

“I simplify and condense.”

Greg Bear

P=fm

Fostering Innovative Teaching and Learning in a Digital Age

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“We must prepare for change, said Santiago.”

**Paulo Coelho
*The Alchemist***

Introduction

A larger scale context for power teaching includes ideas from Duane Elgin, Lester Brown, Al Gore and many others. Collectively, they say the convergence of systems level global problems without national borders place before humankind a choice the species has never encountered in 195,000 years of life on “Spaceship Earth.” In Elgin’s language, humans can experience an “evolutionary crash” or “evolutionary bounce.” We can continue a path of global gluttony. Or we can create a path of voluntary simplicity. Elgin argues that we can choose the scenario best suited for what we want tomorrow.

Far ahead, we can see Peter Ward’s “Homo futuris” (a new species of humans replacing Homo sapiens the way Homo sapiens replaced Homo erectus). We can see world class schools across the planet as central agents in the growth of human intelligence and wise living. And we can see schools in the United States as agents for what Thomas and Brown call a “new culture of learning.” That is the grand context for President Obama’s strategic vision: create a world class public school system in our nation by 2020. The power teaching prototype (P=fm) aims at the president’s vision.

With just two factors, the prototype connects the future of learning and Mind, Brain, Education Science. Most recently, it created future bent, writing/thinking intensive psychology courses at a small college in the urban South. With just two factors, P=fm fosters innovative teaching and learning.

Future of Learning Factor

Teaching for Understanding

Thinking about the future can be rooted in the past. That is a stance Millet and Staley take in their World Future review article about the futurist field. It is possible to see historical trends and project a continuation in the near future. That is the heart of the content analysis approach John Naisbitt used to create his landmark book *Megatrends*. Most, if not all, of his original ten megatrends were late 20th century events, including the most significant of the trends—shifting from the Industrial Society to the Information Society. In contrast, some trends in education date back to the time Homo sapiens co-existed with Homo erectus. So thinking about the future can be a tree planted by the river.

Teaching for understanding, for example, included a father teaching his son how to hunt large and small game with tools. Understanding meant the son could spear a Woolly Mammoth or a rabbit. A photo exhibit in the hallway of Mayo Clinic, Jacksonville, Florida illustrated a present version of this trend. “Moagana carried Kwanbr on his shoulders and taught his son everything he needed to know until he was bitten by a fer-de-lance while hunting and died in the forest.” A photograph of Moagana stood above the caption. Two wall photos over, National Geographic’s Loren McIntyre captured Kwanbr. He would replace his father as an Amazon headman.

About 10,000 years ago when the agrarian age emerged along the Nile River and complimented hunting and gathering, a stable population invented apprenticeships. Studying with a master artisan offered another way of teaching for understanding. In their book on the digital revolution, Collins and Halverson say that apprenticeship was the most successful model of teaching for understanding for centuries until Horace Mann and others invented public education in Massachusetts 200 years or so ago.

But unlike apprenticeship, which kept teaching for understanding relatively pure, public education in our nation fractured into a two-tiered system of education. Teaching for understanding took a twist. On the one hand, a few students experienced the historical trend of teaching for understanding akin to apprenticeship. The most gifted students were taught well. On the other hand, many other students were educated for the factory floor or the military field. They were taught to recall and obey.

Witness our nation’s capital. Shortly after its city charter early in the 19th Century, Washington, D.C. created a public school system for white children only. After the civil war it created a separate but far from equal system for black children. Like something out of Dickens, a little more than one hundred years later, two or three of the high schools in D.C. stood among the best in the nation. Many of its other high schools stood among the worst.

A fractal, echoing self-similarity during the Industrial Society, the elite/non elite pattern was repeated. Academically selective magnet schools and advanced placement classes or gifted programs within schools served the few. Industrial or Commercial tracks served the many. So, primarily, the elite engaged an education geared toward deep disciplinary understanding. The non elite population in DC and elsewhere got an education designed to fill low knowledge jobs in the labor force, the infantries or the jails.

During the Industrial Society, such a pattern of public education worked well. Only a few needed to be prepared to sustain economic output. But as Thomas Freidman, Collins and Halverson, Vito Perrone, Peter Senge and others, argue, in a digital age, such a pattern is unsustainable.

President Obama’s “Blueprint for Reform: Reauthorization of the Elementary and Secondary Schools Act” says our nation has fallen behind many other developed nations who are competing for good ideas in a knowledge age. The “elite-only” approach no longer works. We need a mass national system that fosters teaching for understanding from K to 16. That may not eliminate the elite/non elite pattern. But as Harvard historian Vito Perrone once said, we need a “pedagogy” of teaching for understanding—one becoming more widely distributed across ability groups and zip codes. Such a possibility for great teaching is already here. And its future is clear.

About 20 years ago, Harvard University’s Project Zero (PZ) Research Center began developing the teaching for understanding (TfU) framework in collaboration with teachers in real world settings. The Ivory Tower met the chalkboard over pizza and coke to create a framework for designing performance based instruction. And for the last 16 years, 250 or so educators from around the world each summer have gathered at Harvard Graduate School of Education for an intense, week-long “Views on Understanding” Summer Institute plus an army of other educators taking online courses in Harvard’s World Wide Web. The teaching for understanding framework has been spreading exponentially, making it possible to create high quality instruction for many.

Charles Reigeluth’s compendium on new paradigm instructional design theories says that TfU frames instruction and Howard Gardner’s MI approach (based on his landmark multiple intelligences theory) organizes the class by class design or even whole projects. Both TfU and MI foster teaching for understanding. Both help to invent student centered instruction across ability groups. Both extend the historic trend of teaching for understanding to the 21st Century and beyond. Both are levels of the future of learning factor in the power teaching prototype.

Five Minds for the Future

Howard Gardner first shared a chapter from his *book Five minds for the future* with 250 participants gathered in the lecture room of Longfellow Hall, home of Harvard Graduate School of Education. The year was 2005--10th anniversary of the TfU summer institutes. At one of the plenary sessions for “Views of Understanding,” Gardner offered a new direction in education that might increase in value as tomorrow unfolds. His quintet of minds for the future already has a place as a framework for directing assessments of disciplinary understanding in one, writing/thinking intensive psychology course at a small college in the urban South. It already is hard to imagine how a world-class public education system could not develop disciplinary minds, synthesizing minds, creating minds, respectful minds and ethical minds.

When Gardner took the stage and presented the opening plenary at Harvard’s 2010 Future of Learning Summer Institute, he offered the packed house of participants from 26 nations and across the United States up to the minute arguments about the value of five minds for the future. He said the five minds are claims about policy in a world in which lifelong learning is essential. People can reflect on their own learning without age limits. Then, he summarized the five minds.

Disciplined mind is first: working steadily to improve, learning major ways of thinking, becoming an expert in a profession. He added that disciplines are not natural ways of thinking—e.g. scientific or historical or mathematical require special preparation; they offer characteristic ways of creating knowledge. Gardner said we need experts for new jobs today and tomorrow, but people must continue to learn. As cited in Cynthia Wagner’s article in the January 2011 issue of *The Futurist*, “many functions will be more automated in the future, including professional services, but people will still find creative ways of using their skills and talents to make a living. The embodiment of life-long learners, these future workers will retrofit (add new skills and knowledge to existing jobs); blend (combine “skills and functions from different jobs or industries to create new specialties”); and, problem solve (“...the supply of future problems for people to solve seems limitless”).

Synthesizing mind is next: Darwin embodied the synthesizing mind. According to Gardner, such a mind samples, takes stock, processes, keeps track and most of all connects ideas. A back issue of *The Futurist* cited “synthesizer” as a new job for the 21st Century. Note that Wagner’s recent article in *The Futurist* cites 70 jobs for 2030; each appears to require both the disciplinary mind and synthesizing mind.

Creating mind follows. This mind requires people to not only create new ideas but to make new mistakes as a valuable part of the creative process. Wagner’s “Space junk recycler,” “Exobotanist” and “Astro psychologist” might engage the creative mind. Gardner said the first three minds (discipline, synthesizing, creating) can be reframed in terms of “depth, breath, and stretch.”

The respectful and ethical minds are more on the equally valuable social side. In a world of high immigration, respecting people different from self is critical in the workplace, school, and neighborhood. As a rule, the ethical mind requires treating well the people you see every day. Though difficult to achieve, solutions to ethical problems advance the interest of others. In brief, Gardner said the “three Es of good works are excellence, ethics, engagement. Imagine Wagner’s “Global system architect” and “Environmental health nurse” as engaging respectful and ethical minds.

Gardner, in closing, asked the crowd of FoL participants this: “how do we think about the five minds in a digital age?” Within the context of the power teaching prototype as it has been used for reinventing college courses, Howard Gardner’s pentad of minds for the future add value as an assessment framework. They direct instruction.

Learning by wholes

Perhaps the most hidden idea at Harvard’s Future of Learning 2010 Summer Institute was David Perkins’s learning by wholes, a new theory of teaching and learning. His plenary talk on teaching for the known and unknown hinted at a revolution in education that “won’t be televised” (as the Last Poets once exclaimed). His view of connecting the known and unknown appeared difficult to translate and did little justice to illuminating his theory “learning by wholes.” Yet, a close reading of his book made it clear that the seven principles of learning by wholes had to be part of any discussion about the future of learning. His plenary talk about connecting the known to the unknown was like the image Kenneth Koch gave in his poem: one train passes, wait before crossing. There might be another train hidden by the first. Or as Koch says later in the poem, wait to see all the sisters before deciding which one to date. David Perkins’s talk hid the book. And the book is the sister to date.

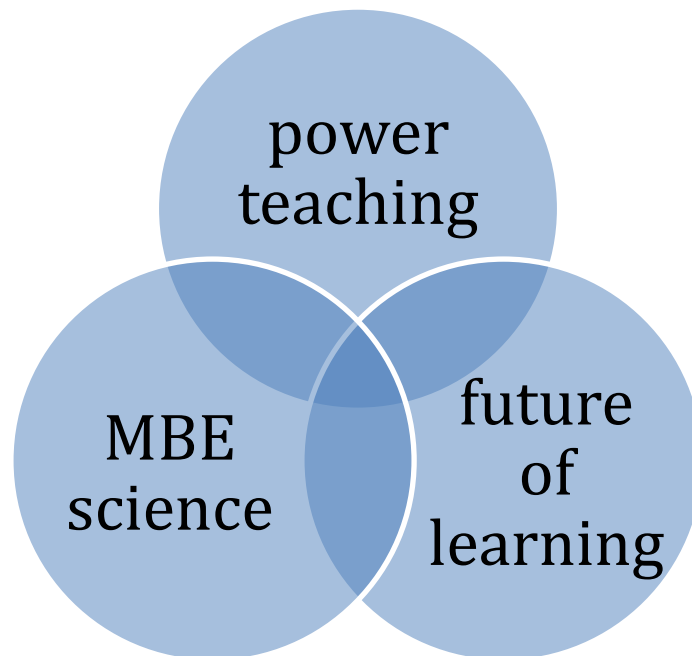
Using “game” as a metaphor, Perkins says teachers might consider helping students to engage the whole discipline under study. Sometimes that might mean giving novice students a “junior game” to gain access to core disciplinary ideas. Students in the fall 2011 Tests and Measurements course at the college, for example, engaged the Langer Mindfulness Scale, a psychological scale designed to measure the trait of mindfulness instead of its state. In data analysis workshops, they played around with organizing data and finding range, mode, median and mean. They compared the class mean to Langer’s norm group mean and standard deviation. Each one compared his or her individual score to the norm group and the class means. Each created inferences and drew conclusions from the data. Finally, the class examined Langer’s test manual description of what her research team did to create a reliable and valid psychological measurement of mindfulness. The junior game prepared them to take on more complex issues of reliability and validity in the construction, administration and evaluation of psychological measures.

Such a junior game enabled them to work on three other principles in the Perkins theory of teaching and learning as well: (1) make the game worth playing; (2) work on the hard parts; (3) uncover the hidden game. By using their individual and class data as a springboard, the students made the game worth playing. Motivation to encounter reliability and validity concepts increased. Studying the way Langer and her research team dealt with issues of reliability and validity to construct the scale served as “working on the hard parts” as well as “uncovering the hidden game.”

Finally, for the entire semester, students utilized strategies for thinking and writing including Robert Marzano’s research based strategies for summarizing and note taking, similarities and differences, and cooperative learning. With “writing to learn” and writing to demonstrate learning strategies, students played Perkins’s game of “learning how to learn” as well as a few of his other seven principles including “play the game out of town (demonstrate understanding). Learning by wholes, thus, also served to reflect on the direction of instruction. It directed the direction.

In summary, the future of learning factor has four levels: teaching for understanding and MI approach for designing student centered instruction, five minds for the future and learning by wholes to direct teaching and learning. But P=fm has an “m” factor. Thus, the prototype delivers instruction rooted in Mind, Brain, Education (MBE) science.

Figure one

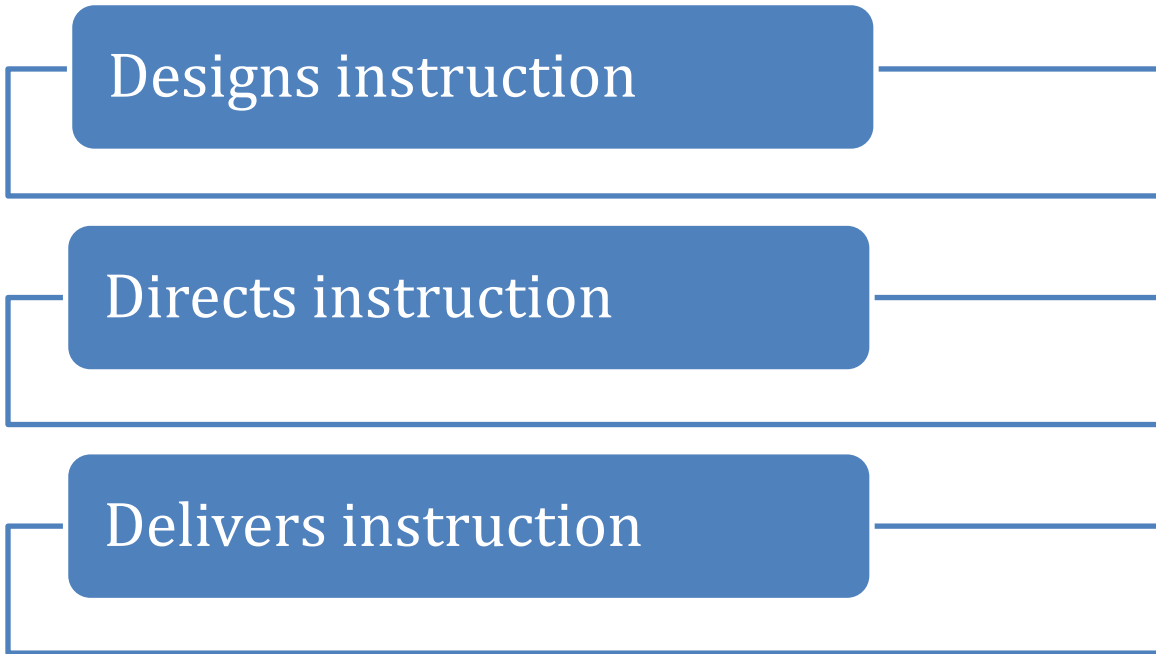


Mind Brain Education (MBE) Science factor

One useful synthesis of core ideas in this new discipline rests in Tracey Tokuhamma-Espinosa's landmark book. *Mind, Brain, and Education Science: A comprehensive guide to the new brain based teaching* explores the emerging discipline with four themes. Firstly, she defines mind, brain, education (MBE) science. A discipline born in 2004, MBE science derived from three parent disciplines, psychology, education and neuroscience. Each discipline had stood alone just as the four levels in the future of learning factor had once stood alone. But together, the parent disciplines formed a whole that was not only greater than the sum of its parts, but gave scientific depth about human learning as an emergent property. For example, her extended definition of MBE science, as a theme, served as one of those emergent properties. Secondly, she connected the dots in the history of learning theory plus suggested goals and standards needed for the future of the discipline. Thirdly, she examined the concept "scientifically substantiated art of teaching" from the perspectives of "lessons from research" and human survival skills. Finally, Tokuhamma-Espinosa illustrated how MBE science research had examined problems in selected subject areas such as reading, writing, mathematics and music. She used the research based insights collected in MBE science to describe characteristics of "great teachers." In all, her themes (definition, history, new paradigm concept of teaching, practice based research and development) provided four emergent properties of the discipline. Her ideas spark great teaching. Now, as a factor of power teaching, MBE science interacts with the future of learning to create what Steven Johnson calls an "adjacent possible" for education tomorrow. In all, power teaching embodies Johnson's view of innovation: it designs, directs and delivers student centered teaching and learning.

figure two

P=fm: jobs in innovation



Scientifically Substantiated Teaching

The College will become a national model for a dynamic, globally-diverse learning-centered community that champions academic excellence through innovative teaching and learning strategies under-girded by a spirit of servant leadership.

Originally created in 1866 to educate former slaves, the College is a short stroll from downtown. With less than 1,000 students, it is a small, private institution of higher education set in the urban South. Serendipitously, its vision coheres with Harvard's Tony Wagner who told the 2,000 participants at the 2011 Learning and Brain conference that 21st Century education in our nation needed to focus on developing innovators. The college walks softly but carries a big vision.

Thus, reinventing psychology courses to be future bent, writing/thinking intensive offerings with an explicit framework for the design, direction, and delivery instruction puts the vision into action. As MIT Professor Peter Senge might say from the perspective of his fifth discipline framework for learning organizations, vision describes the gap between the desired state and the reality. The college wants to be a national model for innovative instruction. At present it is not. But several faculty, students and administrators are working to make it so. When applied to selected psychology courses, the power teaching prototype embodies "scientifically substantiated" teaching. For example, the Theories of Learning (Psy 421) syllabus for spring 2012 featured Harvard Project Zero Research Center's Teaching for Understanding (TfU) framework as its course design. That meant five core ideas of TfU organized the plan: (1) generative topic, (2) throughline, (3) understanding goals, (4) understanding performances and (5) ongoing assessments. That meant the design fostered performances of understanding in which students would show what they knew and build new understandings" as Tina Blythe, author of the landmark book *Teaching for Understanding*, would say.

Generative Topic

With TfU as the framework, the “generative topic” for Theories of Learning 2012 was this: “The Empty Cup: Fostering Innovative Teaching and Learning.” This topic focused the interest of both the students and the professor.

Throughline

In one of her five solid research based findings from MBE science, Tracey Tokuhama-Espinosa synthesized almost a century of constructivist thought (from Dewey to Piaget to Vygotsky to Friere to Bruner to Hilliard to Sternberg et al). “The brain connects new information to old.” That became the course “throughline,” an idea or set of ideas repeated, strategically, over and over all course long. For instance, repeated throughlines at Harvard’s FoL 2010 were as follows.

figure 3

FoL 2010

Throughlines	Sidebars
<i>1. What do we know?</i>	What do we know about globalization, the digital revolution, and the human mind and their influences on learning and education?
<i>2. How might we rethink learning?</i>	How do we rethink the what, who and how of learning as a result of these changes or forces?
<i>3. What should we do?</i>	What should I and others do differently to meet the demands of the future of learning in practice?
<i>4. What will these changes lead to?</i>	What consequences may such educational changes have for learners and societies? What is our role as responsible 21st century educators?

The TfU throughline for Theories of Learning 2012 would echo all semester just as the four FoL throughlines had resonated during and beyond the one week summer institute. In all, the whole TfU design for Theories of Learning 2012 was as follows.

Generative Topic

The Empty Cup: Fostering Innovative Teaching and Learning

Throughline

**“The brain connects new information with old.”
(Tracey Tokuhama-Espinosa, 2010)**

Understanding goals

- 1. Understand how to synthesize core ideas of Mind, Brain, Education Science including five solid, transdisciplinary research findings.**
- 2. Understand argumentative writing as a tool for synthesizing ideas.**
- 3. Understand how to search and synthesize primary sources in a literature review across digital space.**

Understanding performances

- 1. Study Tracey Tokuhama-Espinosa’s landmark book on mind brain education science and summarize each chapter on Moodle to synthesize core ideas; engage a midterm argumentative essay on the following topic: *How might mind brain education science become the basis of innovative instruction at a college in the urban South?***
- 2. Conduct a review of the literature about mind brain education science—emphasis on primary documents and depth of understanding.**
- 3. Deliver an argumentative discourse, power point talk synthesizing ideas about MBE science in a mini conference (Obama University 2054: Fostering Innovative Teaching and Learning)**
- 4. Engage a GRE-like final examination of argumentative writing about MBE science—a synthesis of new information connected with old.**

Ongoing Assessments

- 1. Writing to learn: daily activities for writing and thinking (Harvard 3-2-1 activities, Harvard Critical Thinking Games, quick writes, Brain breaks, summaries, Buzan mind maps, comparisons, metaphors, analogies, SQS for critical reading, Venn diagrams, T-charts, smart graphics, etc.)**
- 2. Writing to demonstrate learning: four strategic argumentative discourse experiences each scored with a GRE rubric for writing and thinking.**

Note. The final project (power point slide show talk in a mini conference: “The Obama University 2054: Fostering Innovative Teaching and Learning”) will also rest on argumentative discourse and explore the following:

- 1. Why does Tracey Tokuhama-Espinosa say that 21st Century teachers must understand contributions from mind brain education science?**
- 2. What counts as a “scientifically substantiated art of teaching” from her perspective?**
- 3. To become a national leader for innovative teaching and learning, faculty at a small college in the urban South must ground instruction in MBE science. Why is this so or not so?**
- 4. What is missing from Tokuhama-Espinosa’s perspective of mind brain education science?**
- 5. What’s new?**

As the course unfolded, the MI approach characterized each session, Gardner's five minds for the future and Perkins's learning by wholes guided reflections. And the course itself was grounded daily in ideas from MBE science. The students studied MBE science on the one hand and experienced teaching and learning rooted in MBE science research, on the other.

Given that the TfU framework was by then in place, fieldnotes for the January 24, 2012 session illustrated how the levels of the "f" factor interacted with the "m" factor of power teaching. The lesson embodied the design, direction, and delivery of scientifically substantiated teaching.

Description of lesson

"Synthesize core ideas of MBE science." That boiled down the three understanding goals stated in the TfU course design. Every 75 minute lesson in Theories of Learning 2012 kept that goal up front. The session today (013112) opened with the Harvard 3-2-1 activity as a point of entry. Then, it displayed Dan Rather's YouTube report on "neuroplasticity" (part one of five) as a powerful metaphor. Multiple representations aimed at the main goal including an examination of a student authored summary posted on Moodle, review of a collective mind map on chapter one of Tracey Tokuhama-Espinosa's Mind Brain Education Science, and the SQS (Scan, Query, Synthesize) critical reading method on chapter two. Howard Gardner's MI approach, thus, designed the individual lesson Vis a Vis the overall TfU course design.

Reflection

While TfU-served as the macro design function of the power teaching prototype, it is the MI approach that fine tuned the planning. An "instructional design theory in its own right according to Charles Reigeluth, the MI approach organized each session into point of entry, powerful metaphor and multiple presentations with activities across any set of Gardner's nine intelligences in MI theory. The Harvard 3-2-1, for example, was primarily verbal linguistic with a touch of logical mathematical and visual spatial intelligences. The YouTube video was primarily visual spatial. The SQS critical reading method included Buzan's mind mapping strategy and a cooperative learning strategy. So it included verbal linguistic, visual spatial and interpersonal intelligences. Note that at no time would a session offer activities in all nine intelligences. But over the course of a semester, activities might touch on most of Gardner's set.

Because Theories of Learning was a future bent, writing/thinking intensive psychology course, activities such as the Harvard 3-2-1 were of particular value. With this activity serving as a point of entry, students tapped prior knowledge about a topic, posed new questions to pave the way for active learning, and created a powerful metaphor to think ahead. In the all, the 3-2-1 embodied the MBE principle: “the brain connects new information to old.”

The Harvard 3-2-1 for the model case lesson offered the following topic: How does Tracey Tokuhamma define MBE science? The topic spoke back to chapters one and two—her extended definition. Two questions per student set up active learning for the community of learners. (A few might even discover a research question to guide personalized literature reviews of MBE science.) One metaphor allowed students create an image of the topic.

Figure 4

<p>Theories of Learning (Psy 431) spring 2012 013112</p>
<p>Name of scholar</p>
<p>Understanding goal: Synthesize core concepts of Mind Brain Education Science.</p>
<p>“The brain connects new information to old.” (Tokuhamma-Espinosa, 2010)</p>
<p><u>Harvard 3-2-1</u>Topic: How does Tokuhamma-Espinosa define MBE science?</p>
<p><u>3 ideas</u> you know about the topic</p>
<p>1.</p>
<p>2.</p>
<p>3.</p>
<p><u>2 questions</u> you have about the topic (Mwalimu’s sample questions: Does systematic “scientifically substantiated” teaching improve memory of college students? How have researchers examined memory from a transdisciplinary lens? What pattern connects MBE science and Ellen Langer’s mindful learning? How might Steven Johnson’s seven patterns of innovation tell the story of MBE science?)</p>
<p><u>1 metaphor</u> about the topic (For example, see the following: Brain as kaleidoscope...)</p>

20 out of 25 students completed the Harvard 3-2-1 as a point of entry for the lesson. Grouped along the lines of Ellen Langer’s notion of engagement (see Langer Mindfulness Scale), four categories organized the informal assessment of disciplinary content presented in their responses. High engagement represented responses that demonstrated understanding in all three parts of the instrument. Moderate engagement demonstrated understanding on two of the three items and misunderstanding or shallow understanding on one of the three items. Low engagement meant the instrument was incomplete and showed misunderstanding. The fourth category meant the students were absent.

figure 6

Levels of Engagement Frequency Distribution

High	Moderate	Low	Absent
11	8	1	5

In summary, The Harvard 3-2-1 became a writing/thinking intensive point of entry, similar to one Dina Thomas used every day with Learning Group N at the 2010 Harvard Future of Learning summer institute.

While the Theories of Learning session featured his MI approach in the design or lesson plan, Gardner’s five minds for the future directed the instruction. The session was all about the “disciplined mind” in the form of MBE science as content. Gardner’s “synthesizing mind” helped students to connect ideas within MBE science and across other disciplines. Additionally, his “creating minds” allowed students to invent knowledge about the discipline. For example the Harvard 3-2-1 as well as Buzan’s mind mapping within the framework of the SQS method of critical reading are writing to learn activities fostering engagement in both oral and written recitations. Posting one paragraph summaries of chapters on the Moodle Blog offered an additional writing to learn activity, but one that made thinking visible to the whole community of learners, one engaging the synthesizing mind.

Then, his “respectful mind” informed classroom management. Students occasionally needed reminding that when other students reported or recited ideas, especially when the student appeared to be different or offered novel views, the job was to respect them as fellow human beings. And finally, Garner’s “ethical mind” spoke to creating work that was honest and excellent. Only once in the course did a student submit a plagiarized, word processed argumentative essay. The professor failed the essay, held a conference with the student to discuss the ethical mind, and provided the student with an opportunity to do the assignment again.

For reflecting on the instruction, David Perkins's Learning by wholes-theory of teaching provided another perspective. His seven principles, presented guided regular reflection for a given lesson, the series of two week blocks of instruction, the midterm and even the whole semester. For example, "play the whole game" meant engaging the discipline at a level students could reach. In the case of the model lesson, students played what Perkins called a "junior game." They learned the core ideas of MBE science chapter one, a bite sized task like the joke "How do you eat an elephant? One bite at a time." The elephant is studying the whole book as well conducting personalized literature reviews about a topic and research question on MBE science.

"Play the game of learning" meant using specific strategies such as the Harvard 3-2-1 or Robert Marzano's "Summarizing and Note taking" plus "Similarities and Differences" research based strategies for student achievement. These fostered learning how to learn.

When students presented power point talks in an end of semester mini conference, they synthesizing their knowledge of MBE science. Viewed from the Perkins framework, they "played the game out of town." Additionally, the GRE like final required writing two essays: (1) responding to one of two questions; (2) responding to a short article from the March 2012 issue of Mind Brain Education Science. In both cases, they engaged argumentative discourse and had to demonstrate understanding of MBE science. Playing the game out of town translated into evidence of understanding. 24 out of 25 students who completed the course earned final grades of A, B or C. Thus, Theories of Learning, as a course with challenging content, namely MBE science, had a 96% passing rate—an extraordinary outcome given challenging content. In all, Gardner's five minds for the future and Perkins's seven principles provided a double description for thinking about scientifically substantiated teaching and learning.

Metareflection (Piaget)

What counts as mindful learning?

The last research project in Piaget's five decade career suggested a metareflection model—one seldom cited in text books on theories of learning even ten years later. Yet, his empirical abstraction reflecting abstraction, reflected abstraction and metareflection defined higher order thinking as never before. He gave the world a deeper perspective on teaching and learning.

Take an ordinary tennis ball. At the empirical abstraction level, the ball is a green sphere about the size of an orange. These are directly observable, physical features of the ball. When a tennis ball is placed inside designated lines on a tennis court, it scores points for the player. That, in Piaget's model, is reflecting abstraction. The tennis ball is central to the game and can be struck in such a way that alters its speed and spin to win points. Therefore, reflected abstraction provides a third tier to the process of thinking about thinking. Finally, the tennis ball relates to a number of sports featuring a ball-like object as central to the game even though it may not look like a puck or football. That is metareflection. And metareflection has no limits. A writer might examine tennis for its historical evolution as an international sport or its social, psychological impact on players of color or a comparison with basketball along the lines of any number of dimensions. The point is that Piaget stretches the mind.

Similarly, MBE science suggested a transdisciplinary lens for examining old problems in teaching and learning as well as posing new problems never before possible. That is an empirical abstraction. It gave educators and researchers alike the capacity to see psychology, education and neuroscience along the lines of the degree to which the information about great teaching ranged from solid research to neuromyth. That was reflecting abstraction. It allowed one to evaluate and/or improve instruction in the flow of delivery. That was reflected abstraction. Finally, it allowed me to design a research question beyond the borders of the course.—the stuff of metareflection. “What counts as mindful learning?” That inquiry is at the intersection of Ellen Langer's mindfulness theory and MBE science. Langer's three decades of research on mindfulness/mindlessness including “mindful learning.” But while she connects the concept to psychology and education, the concept fails to have roots in neuroscience. So what counts might now best be viewed with a transdisciplinary lens. Thus, my major project for advanced doctoral studies becomes this: “Mindful Learning, Mindful Brains.”

“Chance favors the connected mind.”

Steven Johnson

Conclusion

Steven Johnson’s “Where do good ideas come from?” (a Youtube video (based on his recent book) said it best: According to Johnson, good ideas typically result from hunches, collisions, and spaces. In contrast to the “Eureka” experience, most good ideas take time. Johnson said Tim Bernes Lee tinkered with a system for organizing his files. Off and on after ten years, his tinkering became the World Wide Web.

Secondly, good ideas collide. Most often one person has a slow hunch that meets someone else’s slow hunch. The ideas collide. Something bigger and better than any single person could create can emerge. Facebook and Google serve as recent examples. Steve Jobs did not stand alone with Apple. Nor did Howard Gardner with multiple intelligences theory.

But good ideas also need spaces for people to share hunches. Salons in the Harlem Renaissance provided settings for writers, artists and musicians to collide. So did coffee houses in London, Paris and Starbucks everywhere. Additionally, The World Future Society met annually so that 2,000 or so minds of futurists could collide. Harvard’s Future of Learning 2010 Summer Institute provided a physical and conceptual space for the power teaching prototype to swim in a “liquid network” with Howard Gardner, David Perkins, Allan Collins, Kurt Fischer, Mary Helen Immordini-Yang et al including participants from across the United States and 26 other nations.

When Netscape introduced the Internet to the public in 1993, the world witnessed an event comparable to that of Guttenberg’s printing press. The web allowed hunches to transcend physical space and connect at the speed of light in digital space. Now ideas collide, morph, send, store and restore—expanding exponentially the opportunities for teaching and learning.

The power teaching prototype (P=fm) collided with other hunches at the 2010 Future of Learning Summer Institute, the 2010 World Future Society’s Education Summit and the 2011 Learning & Brain conference. Faculty, administrators and students at a small college in the urban South added value. All were vital in the liquid network fostering the development of the prototype, helping it to design, direct and deliver innovative instruction in a digital age. Because the prototype sits on “scientifically substantiated” teaching, it takes small steps toward President Obama’s vision of a world class public education system by 2020. And it creates a conceptual platform for nurturing a new slow hunch: “What counts as mindful learning?” (the intersection between Ellen Langer’s mindfulness theory and MBE science).

Finally, P=fn becomes my way of acting locally while wondering globally. This dance between action and vision echoes Elizabeth Alexander's "Praise Song for the Day."

***We cross dirt roads and highways that mark
the will of some one and then others, who said
I need to see what's on the other side.***

***I know there's something better down the road.
We need to find a place where we are safe.
We walk into that which we cannot yet see.***

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