The AI Revolution & Education:

Ten Crucial Transitions

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GROUNDED & SOARING

MARIN MONTESSORI SCHOOL

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During his visit back home this summer, we hosted our eldest and two of his friends for a barbecue. They are finishing up their first year out of college and at the start of their careers. At some point during this dinner, one of them asked, *"Wait, what actually was the original point of school?"*

Are you sure you want to get me started? I thought but did not say.

The Shifting Ground: What is "School"?

While they snacked on corn on the cob, I explained that in their early centuries, many US universities emphasized the ancient Greek Platonic ideal, focusing on developing critical and logical thinking in young people to enable them to discern the requirements for an ethical and meaningful life. This ideal encompasses subjects like mathematics, astronomy, physics, and biology, as well as literature, art, history, and music. I also noted the shift in the mid-19th century, especially in K-12 schools, to an industrialized model that is still dominant today, emphasizing standardization, memorization, and conformity to best prepare students for rote, assembly-line-like work.

Finally, as they patiently waited for dessert, we discussed the massive shift in recent decades, specifically in higher education, away from the Platonic ideal and toward a supreme focus on employment preparation, especially in the STEM fields. My son and his friends recognized this emphasis in their own colleges. As we discussed the causes of this shift, we identified the economic

pressures of rising disparities between rich and poor, rising college education costs, rising student debt, growing inaccessibility of the housing market, and labor market pressures as key factors in our prioritization of graduating young people prepared for an increasingly precarious economy.

Though the ubiquity of it didn't arrive until their junior or senior years in college, they agreed that generative AI is ushering in the dawn of another volcanic shift in the student experience and purpose of schools and education.

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Context, Disclaimers, & Presuppositions

As we steady ourselves for this volcanic level of change that AI presents, I am eager to share my ten calls for the most crucial emphases and shifts we need to make as we educate our children and adolescents for their futures, not our pasts. I am genuinely excited about what the future may hold for education, while also starkly aware of threats to healthy child and adolescent learning and development. I base these suggestions on research from several experts, as well as dialogue with those directly involved in the field. All of this is analyzed through the context of my 30-year career in education. In the U.S. and abroad, and with children of all ages, I've taught and led in public schools, independent schools, and universities.

First, I have three disclaimers:

Due to the specific topic of this communication, I decided *not to* use generative AI for composition help (e.g., style, tone, word choice, sentence construction, paragraph organization, etc.). I *did use* spell and grammar check and generative AI to assist in finding relevant articles and information that supported my learning.

Second, the use of generative AI among adults like us with formed brains is one thing. For the purpose of this communication, I am focused on what children 0-18 most need for their healthy cognitive, emotional, and social development; my specific recommendations connected directly to AI tools generally pertain to older students.

Third, in the spirit of intellectual honesty, my ten suggestions are grounded in the following key assumptions and biases:

- While I am skeptical about tech-utopian promises, I am also excited about the potential for AI to benefit humanity and the planet.
- AI is likely to have moderate to monumental impacts and implications across all industries. Before entering the workforce, students will need skills for working with and harnessing current and emerging uses of AI in their fields. I imagine the bulk of this direct training emphasis will occur in college or vocational programs.
- We risk the hubris of overconfidence in our predictive capabilities (including my predictive capabilities). As a way to soothe our discomfort with the current state of uncertainty, we also risk rushing to declare with blind, mistaken certainty that we know what to do. The rate of change that AI is bringing is far faster than at any point in human history and exceeds our ability to process it effectively. As Yuval Noah Harari shows, AI isn't just accelerating; it's actually outrunning us. We are faced with a massive struggle to adapt mentally, emotionally, politically, economically, spiritually, and ethically. Our evolutionary wiring and institutional levers are inadequate for these timescale-defying shifts. To the extent possible, we must proceed with great care, humility, and prudence, as well as the capacity to stay steady within the discomfort of uncertainty.
- Many students will use generative AI to do assignments for them. While tools may be somewhat helpful in identifying plagiarism and unauthorized use, middle, high school, and college educators will be savvy to assume and adapt to the fact that, for many of their students, the learning value of traditional assignments done unmonitored and outside the classroom will be significantly degraded.
- A key reason *homo sapiens* dominated is our ability to communicate, plan, and coordinate with each other. As we painfully learned during the pandemic lockdown, it's highly problematic for a young person's education to occur in isolation and online. As screen-based living and AI become increasingly ubiquitous, schools have the potential to further harness the power of hands-on, in-person student collaboration as a central value proposition.
- AI raises the question of what it means to be human. There is much more to a meaningful human life than ease and consumption. Depth of thinking, creating, contributing, relishing beauty, compassionate action, loving relational connections, aligning actions with integrity, personal reflection, and continually learning contribute to a well-lived human life.

10 Crucial Transitions for Education at the Dawn of the AI Revolution

1. Highly Intentional Design & Insist on Pro-Social Purposes

We must not take a 'wait and see' approach or proceed with non-critical enthusiasm.

I was a classroom teacher at the start of the internet, smartphone, and social media era. I witnessed our gold rush enthusiasm, believing these new technologies would usher in unimaginable benefits for students and society. Recent evidence shows several significant and devastating consequences of that magical thinking and blind optimism, especially in allowing companies whose top motivation is financial profit to dominate our children's lives (e.g., "Screens in School are a 60 Billion Dollar Hoax," Jonathan Haidt's work, the ebook I wrote and shared with you in 2023, and even recent research showing that brain activity is far more robust when students handwrite instead of using laptops or tablets). We must not take a "wait and see" approach or proceed with non-critical enthusiasm. We need to wrestle with the topic of AI and education sober-eyed, as the following examples embody:

- Rebecca Winthrop, Director of the Center for Universal Education at the Brookings Institution, argues that companies seeking to work with students and schools should be required to be benefit corporations (i.e., a for-profit corporate entity that is legally required to consider the impact of its decisions on society and the environment, alongside its financial interests). She says, "... you have a lot of companies who are creating perhaps really good stuff if used well, but they have to maximize profits. They can't maximize social benefit and well-being."
- Like what is currently underway through a Dutch government initiative, partnerships should be formed between teachers, tech companies, and academic researchers to ensure that what is offered to students is highly intentional in design, maximizing students' best interests for robust, authentic learning and well-being.

2. Harness the Positives: Tutoring, Research, Critical Analysis of AI Itself

When our older son was taking a lecture-based advanced science class in college last year, he would sometimes use a generative AI program for tutoring, prompting it with, "From the perspective of a college senior, explain the concept _____ to help me better understand it." He would not use AI to write his papers, but only for that type of tutoring support, which proved quite helpful.

Indeed, there is compelling evidence that AI tutoring can have a positive effect (ranging from moderate to substantial) on supporting student learning through individualized instruction. This is especially exciting in connection with supporting the education of students with fewer resources. These positives also suggest that teachers may discover AI tools that help them better understand and plan for students' individualized learning needs.

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Additionally, as I shared last year in my podcast conversation with Dr. Alex Curtis, Head of School at Choate Rosemary Hall, their school is finding learning benefits through incorporating generative AI into their high school curriculum, such as teaching students how to test their hypotheses and thesis statements, find relevant research and summaries of research to support class projects, and critically—as a class—analyze AI's responses and feedback.

3. Do Hard Things: Learning Requires Friction & Focus

There is no such thing as "frictionless" learning. When it comes to our students, we need to push back against our society's current obsession with ease and speed.

Intellectual wrestling is required for depth of thinking central to the type of robust learning that will develop the cognitive skills future generations need to be effective, contributing adult citizens.

Generative AI promotes "cognitive offloading," the act of using external resources to reduce the cognitive weight on internal memory or mental processes. This feature poses several threats. Most importantly, it deprives students of the struggle *required* for learning. (Consider the work of UC Berkeley Professor of Developmental Psychology, Dr. Alison Gopnik, showing that when we interrupt a child's struggle to problem-solve or grasp an object or concept, we reduce the child's opportunity to learn in a way that is essential for brain growth.) Although some part of us craves a frictionless existence, especially for our children, it's not actually good for human beings; struggle is critical for all of our brains to learn.

So, while we can argue that knowing how to spell "accessory" or "conscious" or "hippopotamus" is no longer necessary (or even learning how to spell "necessary..."), it's the struggle in the learning itself that is vital for cognitive development.

Additionally, across the globe, concentration has become far more difficult for students, and even college students are demonstrating an inability to focus deeply enough to read books. The capacity for deep, focused learning and work can be supported by screen-free or minimally screen-based learning environments that promote concentration. Emphasizing handwriting and reading books is highly virtuous for our students' cognitive development, too.

4. Emphasize Engagement through Agency, Experience, & Peer Connections

The results of a June 2025 MIT study, "Your Brain on ChatGPT," indicate that individuals who rely on generative AI exhibit lower brain activity, weaker executive control, reduced memory, and decreased creativity. To counteract this risk, we need to emphasize engagement.

They'll need to be passionately curious and capable of deep work and problem-solving.

Engaged students feel a sense of belonging, interest, and excitement at school. They are motivated, they participate, and they push themselves to learn more, regardless of what is minimally required. They want to do more because they are genuinely interested. Students who feel engaged in their learning experience have significantly better academic and mental health outcomes, including a deeper understanding of the content and a higher likelihood of college enrollment.

Learning environments that promote peer collaboration lead to increased engagement and stronger learning outcomes. Hands-on, experiential learning also fosters engagement and leads to profound benefits for students.

Is my kid developing agency over their learning?

The most crucial quality to emphasize is this: Agency. When students are empowered with agency (e.g., intentional goal setting, choosing topics, creating individualized projects to deepen and demonstrate understanding), it increases intrinsic motivation, self-regulation, information retention, understanding, and academic performance. We need to double down on developing students who are pilots in their learning and lives, not passive passengers. These are the highly engaged students who soar.

Concerning AI, this is key: simply pursuing a grade in a class does not foster the habits of mind and heart that will prepare our children to flourish in the AI-saturated world and economy they'll enter as adults. They'll need to be passionately curious and capable of deep work and problem-solving. Passivity, standardization, and conformity are detrimental to fostering the engagement students most need.

5. Sunset Letter Grades & Move Toward Mastery

With student engagement being the pinnacle of importance, we need to find a different approach to assessment, as letter grades don't show a student's engagement level. As Rebecca Winthrop says in an interview:

"Schools are not designed to give kids agency. Schools are designed to help kids comply...And what you really want are some feedback loops that are beyond just grades...[to]know: Is my kid developing agency over their learning?... Are they able to reflect and think about things they're learning in a way that they can identify what's interesting, and they can have the skills to pursue new information? That right there is, I think, going to be the core skill...for learning new things in an uncertain world..."

Approaches like the Mastery Transcript are the right direction for the future (see our Grounded and Soaring podcast conversation with the founder of this movement here). These replace letter grades with a system that shows what a student has truly learned and can do. Mastery Transcripts focus on competencies, demonstrated skills, understanding, and growth instead of a single test performance or class rank.

...an essential skill our students will need to learn is how to ask questions in the right way for the most robust and helpful responses from AI.

6. Teach Critical Thinking, Questioning, and AI Prompting

Columnist David Brooks has argued that "We live in a country in epistemological crisis." In other words, our society's loss of a common understanding of what constitutes something as "true," "factual," or "honest" has brought us to a state of emergency.

Given the capacity for deepfakes and the reality of AI hallucinations, it has never been more urgent that our children become critical consumers of information. Critical, logical thinking, achieved through discussing literature, ethics, philosophy, and contemporary issues, is a powerful pathway to cognitive development and robust analytical reasoning. This is complemented by an appreciation for and application of the scientific method, as well as the requirement for empirical, peer-reviewed evidence before labeling something as accurate and factual. Such an education should include classwork that analyzes the results of generative AI searches and AI's feedback on student work to consider the quality and validity of AI's responses.

Additionally, experts in the field suggest that an essential skill our students will need to learn is how to ask questions in the right way for the most robust and helpful responses from AI. (An MMS parent in the field suggested Anthropic's prompting guide.)

In higher education, you are likely already familiar with esteemed schools like the University of Chicago, Carleton College, Brown, Kenyon College, and Bard College, known for their emphasis on objective analysis and cognitive rigor. To expand your knowledge of educational approaches in higher education, you may be interested to learn about these three colleges that are especially focused on developing in students muscular critical thinking and intellectual depth.

Deep Springs College (likely the most selective college—five percent acceptance rate—and cattle ranch you've never heard of. Fun fact: Their current president is an MMS alumnus parent), St. John's College, and the University of Austin (a new university not without controversy).

7. Analog Creativity Matters

Human creativity is the cornerstone of our species' survival and flourishing. An accepted definition of creativity is that it "...is the ability to generate new and original ideas, solutions, or artistic forms that are genuinely unique and have not been previously conceived or produced."

If we are to control the direction of AI and not become passive recipients of what it decides to create and do to and for us, the next generations will need to be empowered with robust creativity that schools can teach and foster. Unfortunately, the results of current research lend credible doubt to highly optimistic arguments about generative AI and human creativity.

Recent studies find "... the use of ChatGPT in creative tasks resulted in increasingly homogenized content..." The homogenization effect persisted even when generative AI was not used afterwards: "In fact, generative AI like ChatGPT lends to humans with a temporary rise in creative performance but boxes human creative capability in the long run, highlighting the imperative for cautious generative AI integration in creative endeavors."

8. Index for Passion & Compassion

Passion is the coin of the realm: When students are encouraged and supported in going deep into learning, developing, creating, and sharing with others individual learning pursuits about which they feel passion, their engagement soars, their concentration deepens, and they experience the depth of internal contentment and joy that becomes the seedbed for a lifelong thirst for learning. These are the students who will most successfully ride the waves of the shifting employment landscape in their adulthood because of their robust curiosity and capacity for deep learning.

On a pragmatic level, generative AI is completely disrupting college admissions, with colleges now placing increasing emphasis on finding evidence of applicants' sustained dedication to a passion, as well as their compassionate contribution to their community around an issue in which they're genuinely invested.

Passion is the coin of the realm.

9. Encourage & Invest in Educators

Students learn best through in-person human relationships. Human teachers do so much more than simply transmit factual information. They observe and intuit students' individual needs and challenges. They support students' development of self-regulation, self-awareness, emotional intelligence, social skills, conflict resolution, and empathy in understanding different perspectives. They motivate students' engagement and enthusiasm for learning. They role model appropriate and effective adult behavior. Teachers can boost students' belief in their capacities and help them learn how to ask great questions and seek support along the way.

We need outstanding teachers to impart knowledge, yes, and also to coach students in deepening, refining, and making meaning from what they learn.

As a nation, though, we are reaching a crisis point: The people we rely on to deliver the education are not there. We know the facts:

- In the last few years, there's been a 33% decline in enrollment in teacher training colleges.
- Currently, 50% of teachers leave the profession within five years of starting their careers.

We need to begin by addressing three of the key contributing factors to our current national and regional teacher shortage: compensation, parent relationships, and student accountability.

- There is a growing pay gap for teachers compared to other college-educated professionals. In 1996, this pay gap was 6%. Now it is 24%. (For context, presently the average salary for a first-year California public elementary teacher is $58,000. The maximum average salary for a California public elementary teacher is about $100,000, and this requires at least 20 years of continuous full-time teaching.)

- Increasingly demanding and antagonistic parents, as well as perceptions of low-to-no accountability for problematic student behavior, contribute to eroding teachers' work experience, driving them from the profession.

In addition to increasing teachers' compensation and ensuring good, supportive working conditions, we need to support teachers in staying at the cutting edge of effectiveness: We should commit to training all current and future teachers in harnessing the power of AI for the positive potentials it may offer in supporting teaching and learning.

To keep them at the peak, our educators must have a sophisticated understanding of how AI is and will impact their students' lives, development, school work, and learning. A few examples of existing programs for teachers include MIT's RAISE open-source initiative for teachers, the University of Pennsylvania's Graduate School of Education's Introduction to Teaching with AI, and Cal State Dominguez Hills' PK-12 AI Integration Certificate.

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10. Explain the What & Why: Academic Integrity

In addition to being clear with students about each school's expectations for if/how/when students may intentionally use AI in their school work, and how to acknowledge this, schools also urgently need to guide our children and students in developing an inner appreciation for integrity in their work.

As educators and parents, we can regularly share the following sentiments:

- "In our family/school, we value learning. Struggle and mistakes are how we learn. We expect you to be honest about what is really your work, and what is the work of others (including AI). What's most important to us is that you put your best effort and attention into your work, being honest about it, and seeking to learn from your mistakes. That's what we expect and care about more than anything else."
- "As your parents/teachers, our job is to prepare you for effective, successful lives beyond us. If your future friends, classmates, and co-workers learn they can trust you to be honest, it will be one of your greatest superpowers. That starts now with being honest in your school work."
- "In our family/school, we value honesty because we know that when we can go to sleep each night without regret for deceiving others or being afraid of getting caught in some deception, we are so much happier in our lives. We want this happiness for you."

If your future friends, classmates, and co-workers learn they can trust you to be honest, it will be one of your greatest superpowers.

Next Steps for MMS

While our MMS community can breathe easier, confident that what is already woven into our DNA embodies much of what is most needed, we cannot be complacent. As a school, we will work to support our educators in staying current with the impact of AI on their students' learning and lives, the adaptations this may require, and the possibilities of harnessing AI to enhance student learning and engagement.

One truth that will never change, however, is our singular ability as Montessorians to observe, engage with, and respond to the unique needs of each of our students. No doubt, AI will provide temptations for some students to seek shortcuts and will likely continue to challenge all our students in their understanding of what is real, right, and true. Our responsibility as educators is to build our own capacity and knowledge and to work collaboratively to design and facilitate hands-on, minds-on learning experiences that support students in achieving desired outcomes (theirs and ours).

AI is a game changer, and the brilliance of Montessori education is that we operate in a different playing field: Technology (AI and otherwise) is regarded as a potential tool that may be utilized if it benefits genuine, deep learning and enagagement, and if not, it takes the back seat (or gets locked away in the trunk.)

Our perennial North Star is to always offer rich, authentic learning in which young people are empowered with real experiences to learn, grow in independence, and develop naturally into the unique and extraordinary human beings they were born to be.

In the near term, we'll be engaging as a teaching crew around the following topics and questions:

1. Examine whether there are AI tools that can offer a value add in responding to the unique needs of each of our students.
2. Examine whether there are AI tools that can offer a value add in supporting our teachers' teaching craft.
3. Consider assignments in light of the ubiquity of access to generative AI outside of school.

4. Through robust dialogue with our older students, foster an AI-conscious community with the following goals:

- Teach students about their cognitive and creative development and help them understand what supports these developments and how and in what ways certain uses of technologies, including AI, erode their desired development.
- Examine ethical questions about authenticity, integrity, ownership, and creativity in light of AI.
- Enhance skills for critical discernment to assess the accuracy of content.
- Build literacy around AI and generative AI and how it might be ethically harnessed today and tomorrow for valuable, authentic learning, while continuing our minimal use of real-life distancing screens and internet-enabled technologies.
- Continuously update alignment with shared expectations for work citations, academic integrity, and best practices.
- Establish and reinforce shared expectations for academic integrity in all aspects of creative work, both inside and outside the classroom.

A Hopeful New Chapter

Worry and trepidation are natural and warranted in light of humanity's current liminal state: We don't know all the future implications of AI on the human experience and on what students will need to understand and be able to do.

We can also be excited; by continuing to honor the unique role of schools in bringing children and adolescents together in person to engage, collaborate, disagree, play, bond, celebrate, and learn, we are accessing our awe-inspiring and fundamental human potential.

If we look more deeply at how we do school and ask, "What are the intellectual, physical, social, emotional, and ethical developments essential for our young people?" then, yes, we may need to make adaptations to the "how" of our approach to delivering that development. However, as we've shown for over six decades at Marin Montessori, we can adapt to harness what is now to meet the needs of our children and adolescents' flourishing for today and tomorrow.

We've got this, MMS.

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