently long to establish enduring sensory-motor memory traces.”⁸

Cursive Writing and Pencil Grip

What is the “right” pencil grip? When we observe children (also adults), it is amazing how many different pencil grips they exhibit. Which can we identify as being a “good one”?

For a start, we need to know that little children cannot yet move their wrists in a flexible manner, and as a result they tend to hold a writing instrument in awkward positions. Jan McCleskey, who has extensively studied the ways in which young children come to grasp a pencil, writes:

The optimal grasp pattern for good manipulative skills has good separation between the two sides of the hand with the thumb, index and third fingers providing dynamic movement to control the tool, and the 4th and 5th fingers providing stability of the hand. Movement of the pencil requires the ability to isolate and grade individual finger and thumb movements (Case-Smith 1995). Separation between the two sides of the hand for manipulative skills occurs around age four. Finger excursion while using a writing instrument occurs around 5-6, if a child uses a tripod grasp pattern. It involves dynamically moving the thumb, index and third fingers as a group to move forward and backwards in the vertical plane, and sideways in the horizontal plane. To achieve finger excursion, a child must flex/extend the thumb, index, and 3rd finger IP joints.⁹

The protocol of a functional grasp pattern appears as follows:

- 4th, 5th fingers tucked in palm (ulnar stabilization)
- The pencil should rest on the lateral (radial) edge of the index MCP (metacarpophalangeal joint, also

known as “knuckle”) joint

- Wrist slightly elevated to 30 degrees
- Prehension between index and thumb with support from medial edge of the 3rd finger (radial manipulation)
- Rounding of the thumb web space
- Flexion of the thumb interphalangeal joint and the index and third PIP and DIP joints
- Wrist stability
- Forearm stability

In an earlier paper, McCleskey describes eight types of grasp patterns predominant in children and adults. She gives several very useful ideas how to remediate the pencil grip.

It is important for teachers in early childhood and elementary school to know the developmental stages of the grasp patterns. McCleskey describes them in meticulous detail:

Development of fine motor skills are important for kindergarten readiness! By understanding the development of grasp patterns, therapists, preschool teachers, parents, and kindergarten teachers can prepare a child for writing. The developmental characteristics of grasp development are as follows:

- Forearm/ wrist stability - developmentally comes about age 4 during coloring, with refinement around age 5.
- Tripod grasp - the child experiments with many grasp patterns prior to age 4. By age 3.5 to 4, therapists should be encouraging a tripod grasp on a pencil for all students. This is the window of opportunity where a child develops a kinesthetic awareness of a grasp on a pencil through practicing coloring and drawing. Learning a correct grasp later is much more difficult than learning a correct grasp initially.
- Radial manipulation/ulnar stabilization - begins to develop around age 4.5 and becomes more refined around age 5 to 5.5. Manipulative grasp continues to develop, with additional increase in coordination for several years as finger excursion matures.
- Finger excursion - the ability to point and bend the IP joint (Interphalangeal joint, the thumb has one and the other fingers have two) of the thumb for dynamic control during writing or

7 M. Kiefer et al, “Handwriting or Typing: The Influence of Pen- or Keyboard-Based Writing Training on Reading and Writing Performance in Preschool Children,” in *Advances in Cognitive Psychology*, Dec. 31, 2015; 11(4):136-146.

8 Ibid.

9 Cf. M. Benbow, “Principles and Practices of Teaching Handwriting,” in A. Henderson and C. Pehoski, eds., *Hand Function in the Child* (St. Louis, MO: Mosby), pp. 255-281.

coloring may begin around age 5 but seems to refine around age 6 with coordination. Some children do not develop good finger excursion if they have a non-manipulative grasp.¹⁰

As a Waldorf director of pedagogy, I have had the privilege to observe all our students from parent/toddler groups to the 12th grade. During one of my observations in kindergarten, I noticed how a kindergarten teacher “corrected” the 5½ and 6-year olds’ grasp of their spoon while they were eating their snack. She used a beautiful image to get the students to do this. The children held their spoons in the so-called Palmer-grip, which is normal for little children. She wanted them to use the tripod-grip, holding the spoon between thumb and pointer while resting it on the middle finger. In this way the children grew accustomed to using their wrists and the so-called IP joint of the thumb, rather than moving the hand from out of their elbow. This transition is essential for getting the right pencil grip.

There are several reasons why a child may develop a poor pencil grip. McCleskey writes:

As a child develops hand coordination, the intrinsic musculature in the hand strengthens. Children who enjoy drawing and coloring tend to develop strength in the hands and have good stability when holding a pencil. The reason for the development of a poor grasp pattern is often due to the child enjoying writing and coloring at an early age before the hand develops the coordination and proprioceptive awareness of a manipulative grasp.¹¹

Nowadays children in (public) preschool are forced very early—some as young as 2½—to “write” letters and numbers with a pencil. They cannot hold a pencil in the correct way yet, resulting in a poor grasp, which will be hard to correct later on. It is better not to have to “write” any letters or numbers at this age. But if they do, then at least they need to use a crayon stick because they are still engaged more in drawing than in writing at this age.

In his illustrated booklet, *Handwriting in a Modern World: Why It Matters & What to Do About It*, William Van Cleave offers valuable information about the “correct” pencil grip and “paper-position.” He also gives “warm-up” exercises for learning cursive writing. In Waldorf schools we would call them “running form drawings.”

Van Cleave is very specific about the importance of teaching cursive writing: “A significant amount of statistical and empirical research,” he says, “supports the use of cursive writing with students who struggle, particularly those with language-based learning difficulties.” At the end of his article, he advises educators to start teaching cursive writing as early as first grade, especially to help students with dyslexia. He gives four reasons why we should do this:

- The kinesthetic-motor reinforcement of cursive writing is stronger than that of manuscript (lower case letters), and cursive is therefore better for spelling. Skywrite (always with two fingers) the word “the” in print and then in cursive. Feel the difference in your arm as you “write” the letters. Your body actually learns the spelling of the word better in cursive.
- Students who struggle with directionality and starting point will find cursive less difficult and faster. First, in a good lowercase cursive alphabet, all letters begin on the baseline. Students always know where to begin. Second, since letters within words connect, students must only “begin again” once per word, rather than for each new letter.
- Letters sometimes reversed in manuscript (e.g., b/d and m/w) not only look different in cursive but also are formed differently, so cursive decreases the frequency of reversals in writing.
- Thanks to the connected letters in cursive, students with word spacing issues can easily discern where one-word ends, and another begins.¹²

In the 1970s and 1980s I worked as a class teacher at a Dutch Waldorf school. We would send students with learning difficulties to the practice of Dr. Pierre Mesker to solicit some suggestions on how to help these students. It was always inspiring to read his reports. His advice was to start cursive writing as soon as possible in order to help these students with writing language and comprehension. In his book he describes the anatomy of the hand and its development during the first eight years of life. One very interesting part is the description of the connection of the right hand with the left part of the brain and the left hand with the right side

¹⁰ Ibid.

¹¹ J. McCleskey, “The Influence of Joint Laxity on the Development of Grasp on a Pencil” in *Manual for Handwriting Clinic* (2010). See: “First Strokes Research” in thehandwritingclinic.com.

¹² W. van Cleave, *Handwriting in a Modern World: Why It Matters & What to Do About It*, privately published by W.V.C.Ed. at www.wvced.com. I was pleased to read this pamphlet because it reminded me of the work of Dr. Pierre Mesker, a neurologist/psychiatrist from Maastricht, The Netherlands. He wrote a very interesting book: *De Menselijke Hand [The Human Hand]*, published by Suyi Publications, 1972. See also the research paper by Ruud van der Weel et al, “Only Three Fingers Write, but the Whole Brain Works” in *Frontiers in Psychology*, Vol. 8, 2017.

of the brain. However, the right thumb relates to the right side of the brain and the left thumb with the left side. The consequence is that when we use the correct pencil grip (i.e. tripod grip), we activate both sides of the brain at the same time.

Ever since we worked with Dr. Mesker, we introduced cursive writing in first grade to all students. We didn't introduce manuscript (lower case) anymore, but instead we used what Van Cleave described as "a good lowercase cursive alphabet." All students profited from this, not only the students with learning difficulties. It became clear to all of us that cursive writing helped *all* our students in their development.

To understand the development of the appropriate "grasps," it is worthwhile reading Frank Wilson's celebrated book *The Hand*.¹³ In Chapters 5 and 6 he describes the developmental evolution of the hand and especially the function of the thumbs.

Are There Benefits Beyond Learning the Technical Skill of Cursive Writing?

Several articles already mentioned confirm that there are many more benefits to writing in cursive than simply linking letters. In the words of one team of researchers, "One of the most vexing educational problems in children is the inability to learn to read. Recently it has been shown that the inability to write skillfully imposes great limits on a child's ability to learn to read." They refer to a study done by Richards in 2015, which showed that "writing by hand (cursive) is important for the early recruitment of letter processing in brain regions that are known to underlie successful reading."¹⁴

The researchers studied specifically the so-called RPS (Reversed Positioning Sensation) syndrome. They noticed that children with this syndrome were working with an "inverted" hand position, which put the controlling fingertips under the pencil. Their article describes how to remediate this syndrome and work actively to promote what they call "fluent handwriting" (i.e. cursive writing) as a solution to written language difficulties and illiteracy.

I have already mentioned the work of Virginia Berninger and others from the University of Washington. She described how "children writing by hand was associated with better phenome skills, spelling, and idea expression, compared with typing on a keyboard, indicating a

brain basis for these different disabilities."¹⁵

Berninger has done extensive research on this topic for the past fifteen years. In a research paper entitled "The Development of Multi-Leveled Writing Brain Systems: Brain Lessons for Writing Instruction," she writes:

Lesson 1: It is important to teach handwriting, beginning in early childhood and continuing through middle childhood, with attention to both the motor and letter coding processes involved, and integrating handwriting with reading, spelling, and composing.¹⁶

In many of the research papers I have read, the researchers conclude that writing by hand, especially cursive writing, stimulates several areas in the brain connected with spelling, comprehension, syntax, composition, memory, and reading. William Van Cleave, for instance, in the article cited earlier, gives many reasons why cursive writing is still very important for acquiring language skills in children. These considerations alone are grounds enough to keep cursive writing in the elementary grades curriculum.

In an article entitled "The Power of Touch is Vital for Both Reading and Writing," Naomi S. Baron (Professor Emerita of Linguistics, American University) quotes comments by some of her students who participated in her research (using paper and a writing instrument):

- "I can see what I'm thinking."
- "I feel more attached to the content I produce."
- "The satisfaction of a whole page filled by handwriting; it feels like I climbed a mountain."¹⁷

There have been so many articles coming out recently about the importance of cursive writing amidst pleas to reinstate it in the school curriculum. Just recently I received one by Lucinda McKnight and Maria Nicholas from Deakin University in Canada, with the enticing title, "Five Reasons Kids Still Need to Learn Handwriting (No, AI has Not Made It Redundant)". I will just list the five reasons, but it is worth reading what they have to say about each of them:

1. *It develops fine motor skills.*
2. *It helps you remember.*
3. *It's good for your wellbeing.*

13 F. Wilson, *The Hand: How Its Use Shapes the Brain, Language, and Human Culture* (New York: Pantheon Books, 1998).

14 R. A. Young, R.V. Rose, & R. Nelson. "Teaching Fluent Handwriting Remediates Many Reading-Related Disabilities," in *Creative Education*, Vol. 6, No.16 (September 2015).

15 V. Berninger & W. Winn, "Implications of Advancements in Brain Research and Technology for Writing Development, Writing Instruction, and Educational Evolution," in *Journal of School Psychology* 34 (2012-2013), pp. 23-52.

16 Ibid.

17 N. Baron, "The Power of Touch is Vital for Both Reading and Writing," in *The Conversation*, May 1, 2024. theconversation.com.

4. *It's very accessible.*
5. *It's about developing your thinking.*¹⁸

Hetty Roessingh (Professor at the Werklund School of Education at the University of Calgary, Canada) also wrote an article in non-profit media outlet, *The Conversation*, entitled “Why Cursive Handwriting Needs to Make a School Comeback.” She states, “Handwriting is also an elegant testimony to the human capacity for written literacy and an inspiring symbol of the unique power of the human voice.” In response to the commonly-heard complaint, “*It’s too difficult to write in cursive!*” she says, “Handwriting is only difficult if it is not automatic and, in turn, offloaded into long-term memory. Evolving research in the neurosciences underscores the importance of developing automatic skills in relation to what educational psychologists call the cognitive load.”¹⁹

More recently, Roessingh summed up her research by saying:

Good Handwriting is not an end in itself. Rather, it is a means to literacy that fundamentally transforms the human experience.²⁰

It is becoming clear to many states in the U.S. (also in Canada) that reinstating cursive writing in the school curriculum is crucial for several aspects of the language development in children. At least 25 states—most recently California and New Hampshire—are already listed, and five states have legislation pending.²¹

Are There Disadvantages to Learning Cursive Writing?

From my own experiences as a teacher, and having read many research papers on cursive writing over the past 20 years, I would say: No, there are no disadvantages. The only challenge one could cite is that learning cursive writing requires practice, and practice requires sufficient time to master this skill. To give our students

adequate time to learn cursive writing, we need to incorporate it into the curriculum from the first until the middle grades of elementary school.

As for the adults – we, too, benefit from practicing this skill, if only to enjoy the beauty of it!

Conclusion

This research has kept me busy for the past two years. I have always been fascinated by cursive handwriting. It is so personal and characteristic. Reading a handwritten note feels like truly connecting with a real person, something an email doesn’t do.

I have read multiple research papers and articles about the importance of cursive writing, and they have given me even greater respect for this skill. The focus Rudolf Steiner placed on introducing writing before learning to read has proved to be fundamentally important for literacy development in children. He gave us a Waldorf curriculum for the developing human being. Experiencing and working with this gift makes one realize how remarkable his work is. Cursive writing is still important—perhaps now more than ever—for the developing human being of today. It inspires much gratitude for Steiner’s work (in Spiritual Science) and the gift he gave us more than 100 years ago. He was truly ahead of his time!

After Common Core of 2010 became the standard for our schools and cursive writing made way for learning to keyboard at a very young age, many educational professionals began to realize that this was not a good move. Since then many researchers have identified what has been lost and what the benefits of writing by hand and cursive writing can do for the development of the brain.

As I was completing this research project I came across Hetty Roessingh’s article in *The Conversation*, already cited.²² Under the heading “Joey Votto’s Handwritten Apology to Baseball Fans Shows the Pen is Mightier than the Bat,” she recounts the story of the celebrated Canadian-American baseball player who wrote a three-page handwritten letter to all his Canadian fans, apologizing for remarks he had made in 2018. He posted his letter on X (formerly Twitter) in cursive. Within 24 hours of posting it, he had received almost two million views. Roessingh comments: “The fact that Votto chose to write the letter in cursive makes the apology that much more authentic: had he typed it out, readers could have assumed that someone else or a computer program chose the words. But the handwritten

18 L. McKnight & M. Nicholas, “Five Reasons Kids Still Need to Learn Handwriting (No, AI has Not Made It Redundant),” in *The Conversation*, June 6, 2023, theconversation.com.

19 H. Roessingh, “Why Cursive Handwriting Needs to Make a School Comeback,” in *The Conversation*, August 22, 2019, theconversation.com.

20 H. Roessingh, “Teaching Cursive Handwriting to Young Children? Here’s How They Learn, and Resources for Instruction,” in *The Conversation*, March 24, 2024, theconversation.com.

21 The list is regularly updated at the website mycursive.com, which tracks cursive writing requirements nationwide. Another source for updates is NPR, which carried an article on May 11, 2024 by Jonathan Lambert on “Why Writing by Hand Beats Typing for Thinking and Learning.” Basically, he summarizes much of what I have researched, and he even used several of the research papers I mentioned in this article. His is a good article for teachers to use in their parent evenings when they discuss with their parents the importance of cursive handwriting.

22 Cf. footnote 20.

note clearly shows Votto's emotional commitment to the apology – including some grammatical errors that a computer would have corrected."

After reading this article, I would like to say: Let us keep the instruction of cursive writing in our school curriculum and make sure our students get enough practice time to learn this beautiful skill. And, as adults, let's take up the old fountain pen and write some nice cards to our friends and family.

The last word, though, goes to Malala Yousafzai, the youngest ever Nobel Peace Prize laureate. She reminds us:

One child, one teacher, one book and one pen can change the world.²³

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23 M. Yousafzai, *Malala's Magic Pencil* (New York: Little Brown and Co., 2018).

Report on the Research Institute for Waldorf Education

Patrice Maynard

Director of Publications and Development

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The past year at the Research Institute for Waldorf Education and Waldorf Publications was filled with exciting new opportunities and challenges, most notably in advancing the Qualitative Meta Research project, described on page 55 of this issue, and exemplified by the studies conducted by Jason Child and Nettie Fabrie (see pages 56-63).

Waldorf Publications

For the past eleven years, one of our key goals has been to get our literature more recognized and circulated beyond the North American Waldorf community. Support from Waldorf schools, who started Waldorf Publications in 1987, through the Book Bank program is extremely helpful in this area. Waldorf Publications has been working to expand its readership and develop markets beyond our immediate community. Last January, we joined a group called Faire, which is a platform to assist “Main Street” stores with their purchasing and marketing as well as helping titles and publishers find their way to small store fronts. Through this platform we have connected to 20 retail stores in the United States and in Canada. Our hope in this is to spread information about Waldorf education as far and wide as possible and to build support for RIWE.

High on the list of WP’s recent accomplishments is publishing volume 2 of Nana Göbel’s brilliantly written *History of Waldorf Education Worldwide, volume 2, 1945 to 2019*. Nana took on volumes 2 & 3 of the original German edition and rewrote it substantially to create a single volume for the English version. Volumes 1 & 2 of the English edition now comprise the complete 100-year history of Waldorf education worldwide.

Also among significant completions is the last book in the series of *Play! Recorders in the Classroom*. This final volume completes the series of five volumes (grade by grade, starting with grade 3) with two books in each volume: one is a teacher’s guide and the other is almost nothing but music for students to play, with many songs chosen to support the curriculum for each grade. With the whole series completed, there is nothing like it anywhere else! Teachers can now proceed with stepwise guidance on how to introduce and play recorder with a

class, as well as mastering a musical instrument themselves, right along with their students.

In addition, Michael Holdrege’s much awaited book, *Embryology, Genetics, and Ecology: Windows into the Dynamic Nature of Living Organisms*, will be on its way to schools soon. Teaching life sciences in eleventh and twelfth grade is made lively and fulfilling as Michael leads the way on “how to do it.”

RIWE’s annual Board of Trustees meeting (2024)

took place in Harlemville, New York, and Sheffield, Massachusetts. The gathering included an expanded meeting with educators from several walks of life, who assembled to discuss important questions about the future of education and the preoccupation with testing as a limited assessment tool for decisions about how students are faring.

Lastly, take a look at RIWE’s Online Waldorf Library (OWL) re-born!

Marianne and Dave Alsop, with their technology team, have refurbished the OWL, and it is now not only able to accommodate the increasing volume of wonderful resources, but it is beautifully replete with illuminations from the work of students from many Waldorf schools! The OWL comprises our most potent platform for reaching beyond our own borders into the world. Last year, 637,000 hits were recorded on the OWL – an average of 1,750 per day, or roughly one each minute. Among the 105,000 active users are residents of Central and South America, as well as Taiwan, Hong Kong, China, and other Asian countries. How Marianne and company managed to sustain this level of activity with only a few days offline to complete the reconstruction of the entire collection remains one of life’s mysteries — is a miracle!

Report from the Online Waldorf Library

Marianne Alsop
OWL Site Administrator

Since 2001, the Online Waldorf Library has offered a wide range of published information about Waldorf Education in North America and internationally. In 2024, the OWL had 176,000 site visits with the USA, Australia, India, United Kingdom, Canada, Mexico, Spain, Argentina, Chile, Vietnam, New Zealand, Colombia, Malaysia, South Africa and Philippines in the top 15 countries.

In 2024, we upgraded the Online Waldorf Library website to accommodate the vast number of eBooks, articles in both English and Spanish, and the full archives of several Journals on Waldorf Education. We feel it is essential to make all of these publications freely available for anyone interested in Waldorf education.

In our Journals section, we are pleased to have added all back issues of *Pacifica Journal*, published by the Anthroposophical Society in Hawaii, and edited by Van James for the entire Pacific Rim.

Also recently added are all available issues of *Child and Man*, published from 1936 to 2005 by teachers of the New School, London, and later by the Educational Association at Michael Hall School in Forest Row, Michael School in Ilkeston, and The Steiner Schools Fellowship.

The OWL has added the complete collection of *Education as an Art*, published by the Rudolf Steiner School Association, New York City, with issues dating from 1940 to 1978. With the Rudolf Steiner School being the first Waldorf School on this side of the Atlantic, these newsletters contain a wealth of information about the early growth of the Waldorf schools in North America. They also serve as an articulate introduction to Waldorf education itself.

We continue to offer back issues of the *Research Bulletin and Gateways* – the newsletter of the Waldorf Early Childhood Association of North America.

Our ever-expanding library of eBooks, articles, and journal articles are available to download in pdf format, which can be accessed by downloading free software from Adobe Reader. New articles in Spanish and

English are posted every month and can be accessed from the home page by clicking on *Artículos en Espanol* and *Articles*.

eBooks added in 2024 include: **From WECAN Publications**

- *Toward a Kinder More Compassionate Society: Working Together Toward Change* - WECAN 2022 Conference
- *Covid 19 Pandemic* by Dr. Neil Boland

From Waldorf Publications:

- *A Main Lesson Primer for the High School* by Deborah Mann
- *Awakening the Spirit, Freeing the Will* by Hugh Renwick
- *From Mechanism to Organism: Enlivening the Study of Human Biology* by Michael Holdrege
- *Home Surroundings the Waldorf Way, A Guide for 1st and 2nd Grade Teachers* by Roberto Trostli
- *Play! Recorders in the Classroom, Vol. 1, Third Grade, for Students* by David Gable
- *Play! Recorders in the Classroom, Vol. 2, Fourth Grade, for Students* by David Gable
- *Tapestry of a Waldorf Curriculum* by Tobias Richter
- *Teaching Art History* by Van James
- *The Waldorf Book of Blessings* by Warren Lee Cohen

New eBooks in Spanish include:

- *El Estudio General del Ser Humano; Metodología y Didáctica; Coloquios Pedagógicos y Conferencias Curriculares* by Rudolf Steiner

The Online Waldorf Library welcomes your questions, and we are happy to help you find resources for your research projects.

Visit the Online Waldorf Library at
www.waldorflibrary.org

The Online Waldorf Library's Story

Patrice Maynard

In the previous issue of the Research Bulletin, we misattributed the founding of the Online Waldorf Library. It was, of course, David Alsop who led this initiative. In order to set the story straight, and give full credit where credit is due, we present below a short history of the founding and nurturing of the Online Waldorf Library.

After twelve years of leadership in the Association of Waldorf Schools of North America (AWSNA) Dave Alsop made the decision in 2001 to pass the baton to new leaders. His tenure at AWSNA added the broad view of Waldorf education in North America and throughout the world to Dave's experience as a class teacher and administrative chair at Sacramento Waldorf School in California.

Over the years in AWSNA, Dave forged a strong friendship with Robert Dulaney and the Norton Foundation in Louisville, KY. Both Dave and Robert shared an interest in providing high caliber resources to assist Waldorf teachers around the world. Upon leaving AWSNA, Dave was invited by Robert Dulaney to lead a project that had long been Robert's heartfelt dream: to take advantage of the burgeoning internet and create an online resource center—accessible to all and free of charge—for published books, research confirming Waldorf education, and monographs focused on authentic information about the anthroposophical view of child development and the Waldorf curriculum. Dave's technical savvy, combined with his varied years of experience at AWSNA and the Sacramento Waldorf School, was invaluable in the development of this resource. It was decided to call this website the "Online Waldorf Library," or OWL for short.

From its very beginnings, the OWL was affiliated closely with the Research Institute for Waldorf Education (RIWE). Roberto Trostli served as an integral partner in the early work of establishing the OWL. David Mitchell, Director of Publications at AWSNA, offered books and materials from AWSNA's publications arm to the OWL and helped in soliciting publications from SteinerBooks and the Waldorf Early Childhood Association of North America (WECAN). They were supported by Robert Dulaney, through his Waldorf Curriculum Fund, to fill up the "shelves" of this virtual library. This close

collaboration made it an easy error, published in the 2024 issue of RIWE's *Research Bulletin*, to name David Mitchell the founder of the OWL. In fact, the actual founders are David Alsop with help from Robert Dulaney.

Dave spent a year building the initial website and establishing important connections to professional website resources. The support of Dave Soltis and Brett Rademaker at *An Internet Store* was invaluable and continues to this day. In 2002, Marianne Alsop, for years the designer for *Renewal* (the AWSNA journal for Waldorf Education), and spouse to Dave, accepted responsibility for the development of the OWL and took over the position of curator of this remarkable resource. She has now held this post for 22 years. For the last five years and since his retirement, Dave, has served as a volunteer to support the OWL.

Over time, this resource has been built to a mighty collection of remarkably varied and rich selection of books, journals, articles, monographs, charts, research articles, and links, all helpful resources for Waldorf teachers, schools, students, and communities.

David Mitchell and Douglas Gerwin became co-directors of RIWE in 2004 and worked more closely with the OWL in this role. Upon David Mitchell's passing, in 2012, RIWE's focus expanded the readership of the OWL by launching a Spanish translations project. Douglas Gerwin offered this idea to Marianne and to the WCF. Some training done in conjunction with RIWE in México gave RIWE access to Waldorf teachers there. Susan Howard of WECAN suggested to Douglas a translation training center in Spain that further broadened this new idea. In the past decade, foreign-language resources on the OWL, with help also from individual translators in México and other parts of the Spanish speaking world, have grown with numerous articles and books translated into Spanish specifically for the OWL, making a new vista of helpful resources available.

Several books and articles translated into Mandarin have also been started as an additional resource center designed to make international materials possible. In 2014, a long-held wish for AWSNA's publications arm to join the OWL under the auspices of RIWE was realized

and it then became Waldorf Publications. This further enriched the partnership between RIWE and OWL.

During the past year, the OWL website underwent a remarkable transformation, made necessary by the overcrowding of the virtual shelves of the Library, to accommodate the continuing flow of valuable resources coming to the OWL. Without losing more than a few days of operational function, Marianne and Dave Alsop transformed the OWL into a larger, more capacious organ of research and resources, lavishly illuminated by Waldorf students' artwork. It is now as beautiful a collection as it is a priceless resource, which is still growing.

The celebration of the original brainchild and foresight of Robert Dulaney, realized through the dedication and commitment to Waldorf education by both Dave Alsop and Marianne Alsop, and made possible by Robert Dulaney's ongoing support, came from this opportunity to clarify and acknowledge the glory of what has been accomplished through and for the OWL.

Donors to the Research Institute for Waldorf Education and Waldorf Publications

Showers of gratitude are due for those who make the work of RIWE possible year-by-year! These generous donors and organizations surprise RIWE each year with recognition and support. Golden are the many who have supported us over many years unwaveringly. Golden are those who have given for the first time this year helping to bolster the marvelous matching grant from the Rudolf Steiner Charitable Trust, matching all dollars and then again matching new dollars. One donor listed here gave a remarkable first gift of \$1,000, which, when matched, became a \$3,000 value. It is breathtaking to us here at RIWE to experience such a flood of generosity on behalf of this work. **Thank you all!**

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The *Research Bulletin* offers the Waldorf community in North America and abroad a published verification of practices, curricula, and philosophy in Waldorf classrooms and Waldorf schools. Beyond the Waldorf community, the greater academic and educational community receives a glimpse into the unique worldview and approach used in Waldorf education.

RIWE salutes the following schools who support the Institute with their sustaining membership. Supporting Members receive twenty copies of each issue of the *Research Bulletin*. Schools use these additional copies for their school and teacher libraries, for distribution throughout their communities, and as public relations offerings to visitors to their communities. Unlike other public relations and enrollment materials, the *Research Bulletin* offers academically documented evidence of the scholarly basis for Waldorf education and its techniques.

In addition to these twenty copies of each issue, the Supporting Members listed below receive the immeasurable appreciation and enormous thanks from all at RIWE for the generosity and solid help their sustaining membership gives for the continuing production of the *Research Bulletin*.

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Chemistry

Computer and Information Technology

English

Life Sciences and Environmental Studies

Mathematics

Physical Sciences

U.S. History

World History: Symptomatology

Recent Research Projects

Alternatives to Standardized Assessment Computer Technology in Waldorf Schools

A Handbook of Research on Waldorf Pedagogy

Human Sexuality Curriculum

Meta-Research on Waldorf Curriculum and Practices

Screen Free September Initiative

Worldwide Survey of Waldorf Graduates

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Waldorf Publications

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About the Research Institute for Waldorf Education

The Research Institute for Waldorf Education (RIWE), founded in 1996 in order to deepen and enhance the quality of Waldorf education, engages in sustained dialogue with the wider educational-cultural community and supports research to serve a wide range of educators in their work with children and adolescents.

The Research Institute supports projects dealing with essential contemporary educational issues, such as computers and the effects of media on children, alternatives to standardized testing, physical health and psychological well-being of students, science teaching with a phenomenological approach, the role of the arts in education, and the philosophical underpinnings of Waldorf education.

As a sponsor of colloquia and conferences, the Research Institute brings together educators, psychologists, physicians, and social scientists for discussions on current issues related to education. RIWE publishes a *Research Bulletin* and prepares educational resources, including

collections of eBooks and articles, a growing number of them newly translated into Spanish and Mandarin Chinese. Many of these publications are available without charge on the website of the Online Waldorf Library (OWL), a virtual library created and managed by the Research Institute,

www.waldorflibrary.org

In 2013, the Research Institute took on the publications arm from the Association of Waldorf Schools of North America (AWSNA) and re-branded it as Waldorf Publications. It includes resources for teachers and administrators, readers and children's books, collections of plays and poetry, science materials and kits, science and math newsletters, inspirational essays, proceedings of colloquia, and a range of publicity materials about Waldorf education. It also carries books published by the Waldorf Early Childhood Association of North America (WECAN) and the Pedagogical Section Council (PSC) of the School for Spiritual Science, as well as archived copies of AWSNA's magazine, *Renewal*, now renamed *School Renewal*.

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United States

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