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We Have the Power to Invent the Future

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"You who are on the road
Must have a code that you can live by
And so become yourself
Because the past is just a good-bye.
Teach your children well..."

- Graham Nash

Preamble

Shortly after the Pandemic began in 2020, I wrote two blog posts: The first was about what children should master to cope with an uncertain, turbulent, and dangerous future; the second discussed how better methods of assessment were needed to provide a compass for this journey of learning. Walter McKenzie kindly offered to publish this combined, updated, and extended reflection that builds on those two posts. My thoughts have evolved in the past five years, a chaotic period of profound worldwide discontinuities: the culmination of the pandemic, the advent of generative AI, and the rise of authoritarianism across the globe. That said, my fundamental assertion is unaltered: Learning is a journey, not a destination and, like all travel. the settings through which one passes shape what is important to master.

An Illustrative Profound Worldwide Shift

Full fathom five thy father lies;
Of his bones are coral made;
Those are pearls that were his eyes;
Nothing of him that doth fade,
But doth suffer a sea-change
Into something rich and strange
-William Shakespeare
The Tempest, second stanza of 'Ariel's song'

The storm caused by the pandemic created conditions for change in how we teach and how students learn.

In Dede (2022) I wrote:

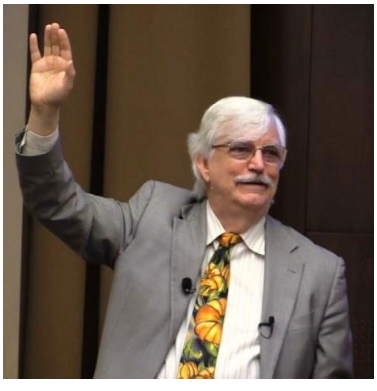
> All stakeholders in schooling, including teacher educators, are slowly realizing that the pandemic has created a sea-change rather than a temporary discontinuity. The pandemic-as-endemic world is neither a return to pre-pandemic normal nor a new-normal; the world is now irreversibly hybrid... Businesses, civic organizations, entertainment venues, and social relationships that used to be primarily face-to-face are now often or even predominantly online. Many people and organizations value the new opportunities this presents. Most employees who have the option of working from home part or all of the time are delighted by this new flexibility. Workers who accept new jobs far from their current location can now negotiate to avoid relocating by instead working across distance. Businesses that can accommodate remote work find their expenses for physical offices declining, increasing profits by reducing costs. Many workers have shifted to occupations providing remote services that previously were face-to-face, and quite a few find their new form of employment better than their old job. Older people and those with comorbidities to COVID appreciate having their meals and groceries delivered. Politicians, pundits, and entertainers delight in the scope and reach of social media with global impact via enhanced digital infrastructures. Through mobile apps, families can keep close contact with remote friends and relatives...

> From now on, when students leave the shelter of classrooms to interact with the world beyond schooling, they must have skills for adept hybrid performance both face-to-face and across distance. Schools, colleges, regions, and countries that force all teaching and learning to be face-to-face are dooming their graduates to reduced agency in every other aspect of life. We are now in Oz rather than Kansas, and - contrary to what some parents, many politicians, and all technophobes are hoping - no magical red slippers can bring us back to where we were...

We have all the infrastructure and insight we need to develop a massive learning ecosystem at global scale but, unlike every other sector of society, many educators refuse to acknowledge the value of hybrid.

What Children Should Master Given our Chaotic, Troubled Global Economy and Civilization

Every generation has its struggles. Certainly, I grew up in a troubled time: the nuclear arms race, the Vietnam War, the Civil Rights movement. I was grateful for my parents' clear advice about learning:



Achieve high marks in school and outstanding scores on the high-stakes tests. Get into a top-ranked college, and attain excellent grades there, then gain admission to an elite graduate school. That path will enable you to become a professor, as you have always wanted. Don't let war and injustice and the threat of imminent death distract or lure you into neglecting your education.

At that time, this was good guidance. I participated in anti-war activities and civil rights marches, but I followed my parents' blueprint for educational success until I graduated from college. After that, I ignored my family's counsel and invented my own future - but that shift was empowered by the solid foundation of knowledge I had mastered.

Although this path worked for me, I give my children radically different advice about learning, because they are growing up in a world my parents would find incomprehensible, a context in which their blueprint is no longer a guarantee of success. As Preparing Students for a Lifelong Disruptive Future: The 60-Year Curriculum discusses, the future will be quite different than the immediate

past. We and our children face a world-wide interdependent civilization shaped by economic turbulence from artificial intelligence and globalization, failure to reach the UN Sustainability Goals, climate change, disease and famine, widespread and profound shifts in political ideology, and advanced social and immersive media. We stand on the brink of an epic half-century, equivalent in its challenges and opportunities to those faced by the Greatest Generation.

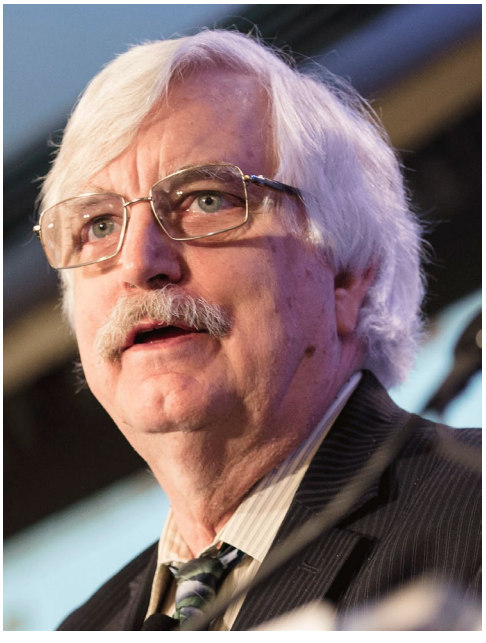
Education is our most powerful lever for systemically shaping the future. However, typical classrooms at every level are now dominated by one-size-fits-all presentational/assimilative instruction. Beyond literacy and numeracy, curriculum standards include far too much information easy to memorize and measure, but of little use in a workplace of search engines and artificial intelligence. In a schooling system dominated by drive-by summative assessments, our children cannot learn capabilities and dispositions vital for the disruptions they must overcome. Strengths such as resilience, perseverance, self-regulation, collaboration, conflict resolution, and forging opportunity from uncertainty cannot be attained in classrooms where compliance, ideological purity, and not-making-waves are the central behaviors demanded of teachers. The non-academic passions and accomplishments of students, which could be foundational for motivation and learning, are often ignored, nor are students provided with scaffolds to help transfer what they learn in school to its application in the real world.

GENERATIVE AI

Generative AI (GenAI) is Reshaping this Educational Mission

I am Co-Principal Investigator and Associate Director of Research for the National AI Institute in Adult Learning and Online Education (AI-ALOE). Our Institute develops AI learning and teaching assistants to enhance the proficiency of adult reskilling and upskilling, thereby improving workforce entry and lifelong learning. The AI assistants are based on known problems in online education for reskilling/upskilling and help personalize adult learning for workforce development. AI-ALOE develops new AI models and techniques for self-explanation, machine teaching, and mutual theory of mind to make the AI assistants usable, learnable, teachable, and scalable. AI-ALOE is also developing a data architecture for deploying and evaluating the AI assistants, collecting and analyzing data, and personalizing learning at scale. (Goel, Dede, Garn, & Ou, 2024).

One example of our tools is SMART for Concept Learning. Concept maps are graphical representations of concepts and relations among them. The Student Mental Model Analyzer for Research and Teaching (SMART) developed by Min Kyu Kim and his team at Georgia State University helps students build concept maps from text and provides feedback to help the students revise their maps. Recent studies engaging hundreds of students in multiple classes in English and Biology indicate that SMART helps students build better and deeper concept maps, demonstrating improved mastery of complex phenomena. SMART and our other tools are examples of Intelligence Augmentation (IA). AI changes the division of labor in most jobs, driving a need for workforce development to shift towards uniquely human skills. Specifically, AI is becoming increasingly proficient at calculation, computation, and prediction ("reckoning") skills. **As a result, we will see increased demand for human "judgment" skills such as decision-making under conditions of uncertainty, ethics, and practical knowing.** Continuing to focus on reckoning, the heart of current curricula, guarantees our students will ineffectively duplicate what AI is taking over. In today's workplace, people are increasingly working with AI-based partners who do reckoning (calculative prediction) in support of human judgment (practical wisdom), enabling Intelligence Augmentation (IA) in which people working in complement with smart machines accomplish more than either can unaided (Dede, Etemadi, & Forshaw, 2021).



As an illustration, cancer specialists have access to reckoning systems that provide estimates of life expectancy and best treatment for a particular patient, based on massive amounts of data synthesized from various sources and calculated through predictive analytics. However, healthcare workers counseling cancer patients need far more than this because real world decisions require considering quality of life versus life expectancy, tolerance for pain, personal and cultural beliefs about death, family circumstances, spiritual beliefs, and other things that no AI system can understand. The education of those workers must focus on judgment, as AI increasingly handles the reckoning. Cao & Dede (2023) discusses how teaching and learning should shift to emphasize judgment, and Dede (2023) delineates why GenAI is structurally incapable of evolving to Artificial General Intelligence (AGI), which would enable some forms of machine-based judgment.

Unfortunately, we often measure educational success using high-stakes tests. However, as described in Luckin's 2018 book, Machine Learning and Human Intelligence, such an approach prepares students for reckoning-based jobs deskilled by artificial intelligence (AI). Instead, as discussed in Fadel's 2024 book, Education for the Age of AI, children should learn what AI cannot do, preparing themselves to judgment-based roles. upskilled. Since judgment skills are performance-based and cannot be accurately assessed by psychometric tests, developing new types of assessments is essential.

Immersive Authentic Simulations as a New Compass for Assessment and Transfer

Imagine a doctor who has only two forms of feedback on whether her treatments are helping patients. First, she can take direct measurements (e.g., body temperature), but no one collects this data when she is not with the patient. Also, the doctor has no way to order repeated lab tests (e.g., changes in liver function); as a result, she has little diagnostic information on which to base her interventions.

Second, if patients die, the doctor can get an autopsy report on what killed them; if they get well and leave the hospital, she can get a medical workup about their condition on release. However, both of these assessments come far too late to improve treatment. Without multi-dimensional, frequent, longitudinal, diagnostic data that enable formative shifts in her therapies, this doctor is severely handicapped in curing her patients.

Of course, this is the difficult challenge teachers face every day. They lack what medical staff have: frequent diagnostic assessments that include real-time guidance about appropriate individual interventions. In education, well-designed diagnostic measures can provide formative feedback that helps students and teachers improve, as well as generating learning trajectories of performance gains over time to inform parents, school administrators, policy makers, and other stakeholders.

Rather than frequently interrupting learning with benchmarking tests, "stealth assessments" provide guidance just-in-time, which means many students will do better when high-stakes summative tests are administered. These diagnostic assessments are not substitutes for psychometrically reliable and valid summative tests, but they can accomplish useful functions not offered by those high-stakes measures. Using assessment as a compass for learning and transfer of skills, beliefs, and dispositions related to judgment requires these complementary approaches.

Personalizing learning is important in preparing students for the next half century, as is inculcating knowledge, skills, and dispositions whose learning trajectories are easier to measure with longitudinal diagnostic assessments than with snapshot summative psychometric tests. Creative teachers have developed classroom assessments that accomplish some of these important objectives; the pandemic has underscored the importance of sharing those innovations across the world, as we do with the Silver Lining for Learning podcast I co-founded. However, given the many responsibilities teachers have, asking them to develop their own fair and valid diagnostic assessments interwoven with learning is as unrealistic as expecting them to develop their own curriculum from scratch.

Despite expert support and validation, over the decades this evaluative model for stealth assessment has never achieved scale. Some of the barriers are financial, others institutional, and the dead hand of past tradition is always an obstacle to any educational improvement. Further, parents, school leaders, policymakers, and admissions officers want a single numerical score that determines who won in education's competition for valedictorians, National Merit scholars, and admittees to elite colleges. Just as it would be in medicine, this simplistic, one-sided approach has a high long-term cost in ineffective instruction, suboptimal learning, and wasted human talent.

As an illustration, Bondie and Dede (2023) developed and studied immersive authentic simulations to help teachers develop cognitive, interpersonal, and intrapersonal skills for leading equitable, substantive classroom discussions. In our work, which was before GenAI, student avatars, controlled by a human simulation specialist, respond to teaching practices and may also initiate challenges, feedback, and coaching. Teaching practices learned through experiences in the virtual classroom build confidence and skills that transfer to interactions with real students.

Beyond learning, these simulations provide a standardized experience for assessing growth in skills. Every teacher utterance can be coded based on the language used to communicate the teacher's intentions during simulations, identified as spoken to individual students, and organized by time elapsed and duration. By leveraging the technology's affordances (e.g., online access, immersive learning, standard challenges, and pausing or restarting), these simulations can redefine and transform field experiences by increasing opportunities for differentiated instruction, personalization, and formative assessments in ways not possible through in-person field experiences.

I and other scholars are now augmenting immersive authentic simulations with GenAI and refining these stealth assessment measures and methods through proof-of-concept design-based implementation research studies. Developing assessment practices such as these is vital to helping learners to master capabilities and dispositions vital for the disruptions they must overcome as adults., because we know for certain that what we choose to measure are the learning outcomes we will get.

Moving Beyond Regression to the Past to Shaping the Future

Many educators are now heroically surmounting these challenges to realize transformational opportunities. In doing so, they are transcending our collective denial, the first stage of grief for a cherished past that is no longer sustainable. We must accept that we are moving into an historically unprecedented, continuously disrupted present in which self-directed lifelong learning is essential for success. We must unlearn our habits and assumptions, shifting our vision beyond the mirage of high grades and elite schools leading to guaranteed success in life.

In his 1969 book, *The Future of the Future*, John McHale coined this epigram:

> *"The future of the past is in the future*
> *The future of the present is in the past*
> *The future of the future is in the present"*

While those who cannot remember the past are condemned to repeat it, the first line indicates that we are constantly reinterpreting history; for example, in many localities Columbus Day has shifted to Indigenous Peoples Day. The second line acknowledges that trends and structures from the past, such as the traditional school curriculum, constrain what we can do in the present. But the third line highlights that we have the power to invent the future, rather than simply see it as an extension of the past and present. In the shadow of the pandemic, which has undercut the dead hand of the past and the compliance mentality of the present, we should seize the opportunity to focus on the future of the future. The best way to predict the future is to invent it.

I tell my children we need a younger generation of heroes to shape the coming half-century:

> As advised in Georgia Tech's 2018 report, Deliberate Innovation, Lifetime Education, declare goals for your life rather than a major based on fields and disciplines. Focus your learning on what is meaningful; don't be distracted by what is tested. Given that you will have five to seven careers, think of yourself as an evolving suite of skills rather than as a role; Dr. Ed Dieterle models how this can help you find your Compass.

I try to walk my talk, seeing myself not only as a faculty member, but aspirationally as someone who is adept at explaining complex things to a wide variety of people, a mentor with decades of experience to share, someone with social capital to connect and convene, and a researcher who, in collaboration with colleagues, is able to inspire through creative designs and scholarly insights. Any stakeholder in education can similarly apply their unique perspectives and insights to contribute to improved strategies of teaching, learning, and assessment via a process similar to the story of "stone soup," a tale of a community coming together to add tasty offerings to what began as a pot of stones and hot water, resulting in innovative and delicious nourishment for all (Dede, 2020).

Of course, my children don't pay much attention to my advice; that is a perennial challenge for parents, yet consistent with young adults taking authority and responsibility for their decisions. More than my guidance, I hope my children are implicitly influenced by what I model in my attitudes and behaviors. In these troubled times, I do my best to project resilience and tenacity, finding opportunity in uncertainty, and inventing a bright future that transcends the mistakes and injustices of our recent history.

Because the future is undetermined, the core curriculum in and out of school should provide a new framework for what children should learn, so they can invent and shape our epic journey into a future we together invent. Carpe Diem!

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In addition, my website is a repository of many interrelated resources.

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