educational technology®

Volume LIV
Number 3

May–June 2014

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A special issue on paradigm change in education; plus several regular magazine features

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educational technology®

Educational Technology (ISSN: 0013–1962) is

Periodicals postage paid at Englewood, New Jersey, and at additional mailing offices. POSTMASTER: Send address changes to Educational Technology Publications, Inc., 700 Palisade Avenue, Englewood Cliffs, New Jersey 07632–0564. USPS: 168–920.

Published bi-monthly at 700 Palisade Avenue, Englewood Cliffs, New Jersey 07632–0564; (201) 871–4007; Fax: (201) 871–4009; to order: (800) 952–2665 toll-free in the United States and Canada; e-mail: EdTecPubs@aol.com.

Available by subscription only, one year for $259.00 in the United States, $289.00 elsewhere; three-year subscription, $679.00 and $749.00. Single issues are $45.00 each. Back volumes are $289.00 each (available from 1964–2013).

The periodical title “Educational Technology” is a trademark registered in the U.S. Patent Office.

Readers are invited to submit articles, Reader Comments, and Point of View columns for possible publication. Address all material to Lawrence Lipsitz, Editor, *Educational Technology* Magazine, Educational Technology Publications, 700 Palisade Avenue, Englewood Cliffs, New Jersey 07632–0564 (Fax: 201–871–4009; E-mail: EdTecPubs@aol.com).

Educational Technology, published since 1961, is an independent magazine covering all aspects of technology in education and training worldwide.

Paradigm Change in Education

Introduction to Special Issue

Charles M. Reigeluth
Francis M. Duffy
Guest Editors

This article sets the stage for this special issue of *Educational Technology* on paradigm change in education. First, it defines paradigm change and presents evidence that it is the only way to improve our systems of education and training at this point in the history of the evolution of society. Second, it gives a brief overview of the likely key characteristics of the new paradigm of education and proposes that this paradigm change is not only possible, but inevitable. Third, it gives a brief glimpse of principles that will guide the paradigm change process. Finally, the organization of this special issue is described, along with a summary of each article.

While the word "paradigm" is greatly overused, we believe it communicates most effectively the nature of change that is so desperately needed in educational systems today. Paradigm change stands in contrast to piecemeal change, in which minor modifications are made to parts of a system, while the structure of the system remains intact. *Paradigm change* is both fundamental and comprehensive. A change in one part of the system is so fundamental that it is incompatible with many other parts of the system, so those parts must also undergo fundamental change. "In education, [paradigm change] must pervade all levels of the system: classroom, building, district, community, state government, and [to a lesser extent in the United States] federal government" (Reigeluth, 1994, p. 3). Examples of paradigm change can be found in all aspects of life, as shown in ***Table 1***.

When a system's environment is stable, piecemeal change is appropriate, but when there are dramatic changes in a system's environment, paradigm change is needed. The Industrial Age brought great changes to the needs and conditions for educational systems, making the one-room schoolhouse obsolete. The Information Age is ushering in even more dramatic changes that are making the factory model of schools obsolete.

For example, during the Industrial Age, manual labor was the predominant form of work (Reigeluth & Karnopp, 2013). There was no need to educate most children to high levels, nor could we afford to. Thus, the factory model of schools was designed to sort out the slower students and promote the faster ones for higher education to become managers and professionals. Student progress was based on time rather than learning, so the slower students accumulated learning deficits that condemned them to later failure. Tests were norm-referenced (comparing student performance to that of other students rather than to a standard) to make it easier to flunk out the slower learners. The "hidden curriculum" focused on compliance with authority and perseverance with boring, repetitive tasks to prepare students for assembly lines.

Now, in the Information Age, knowledge work is becoming more common than manual labor. Also, all aspects of life are becoming more complex, from knowledge needed to make good voting decisions in a democracy, to setting up and operating a TV set, complete with DVR, DVD player, gaming console, Internet connection, and surround-sound system. For occupational, civic, and quality-of-life reasons, far more students need to be educated to much higher levels. The educational paradigm needs to be transformed from sorting to learning.

Fundamental to these changed needs and conditions is the recognition that people learn at different rates and have different learning needs, yet the factory model of schools requires students to learn the same things in the same amount of time. The teacher's responsibility is to teach the material. If some students don't learn, that's *their* problem. Teachers who want all students to learn face a frustrating up-hill battle because the time-based system does not allow slower learners to succeed. If we truly want to leave no child behind, we must forsake the time-based, sorting-focused system for one in which student progress is based on learning, not time. We must allow faster

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Table 1. Examples of paradigm change.

Paradigms in ...	Agrarian Age	Industrial Age	Information Age
Lighting	Flame	Incandescent bulb	Light emitting diode (LED)
Transportation	Boat, horse	Railroad	Automobile, airplane*
Education	One-room schoolhouse	Factory model schools	Learner-centered education

*While the automobile and airplane were invented during the Industrial Age, they did not take over from the railroad as the predominant paradigm of transportation until the dawn of the Information Age.

learners to move on as soon as they have mastered the current material, and we must not force the slower learners to move on until they have mastered the current material.

The implications of this are huge. As noted by Reigeluth and Karnopp (2013), it requires changes in testing from norm-referenced to criterion-referenced (a different paradigm of assessment!), changes in student records from grades to certifications of attainments (with badges and portfolios), changes in instruction from standardized to personalized (with a personal learning plan for every student), from teacher-centered to learner-centered, from extrinsic motivation to intrinsic motivation (e.g., through project-based learning), from large impersonal schools to small, caring learning communities. It requires changes in the role of teachers from "sage on the stage" to "guide on the side," the role of students from passive learners to active, self-directed learners, the role of parents from cookie-bakers to partners with teachers in helping their children to learn, and the role of technology from use by the teacher (e.g., PowerPoints and electronic grade books) to use by the student (e.g., immersive project-based learning environments with just-in-time tutorial support).

These changes are impossible within the structure of the factory model of schools. The changes are so fundamental that they require fundamental changes throughout the rest of an educational system. Such transformation is a huge undertaking. Some people who recognize the need for paradigm change in education cry out in despair that it is too monumental to succeed—that the barriers are too great. Others believe that such a "disruptive" innovation can only take place outside the predominant systems and will eventually replace them (Christensen, Horn, & Johnson, 2008).

However, many believe that this paradigm change is inevitable, just as the transformation from the one-room schoolhouse paradigm to the factory model paradigm was inevitable. The deeper a society evolves into the Information Age, the more misaligned the factory model will be with its educational needs, and the more damage will be done to that society. Eventually, the situation will get so bad that the transformation will occur. So the relevant questions for the United States today are:

- How long will this paradigm change take, and how much damage will be done to our students, their communities, and our economy before it happens?
- What can we do to accelerate the transformation process?
- What features should the new paradigm have, and what infrastructures need to be built?

The purpose of this special issue is to help stimulate the development of answers to these questions. It attributes particular value to those professionals whose careers are embedded in the field of educational technology. Such technologies make paradigm transformation possible, if they are applied using principles of systems thinking and system design. Transformation cannot occur without the effective systemic application of instructional technologies. This issue of *Educational Technology* also provides a glimpse into the world of systems thinking and systems design.

Means and Ends

The organization of this special issue is based on the familiar distinction between means and ends, or process and product. The product issue is what the Information-Age, learner-centered paradigm of education should be like. The process issue is how we can help school systems to transform themselves. Initiatives are desperately needed that will advance knowledge about both the product and the process. Fortunately, many school systems have been reinventing themselves, and we can learn much from them

about both process and product. We can also learn much from other organizations that have undergone paradigm change, such as corporations that have "reengineered" (Hammer & Champy, 2001).

Based on these reinvention efforts, the following appear to be some important features of the new paradigm (Reigeluth & Karnopp, 2013):

- attainment-based system (student progress, testing, and student records);
- learner-centered instruction (personalized, project-based, collaborative, and with just-in-time individualized instructional support);
- expanded curriculum (21st century skills and all aspects of child development);
- new roles for teachers (mentors, designers of student work, facilitators of student work, and lifelong learners), for students (self-directed learners, teachers, and collaborators), for parents (actively involved in deciding what their child should learn and helping their child to learn it), for administrators (a support role rather than a command-and control role), and for technology (a central role in helping each student learn);
- a nurturing school culture (small school size, strong relationships among stakeholders, multi-year mentoring, multi-age student grouping, and intrinsic motivation); and
- organizational structures (a professional model of teacher ownership of their school; choice for students, parents, and teachers; and local and state administrative systems that support rather than control).

The reinvention efforts also provide insights into important principles of the process for transforming educational systems to the new paradigm (Reigeluth & Karnopp, 2013):

- Mindset change about education is the most important result of a transformation process. So it must be a learning process.
- Decision-making about the new paradigm should be made through a consensus-building process. This is another dimension of the learning process.
- Broad stakeholder ownership of the process is important for building commitment, reducing resistance, and enhancing sustainability. It spreads out the learning.
- The transformation process should use a combination of adopting other's ideas and adapting them through invention and designing for the ideal.
- The change process should be comprehensive, addressing work processes, supporting processes, and external relationships, and addressing the instructional system, assessment system, record-keeping system, and so forth.
- Leadership and political support are crucial from all formal and informal groups, with an emphasis on developmental (or servant) leadership.
- Systemic leverage should be achieved by making the most impactful structural changes first and allowing for the gradual emergence of additional changes to support them.
- Readiness, capacity, and culture must be developed before meaningful change can occur.

These and other features of the product and process of systemic transformation are further explored and developed in this special issue.

In This Issue

This issue is organized using four sections, and each section has multiple articles:

- Visions of the New Paradigm (the product issue)
- How to Help School Systems Transform (the process issue)
- Case Studies: What's Happening Now
- Paradigm Change in Other Realms of Education and Training

Each article is highlighted below.

Section 1—Visions of the New Paradigm

Scott Thompson's article, "A Paradigm for Learning in a World of Continuous Change," presents an argument for transforming our educational systems. He points out that while many aspects of our society have transformed to meet the demands of the Information Age, education has not. He argues that schools and school systems must adopt a new paradigm for learning, if they are to remain relevant by preparing children and young people for life and work in the new era.

In her article, "How to Personalize Learning in K–12 Schools: Five Essential Design Features," Dabae Lee provides research-based guidance for five features of truly learner-centered instruction: (1) a personalized learning plan for every student; (2) project- or problem-based learning; (3) competency-based student progress; (4) criterion-referenced assessment for ensuring student learning; and (5) multi-year mentoring of students by a teacher. She describes educational benefits and design principles of each feature.

The article by Charles M. Reigeluth, "The Learner-Centered Paradigm of Education: Roles for Technology," explains very different roles for technology in a transformed education system. Reigeluth argues that, instead of technology almost exclusively serving the teacher for teaching, technology should primarily serve the student for learning. He then goes on to describe four major roles for instructional technology in a transformed school system.

Section 2—How to Transform School Systems

Daniel Kim's article, "Transformational Dialogue for Public Education: From Tweaking to Transforming atthe State Level," describes the work he did with the state of Ohio to transform education in that state through a forum called the "Transformational Dialogue for Public Education." His article also provides a clear and compelling glimpse into the world of systems theory and how that theory can inform efforts to transform education.

"Paradigms, Mental Models, and Mind-Sets: Triple Barriers to Transformational Change in School Systems," by Francis M. Duffy, provides a compelling description of paradigms, mental models, and mind-sets as sources of fierce resistance to transformational change by using a religion metaphor to explain the power of the three phenomena.

The article by Sunnie Lee Watson and William Watson, "Engaging At-Risk Populations in the Systemic Educational Transformation Process," argues that marginalized and disadvantaged student bodies in public school districts have very different cultures of learning from mainstream learning communities. They posit that those marginalized student bodies are isolated for convenience in administration and instruction. They present a strong argument for including the disadvantaged student populations in educational systemic transformation efforts.

Section 3—Case Studies: What's Happening Now

Sinem Aslan, Charles M. Reigeluth, and Dee Thomas, in their article, "Transforming Education with Self-Directed Project-Based Learning: The Minnesota New Country School," describe and highlight a school that was transformed to embody principles of personalized learning. They describe four design principles that make the school unique: (1) a small learning community, (2) self-directed project-based learning approach, (3) authentic assessment, and (4) teacher ownership and democratic governance.

Pratima Dutta's article, "Implementing Learner-Centered Educational Strategies: The Bloomington Project School," presents a case study that offers a glimpse into the school's student-centered, collaborative, and interdisciplinary learning and teaching processes; its mastery-based assessment process; and its successful technology adoption and implementation initiative.

Section 4: Paradigm Change in Other Realms of Education and Training

In "Redesigning Higher Education: Embracing a New Paradigm," William R. Watson and Sunnie Lee Watson make a strong case for bringing transformational paradigm change into higher education institutions. They state that higher education is under significant pressure to transform by embracing a new paradigm. Their article explores the current landscape of higher education reform and describes characteristics of a much-needed new paradigm.

"Paradigm Change in Military Education and Training," by Herbert H. Bell and Charles M. Reigeluth, is the final article in the collection. It presents a fascinating and important story about the transformation of education and training in the U. S. military—a transformation that is creating learning opportunities that are tailored to meet individuals' needs wherever they are and whenever they are ready to learn. They believe the result of this paradigm change will be a culture of continuous, personalized learning with learner progress that is based on proficiency and a greater emphasis on technology-enabled immersive learning environments.

Conclusion

In conclusion, we have compiled a collection of articles that provide insights to the nature of the learner-centered paradigm, why it is important, why it is resisted, and how to create it. It is our hope that the articles found in this special issue of *Educational Technology* will inspire instructional technology specialists and policymakers in all settings to learn more about the nature of personalized learning, the dynamics of systems design, and how to create and sustain transformational change in education and training systems. □

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A Paradigm for Learning in a World of Continuous Change

Scott Thompson
Panasonic Foundation

Through ongoing rapid-fire changes in the nature of communications, the social, professional, and political landscapes of our time are rapidly transforming. But the prevailing paradigm in most schools and school systems is a relic of the industrial revolution. Schools and school systems must adopt a new paradigm for learning if they are to remain relevant and able to prepare children and young people for life and work in the 21st century world. The necessary shift is from a mechanistic mental model involving the transfer of a standardized, explicit body of knowledge from teacher to student to an organic paradigm that personalizes the development of tacit, more than explicit, knowledge and understanding around each individual learner.

Introduction

We live in a world where change is not only constant but is constantly accelerating (Thompson, 2005). It is not simply the tools of communication and collaboration that change as technology continues on the fast lane of continuous reinvention. New tools are now changing the nature, context, and contours of communication. *New York Times* columnist Thomas Friedman likes to point out that the first edition of his book, *The World Is Flat: A Brief History of the 21st Century*, made no reference to Facebook, because Facebook was in its infancy in 2005 when the book was published. At that time, Twitter, Tumblr, Pinterest, and so many other social networking tools that are transforming social interaction, commerce, and politics the world over had not come into being. Consider the role of social networking in the "Arab Spring" that has profoundly changed the political contours of a region of our planet.

All of this has enormous implications for K–12 education. It is not simply that new technologies need to be integrated into classrooms. That alone will not prepare students to thrive in a globalized, networked world of continuous change. A new education paradigm is needed.

Although public K–12 education in the United States has undergone decades of "reforms," a fundamentally mechanistic paradigm has continued to exert pervasive influence on educational policies, practices, structures, and cultures. Most readers will be familiar with the fact that the modern public school and school district are direct descendants of the Industrial Revolution. Public schools were modeled after factories, and factories were built to last. Factories have traditionally been designed with an eye toward optimizing efficiency through regimented processes. Such regimentation is by definition averse to change (Thompson, 2005).

Yet it is also true that schools and districts are socially complex, dynamic systems. Given the double-barreled challenge of social complexity and bureaucratic intransigence, it's no wonder that those involved in efforts to transform factory-style school districts into adaptive, high-performing systems of education have experienced such tough sledding and demonstrated only spotty progress (Thompson, 2005).

The Instructional Core at the Core of Transformation

When you peel away so many layers of structural, cultural, and political activity in the public education of children and young people, what is at the core? As others have argued—Hawkins (1974), Cohen, Raudenbush, and Ball (2003), City, Elmore, Fiarman, and Teitel (2009)—the essence of education is the instructional core: the interrelationship between students, teachers, and content. And as Cohen, Raudenbush, and Ball point out, these interactions take place in environments and extend through time.

Although some "reforms" have ignored the instructional core, it has been and I believe will continue to be at the core of education, even as paradigms and practices and relationships change. In other words, we have some good news: changing our educational para-

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digm does not mean replacing the core of education. But what has changed radically—in those rare instances where the new paradigm has already taken hold—is the role of student, teacher, and content and the relationship between these elements of the instructional core.

Under the new paradigm, the instructional core does not get replaced (the essential elements remain), but it does get transformed in terms of the roles and relationships among and between those elements.

The New Paradigm

What is the new paradigm? The shift is from a mechanistic mental model involving the transfer of a standardized, explicit body of knowledge from teacher to student to an organic mental model that personalizes the development of tacit, more than explicit, knowledge and understanding around each individual learner. According to Thomas and Brown (2011):

> The twenty-first century…belongs to the tacit. In the digital world, we learn by doing, watching, and experiencing. Generally, people don't take a class or read books or manuals to learn how to use a Web browser or e-mail program. They just start doing it, learning by absorption and making tacit connections....They experiment with what they already know how to do and modify it to meet new challenges or contexts. In a world where things are constantly changing, focusing exclusively on the explicit dimension is no longer a viable model of education. (p. 76)

In a world of exploding information, who is going to define a standardized body of explicit facts that all students must master? And having done so, how long will it take for much of that body of knowledge to become obsolete? "The growth of information...redefines learning," according to City, Elmore, and Lynch (2012, pp. 155–156). "When the volume of possible information applicable to human problem solving is vast, and the portals available for accessing that information are numerous, learning becomes mastering the ways of imputing *meaning* to information—not recall and application of official knowledge."

In the new paradigm the relationship between content, students, and teachers not only shifts, but also gets altogether inverted. Instead of teachers *pushing* a one-size-fits-all body of content at students, students themselves are *pulling* content—facts, perspectives, methodologies, creative possibilities—from a range of sources and organizing selected information to make meaning and create understanding with the assistance of "teachers," some of whom are peers; others are adult educators; and others may be accessed remotely through videoconferencing or social media or digital communication tools that have yet to be invented.

This inversion is *partially* illustrated by a growing instructional trend known as the "flipped classroom" (Tucker, 2012). In a flipped classroom, students encounter new content by watching a teacher-made or teacher-selected video on the student's own time. The video may explain and illustrate a scientific or mathematical process or provide a brief lecture on a historical event, etc. In the classroom, the following day, students apply what they have learned, and the teacher is available for individual or small-group coaching and assistance.

It's useful to look at the flipped classroom not only in terms of the three elements of the instructional core—student, teacher, and content—but also the additional elements of environment and time that Cohen, Raudenbush, and Ball introduce. The viewing of the video takes place when and where the student chooses. Some or all of it may be viewed repeatedly, if a student is struggling to grasp the content or is simply inspired to do so. The student may choose an environment and time—her bedroom late at night; a local library or coffee shop in the late afternoon—that is most conducive to her learning.

Clearly the roles of student and teacher are significantly altered in this approach, with the student taking charge of learning by viewing the video to absorb the content and then applying it in class, while the teacher has relinquished lecturing and assumes the role of coach.

But what about content? I said that the flipped classroom *partially* illustrates the new paradigm. If the content is common for all students rather than individualized according to student-defined learning goals that correspond with his or her passions, interests, and imaginative or intellectual proclivities, then a vestige of the mechanistic model persists.

Chemistry teachers Jonathan Bergmann and Aaron Sams take the flipped classroom closer still, but not all the way, to the new paradigm through what they term "the flipped-mastery model of education" (December 2013/January 2014). Bergmann and Sams began flipping their chemistry classes along the lines of what I described in the previous paragraphs. When a new student with background in chemistry joined Bergmann's course halfway through the school year, Bergmann found that the student could use the videos to work at her own pace. In one semester, she completed 80 percent of the full-year curriculum. This prompted a consideration of having students work at their own pace, with each student having to master content before moving on. Through experimentation and refinement, the two teachers developed a model that fuses mastery learning and the flipped classroom, to individualize learning in terms of pace, though not in terms of passions, interests, and imaginative or intellectual proclivities.

Safeguarding Equity

At no point in its history has the American system of public education been pervasively equitable. Yes, individual schools have shown that racial and economic achievement gaps can be closed, but the mechanistic educational paradigm has demonstrated an inordinate propensity for inequity.

By focusing on individual needs, assets, abilities, and proclivities, the new, organic paradigm holds promise for eliminating the "links between race, poverty, and educational outcomes," to borrow language from the mission statement of the Panasonic Foundation. At the same time, it will be essential as new systems are defined around the new paradigm of learning to keep an eagle eye on questions of equity: How are we addressing the needs of what Yvette Jackson calls "school-dependent" students—those who "have been dependent on school to provide the enrichment needed to achieve..." (2011, p. 21)? How are we addressing the needs of children whose first language is not English, and children with physical and mental disabilities? What supports and interventions are needed to help struggling students progress with confidence? Strategies for addressing these questions need to be sewn into the fabric of education under the new paradigm.

Glimpses of the Future of Learning

While there is a vast amount to be learned and demonstrated to fully leverage the power of shifting from a mechanistic, standardized paradigm to an organic, personalized one, I believe it's important to consider the glimpses of the future of learning that are already available. What follows are not case studies but glimpses of the new learning paradigm in action.

High Tech High Network, San Diego County, California

This first example is illustrative not only of the organic, personalized paradigm of learning but also of how equity can be prioritized as the paradigm shifts.

The High Tech High (HTH) Network of five high schools, four middle schools, and three elementary schools grew out of the creation of an innovative high school in San Diego, which resulted from an alliance of more than 40 civic and high-tech industry leaders under the leadership of Gary Jacobs, who was then Qualcomm's Director of Education Programming.

The HTH schools are guided by four overarching principles:

- *Personalization:* "Students pursue personal interest through projects and compile and present their best work in personal digital portfolios. Students with special needs receive individual attention in a full inclusion model" (Stephen & Goldberg, 2013, p. 9). Student projects take place throughout the school year, in all content areas.
- *Adult world connection:* A great deal of HTH learning takes place off campus. All high school juniors, for example, complete a 100-hour internship in a local business or agency. Seniors develop substantive projects that grapple with real-world problems in the community. Students in grades 6–10 may "shadow" a professional through his or her workday or undertake community service learning projects (Stephen & Goldberg, 2013).
- *Common intellectual mission:* HTH schools intentionally blur college prep and technical education with the aim of preparing all students for both college and career. "Assessment at HTH is performance-based; all students develop projects, solve problems, present findings to community panels, and complete an academic internship, a substantial senior project, and a personal digital portfolio" (Stephen & Goldberg, 2013, p. 10).
- *Teacher as designer:* "HTH teachers work in interdisciplinary teams to develop the program for 50–70 students per team. The HTH schedule accommodates team teaching, common planning time, project-based learning, and other regular student and teacher interaction with the outside world" (Stephen & Goldberg, 2013, p. 10).

Collectively these schools serve a population of about 4,500 students, who are 43% White, 34% Hispanic, 10% African American, and with an average of 32% of students qualifying for free or reduced-price meals. The schools have no selection criteria for admissions, and they use no tracking of students according to ability level, whether they are "regular" or "special" education students (about 11% of students are designated as "special education"). The schools have a 100% graduation rate, and 98% of those graduates have gone on to college, with 75% attending four-year programs. About 35% are first-generation college students. HTH's African-American students outperform district and statewide peers vis-à-vis test scores and percentage taking chemistry, physics, and advanced math (100%) and college entry (100%). California's Academic Performance Index rankings place HTH schools among the highest achieving public schools in the state (*http://www.hightechhigh.org/about/results.php*).

Quest to Learn, New York City

Quest to Learn (Q2L) is a public school in Manhattan that is structured around gaming. It opened as a middle school in 2009 and is in the process of expanding through 12th grade. The school's Website describes it with these words:

> Quest to Learn supports a uniquely vibrant learning community that brings together students, educators, game designers, curriculum specialists, and parents. This community is committed to student success with a singular focus, but also recognizes that student success ultimately depends on the commitment of each and every community member to his or her own continuous learning and participation. The learning community [that] Quest to Learn supports extends far beyond the walls of the school, deep into the cultural fabric of New York City, and beyond, across the globe. The school supports the kinds of connections required to knit together and leverage all the opportunities for learning that exist in a student's life, online, and in the real world. Quest to Learn is committed to the ongoing development of partnerships with cultural institutions, social development organizations, companies, and others to make learning live in the world and empower students to create their own opportunities (*http://q2l.org/about#sthash.yBWKY6Pf.dpuf*).

What does learning look like at Q2L? "Learning at Q2L takes place within an integrated curriculum that has a foundation in math and science and is designed to align with New York State standards," according to Salen *et al*. (2011, pp. 15–16):

> Discovery Missions—quest-like challenges that require students to plan, collect data, create theories, test their results, and document outcomes—structure student movement within specifically designed learning contexts. Discovery Missions require students to analyze, build, modify, many different kinds of dynamic systems—historical, physical, mathematical, technological, scientific, written, and social. Through Missions, students are supported in both thinking and doing, and they develop an orientation toward innovation and creativity as well as fluency in foundational numeracy, and comprehension literacies (Salen *et al.*, 2011, pp.15–16).

Mission Lab is a curriculum design studio within Q2L. In Mission Lab a teacher will work with a game designer and a curriculum designer. Prior to a Mission Lab design studio, a teacher will have identified an area of content that students tend to struggle with. The design team will then work to develop a game for helping students master this area of learning. When this approach works, according to Q2L teacher Eliza Spang,

> you see kids more excited. They are jumping out of their seats. They're yelling; they're talking about triangles and the pythagorean theorem. You can just see the energy in the classroom. I call it "controlled chaos."...It's this amazing time in the classroom when you know learning is going on and at the same time students are having fun. (From video on Quest to Learn Website: *http://q2l.org/news/check-out-new-video-about-mission-lab*).

Mooresville Graded Schools, North Carolina

Mooresville Graded Schools has undergone what superintendent Mark Edwards calls a "21st Century Digital Conversion," providing all students grades 3 through 12 with a MacBook Air laptop computer. But there's a lot more than technology integration going on in Moorseville classrooms, as the following vignette makes clear.

In an article published in *The School Administrator,* Edwards describes a visit to one of his middle schools. During his visit he encountered three boys who had burst through a door and were running fast. He asked what was going on:

> In excited and urgent tones, they all spoke at once. The sum of their urgent explanation: "We have been monitoring earthquakes on *Seismic.com*, and we think one is about to happen! Can we go in our room and show you?"
>
> We quickly moved into the nearby classroom, where one of the 6th graders opened up his laptop. He went to his bookmarks and clicked on *Seismic.com*, where he found a link to a map of Southeast Asia. One boy began explaining, "Each place that you see a light blinking..." But then all three boys yelled at the same time, "It's happening right now!" They pointed to a light that had just started blinking.
>
> The boys went on to explain that while tracking seismic activity in Southeast Asia in recent days, they had noticed an unusual amount of activity. They had permission from their teacher to depart early from recess—yes, recess—because they were confident based on earlier readings of the data that an earthquake was imminent.
>
> ...The rest of the class came filtering in, prompting the boys to share their exciting news with classmates while pointing to the still blinking light on the laptop.... Once the students returned to their seats, the 6th grade teacher, Maureen Turnell, explained how this was a really cool part of the North Carolina Standard Course of Study for Science before moving into a vibrant discussion about earthquakes, scientific data and what "real time" really means. (Edwards, 2012, pp. 21–22).

Douglas Thomas's Class at USC

Douglas Thomas, co-author of the book *A New Culture of Learning* (2011), taught a course at the University of Southern California called "Massively Multiplayer Online Games and the University of Southern California." The class met once weekly for three hours, and each class was originally divided into three segments: a 90-minute lecture, a 45-minute discussion, and a 30-minute show-and-tell segment, "where the students, who had previously spent time playing in the virtual world of *Star Wars Galaxie*s, would share examples from their gaming experience that would illustrate course concepts" (p. 23).

By the second week, however, students insisted that the discussion segment be cut short so that the examples from their gaming could come into the discussion. "By the third week, students were arriving early to class, waiting to plead their case. 'Professor, I

know we need to do the lecture and discussion, but we were all in the game last night and found the perfect example for class today, so can we please start with it and then do the lecture after?'" (p. 24)

Thomas goes on to observe that by the fifth week of the course, "show-and-tell lasted for two-and-a-half hours and was followed by Doug's brief attempt to make a few points about the week's readings and see if there were any questions." Deep into the course, Thomas found himself writing it off as an interesting but failed experiment.

> And then Doug read the students' final exams. Every single paper was filled with examples from the students' own experience in the game woven together with readings that had never been addressed in class, either through lecture or discussion. And the students weren't just repeating theory or quoting from source material, either—the examples were very rich and highly textured....
>
> Far more important, however, the students referenced each other. For them, classroom time had become the least significant part of the overall experience. They had formed their own learning community and used course readings and material to make sense of what they were doing. (p. 25)

Thomas initially felt his experiment had been a failure because he more or less lost control over it, but the final exams revealed something quite different. Student engagement in learning was so high that students took ownership of their learning, and that level of learning proved to be very high.

Standards Not Standardization

Does moving fully into an organic, personalized learning paradigm require the abandonment of standards? In a word, no. In the new paradigm, standards of learning may play a critical role, but the standards will need to be oriented around tacit, not explicit, knowledge and understanding. Examples can be found in the Common Core State Standards. Anchor Standard for Writing 1, for example, calls for the student to be able to "write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence." The content involved in meeting this standard is left open. The standard allows for students' own passions and proclivities to be pursued in writing arguments that support reasoned, evidence-based claims. One student might be advocating a global ban on whaling, while another is arguing for the development of nuclear sources of energy, and, at the same time, a small group of students is collaborating on developing an idea for balancing intellectual property rights against the natural inclination to share music among friends.

The good news is that the new paradigm, by capitalizing on personalization and increasing student investment in learning, naturally promotes high student engagement. The not-so-good news is that changing the paradigm, and changing systems around the new paradigm, is monstrously challenging work.

It is likely to happen in one of two ways: (1) schools and school systems will recognize that the old paradigm is already obsolete and that adopting the new must be pursued with urgency; or (2) schools and school systems as we know them will be abandoned as families choose alternative opportunities that will sprout like crocuses in early spring. □

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How to Personalize Learning in K–12 Schools: Five Essential Design Features

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Personalized learning (PL) is spotlighted as a way to transform K–12 educational systems. PL customizes learning pace, instructional methods, and learning content to individual students. As much as PL sounds promising and complex, little guidance is available to educators and policymakers about how to effectively design PL. Five essential features are identified through a literature review: (1) personalized learning plan, (2) project- or problem-based learning, (3) competency-based student progress, (4) criterion-referenced assessment for ensuring student learning, and (5) multi-year mentoring of students by a teacher. This article discusses the educational benefits and design principles of each feature.

Introduction

If we can personalize learning for individual students, the individual's highest potential is more likely to be reached, whether rich or poor, whether intellectually advanced or behind, whether interested in math or music, or whether a student's parents are well or poorly educated. The importance of personalized learning (PL) has been widely recognized (Collins & Halverson, 2009; B. McCombs, 2008; Miliband, 2006; OECD, 2006; Reigeluth & Karnopp, 2013; Software & Information Industry Association, 2010; U.S. Department of Education, 2010, n.d.). PL has been adopted as a goal for educational reform in the U.K. (Department for Education and Skills, 2004a), and recently, it has been selected as the top priority for the Obama administration's Race to the Top District competition (U.S. Department of Education, 2012).

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Why has PL received so much attention? In the industrial age, when manual labor was the predominant form of work, we needed an educational system that focused on sorting—separating the laborers from the managers and professional people (Collins & Halverson, 2009; Reigeluth, 1987, 1999; Reigeluth & Karnopp, 2013). Every student was given an equal amount of time to learn, the academic needs of those who failed to master the content were ignored, and all students were forced to move on regardless of their mastery. This educational system was designed to fail some students (Bloom, 1968; Carroll, 1963; Reigeluth, 1987; Reigeluth & Karnopp, 2013). Now that knowledge work has become the predominant form of work, the educational system must be transformed to meet the diverse needs of individual students and their communities (Collins & Halverson, 2009; Friedman, 2006; Reigeluth & Karnopp, 2013; Toffler, 1984). Therefore, we need an educational system that is learning-focused instead of sorting-focused, and learner-centered instead of teacher-centered (Lambert & McCombs, 1998; McCombs, 2007; McCombs & Whisler, 1997).

Despite the increasing interest in PL, it is difficult to operationalize, and little guidance is available to educators and policymakers about how to effectively design PL. This article describes essential features of PL as well as each feature's educational benefits and design principles.

Definition of PL

The 2010 National Education Technology Plan explains different levels of personalization: (1) individualization—adjusting the pace to individual learners so that everyone can reach mastery; (2) differentiation —adjusting instructional methods to individual student characteristics; and (3) personalization—individualization and differentiation, plus tailoring different learning objectives or content to individual student interests (U.S. Department of Education, 2010). ***Table 1*** summarizes definitions of the three levels of personalization.

Five Essential Features

Based on the definition and an extensive literature review, the following five essential features are herein identified as a design framework for PL:

(1) Personalized learning plan (PLP);
(2) Project- or problem-based learning (PBL);
(3) Competency-based student progress (CBSP) rather than conventional time-based progress;
(4) Criterion-referenced assessment (CRA) for ensuring student learning; and
(5) Multi-year mentoring (MYM) of students by a teacher.

In this framework, each student has a mentor for several years, who prepares the student's PLP together with other stakeholders, such as parents, community members, and external mentor. The PLP includes selecting a project to work on, depending on the student's needs

Table 1. Definitions of individualization, differentiation, and personalization.

	Customization		
	Learning pace	Instructional methods	Learning content
Individualization	✓		
Differentiation		✓	
Personalization	✓	✓	✓

and interests, and the student learns the related academic content, while performing the project (PBL). As soon as the student demonstrates mastery through ongoing assessment, the student moves onto the next topic. I will discuss each feature in detail.

1. Personalized Learning Plan (PLP)

A PLP refers to a customized instructional plan that takes into account individual differences or needs, such as career goals, characteristics, interests, and academic mastery. This includes the notions of individualization, differentiation, and personalization. Preparing and implementing PLPs allows for adjusting the pace to individual learners, customizing instructional methods to individual learner characteristics, and having different learning goals tailored to individual learners' interests.

Having PLPs requires assessment of students' various needs and makes learning more effective and motivational, as it is customized to individual needs and requires learners to be actively involved in their own learning process. In the process of preparing a PLP, learners can (a) actively shape their own learning processes and develop metacognitive skills as they reflect on their interests, career goals, characteristics, and mastery levels; (b) set goals; and (c) monitor their progress (American Psychological Association Presidential Task Force on Psychology in Education, 1993; Bransford, Brown, & Cocking, 2000; Software & Information Industry Association, 2010). The PLPs allow learning to be personally relevant, interesting, appropriate to the learners' capabilities, and respectful of individual differences, which make learning effective and motivational (American Psychological Association Presidential Task Force on Psychology in Education, 1993; Bransford *et al.*, 2000).

There are some recent efforts to prepare and implement personalized learning plans in K–12. The most widely known project is the New York City (NYC) Department of Education's Innovation Zone (iZone). Encouraged by the positive results from some pilot programs for personalized learning, the Department of Education decided to expand their personalized learning approach to hundreds of schools within three years (Lake & Gross, 2011). One of the five core principles of iZone is creating personalized learning plans. These learning plans help accommodate diverse needs of individual students and customize learning pace, instructional methods, and curriculum (Lake & Gross, 2011). Unfortunately, no empirical studies or reports are currently available that examine the effects of different aspects of iZone's personalized learning plans, although several research studies are being conducted (NYC Department of Education, 2013).

Design Principles

Reigeluth *et al.* (2008) provide specific guidelines for preparing a personalized learning plan. First, relevant student data should be collected, such as career goals, interests, characteristics, and mastery levels. Based on the data, the teacher, students, parents, and other advisory members should select long-term goals, short-term goals for topics or academic standards, projects as vehicles to learn those topics or standards, teams to be involved in each project, and each student's roles and responsibilities in each project. After that, a contract should be developed that specifies all of the above in detail. The contract is developed to be explicit about one's learning goals and process, to make the goals more measurable and attainable, and to be able to track one's progress. By no means is the contract set in stone. Flexibility is important. The contract can be renewed or revised based on the student's goals and progress.

2. Project- or Problem-Based Learning (PBL)

PBL refers to any learner-centered instructional method that engages learners in an authentic, complex, ill-structured, and open-ended learning challenge, including problem-based learning (Barrows & Tamblyn, 1980; Hmelo-Silver, 2004; Savery, 2006), project-based learning (Bell, 2010; Blumenfeld *et al.*, 1991), and similar methods, such as inquiry-based learning (Edelson, 1999), discovery learning (Bruner, 1961), and case-based learning (Kolodner, 1993).

Educational leaders and the U.S. Department of Education have recommended PBL as an effective way to customize instruction to individual learners (Software & Information Industry Association, 2010; U.S. Department of Education, 2010). PBL is appropriate for PL, because it allows learners to select learning content that they are interested in, to choose preferred methods to learn, and to advance at paces that they are comfortable with, covering all three levels of personalization.

PBL presents several educational benefits. PBL can be effective and motivating because it engages learners in a way that is personally relevant, interesting, appropriate to the competency level, and comparable to real-world situations, as in the APA principles (American Psychological Association Presidential Task Force on Psychology in Education, 1993) with appropriate guidance (Cindy, Duncan, & Clark, 2007; Kirschner, Sweller, & Clark, 2006;

Reigeluth, 2012).

Empirical research on PBL suggests that PBL is effective for certain types of learning or assessment levels, including long-term retention, principle understanding, and applying concepts and principles. However, traditional methods are known to be more effective for short-term retention and conceptual learning (Gijbels, Dochy, Van den Bossche, & Segers, 2005; Strobel & Van Barneveld, 2009; Walker & Leary, 2009). This imbalance in learning effectiveness can be addressed through customized instructional support overlaid onto PBL (Reigeluth, 2012). Actually, instructional support is crucial in making PBL effective (Hmelo-Silver, Duncan, & Clark, 2007; Kirschner *et al.*, 2006; Simons & Klein, 2007). Kirschner *et al.* (2006) argue that providing minimal guidance in some learner-centered instructional approaches ignores how human cognitive architecture works, and therefore makes the approaches ineffective and inefficient.

In addition, the learning process of PBL helps the learners to develop critical-thinking, problem-solving, and creative-thinking skills while solving complex problems or creating artifacts and to hone collaboration and communication skills while collaboratively performing projects (Bell, 2010; Duch, Groh, & Allen, 2001; Hmelo-Silver, 2004; Jonassen, 2000, 2004; Savery, 2006; Şendağ & Ferhan Odabaşi, 2009). Also, learners can develop meta-cognitive skills while planning their own learning process, monitoring progress, and reflecting on what they have learned and their learning strategies (Gijbels *et al.*, 2005; Hmelo-Silver, 2004; Savery & Duffy, 1996). As they take ownership, an active role, and responsibility in their learning process, they become more motivated and self-directed (Barrows, 1986; Blumenfeld *et al.*, 1991; Gijbels *et al.*, 2005; Hmelo-Silver, 2004; Savery & Duffy, 1996; Torp & Sage, 2002).

Design Principles

Many variations of PBL exist and have been researched (Hung, 2011), but educational researchers share a common understanding of how PBL should be designed and implemented to realize the multiple learning outcomes that have been claimed. The problem or inquiry should be complex, ill-structured, open-ended, cross-disciplinary, appropriate to the learners' abilities, personally-relevant and interesting, valued in the real world, and grounded in the content domain to be learned (Barrows, 1986; Blumenfeld *et al.*, 1991; Hmelo-Silver, 2004; Jonassen, 2000; Savery, 2006).

The PBL process should be collaborative (Hmelo-Silver, 2004; Nelson, 1999; Savery, 2006), provide appropriate instructional and non-instructional guidance (Hmelo-Silver *et al.*, 2007; Kirschner *et al.*, 2006; Reigeluth, 2012; Simons & Klein, 2007), and provide an opportunity for self and peer assessment and reflection (Barrows, 1986; Hmelo-Silver, 2004; Savery, 2006). Also, student progress must to be measured (Blumenfeld *et al.*, 1991; Savery, 2006) and be effectively facilitated (Bell, 2010; Blumenfeld *et al.*, 1991; Hmelo-Silver, 2004).

3. Competency-Based Student Progress (CBSP)

CBSP refers to individual student progress based on one's academic mastery, in contrast to the current practice of time-based student progress (Software & Information Industry Association, 2010; U.S. Department of Education, n.d.). It is often referred to as mastery-based or attainment-based student progress, and CBSP includes the notion of individualization. That is, learning pace is adjusted to individual learners, so that everyone can reach mastery on the current topic and move onto the next topic as soon as mastery is reached.

The time-based student progress school model forces students to move on to the next topic regardless of their mastery of the current topic (Reigeluth, 1999; Reigeluth & Karnopp, 2013; Reigeluth *et al.*, 2008; Software & Information Industry Association, 2010), which ignores one of the important principles of learning—that new knowledge is effectively constructed when it is built upon pre-existing knowledge, and that forcing students to move on without reaching mastery inhibits deep understanding of the subject matter (American Psychological Association Presidential Task Force on Psychology in Education, 1993; Bransford *et al.*, 2000).

Time-based student progress has long been criticized (Bloom, 1968, 1984; Carroll, 1963). Carroll (1963) argued that having all students spend the same amount of time would result in a high correlation between students' aptitude and achievement, accordingly failing students with low aptitude levels. Based on this rationale, Bloom (1968) added that the traditional school system, in which every student spends the same amount of time on learning subjects, was designed to fail students with low aptitude.

Bloom (1984) reported striking findings. When students were given sufficient time and opportunities to master the current topic: (1) the aptitude-achievement correlations decreased from .60 to .25; (2) students' time on task increased from 65% to 90% of in-school time; (3) attitudes and interest of the students in the mastery group were significantly higher than in the group using the conventional, time-based method; and (4), more importantly, the achievement level of the average student in the mastery group was two sigmas higher than the average student in the conventional group. Other studies to date have reported consistent positive outcomes for competency-based student progress (Anderson *et al.*, 1992; Kulik, Kulik, & Bangert-Drowns, 1990; Light, Reitze, & Cerrone, 2009; Research & Policy Support Group, 2010).

Design Principles

Bloom provided some guidelines for CBSP: constant formative tests with a feedback-corrective process, followed by group-based learning for students to help each other on the items that they missed (Bloom, 1984, 1987). Keller (1968) also provided guidelines for his personalized

system of instruction: (1) students move through the course at their own pace; (2) students are required to master the current topic to move on to the next one; (3) lectures and demonstrations are used for motivation rather than for delivery of content; (4) written study guides are used to direct student learning; and (5) proctors are used for repeated testing, scoring, and tutoring.

Those guidelines can be summarized by three principles. First, ongoing formative assessments should take place to identify difficulties in the attainment of learning objectives. Second, there should be corrective procedures immediately followed by assessments via tutoring, group-based learning, etc. Third, students must demonstrate mastery to move on to the next topic.

4. Criterion-Referenced Assessment (CRA)

CRA is often compared to norm-referenced assessment (NRA). CRA evaluates whether students have mastered a certain skill or competency, whereas NRA evaluates how well students have performed compared to a group of similar students (Thorndike & Thorndike-Christ, 2010). CRA represents a more narrowly and precisely defined domain and covers its content more thoroughly than NRA (Thorndike & Thorndike-Christ, 2010). CRA serves PL better and more appropriately than NRA for the purposes of ongoing assessment and summative assessment.

The importance of ongoing formative assessment has been emphasized as a way to understand each student's learning needs, track student progress towards learning goals, and select appropriate instructional materials based on each student's needs (American Psychological Association Presidential Task Force on Psychology in Education, 1993; Miliband, 2006; Sturgis & Patrick, 2010). Also, Bloom's (1984) two-sigma finding has demonstrated the significant impact of formative assessment combined with corrective procedures on learning. Ongoing assessment has been evident in PL practice in the UK and US (Sebba & Britain, 2007; Underwood *et al.*, 2007; WestEd, 2006).

CRA serves these purposes of assessment better and more appropriately than NRA, because (a) it helps thoroughly evaluate whether students have reached a high enough level of mastery on the current topic to move on (Sturgis & Patrick, 2010); (b) it identifies specific learning needs; and (c) it allows tracking of individual progress towards learning goals (American Psychological Association Presidential Task Force on Psychology in Education, 1993; Bransford *et al.*, 2000; Miliband, 2006; Sebba & Britain, 2007; WestEd, 2006).

Design Principles

The domain to be tested should be narrowly and precisely defined, and there should be enough items to thoroughly cover the content (Thorndike & Thorndike-Christ, 2010). Deciding on an appropriate mastery level is critical. The mastery level selected should be high enough for the tested knowledge to be used by the student to build related new knowledge. In light of this, Sturgis and Patrick (2010) claim that "teachers must share a clear understanding of what students need to demonstrate before they advance to higher levels" (p. 10).

5. Multi-Year Mentoring (MYM)

MYM refers to each teacher mentoring each of their students for multiple years. Similar terms include looping that involves multi-year assignments of students to a teacher (Burke, 1997) and multi-year teaching assignment (Hanson, 1995). Often, this involves multi-age grouping or multi-age classrooms. MYM has been widely adopted in some European countries, such as Italy (Palestis, 1994) and Germany (Zahorik & Dichanz, 1994).

There are five major benefits of MYM: (1) the teacher knows the students well enough to take their individual development levels and needs into account when planning personalized instruction; (2) the teacher can be more attentive to the students' cultural backgrounds, beliefs, and affect (Burke, 1997); (3) the teacher and students can build a closer and more caring relationship (George, Spreul, & Moorefield, 1987); (4) the teacher and parents can build a stronger relationship, so they can better coordinate their efforts for the student's learning in and out of school (George *et al.*, 1987; Reigeluth, 1987) and encourage the parents to be more involved in their children's education (Hampton, Mumford, & Bond, 1998); and (5) the teacher does not have to spend much time to get to know the students and to establish classroom rules or expectations at the beginning of each academic year, which adds extra time for teaching/learning (Burke, 1996; Hanson, 1995; Mazzuchi & Brooks, 1992).

In addition, MYM is more compatible with other essential features of PL, such as PLP and CBSP, than the traditional classroom organization. The teachers can create a more personalized and appropriate learning plan by suggesting learning topics that are more closely aligned with student interests and selecting more effective learning strategies for individual students, because the teachers know more about their students in various aspects. Also, CBSP can be implemented more naturally and easily, because the teachers do not have to make a summative decision about students' failure every year.

Design Principles

Multi-year mentoring should be implemented in a similar way as in a doctoral program. Students should be able to select their own mentor based on their interests, backgrounds, and personal needs. Also, they should feel free to change their mentors when needed.

Role of Technology in PL

The complex and flexible nature of the five features warrants a great emphasis on the role of technology in PL. As much as PL sounds promising, implementing PL can be extremely complicated, costly, and even impossible with-

out the help of powerful and advanced technology, as technology plays a pivotal role as assessing, recording, and analyzing student performance, providing a greater range of learning resources and opportunities, and managing individual learning activities (Department for Education and Skills, 2004b; Sebba & Britain, 2007). Therefore, careful consideration and proper investment should be allocated to a technological system that can effectively and successfully implement PL when creating a PL environment, as described in the next article in this issue. □

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The Learner-Centered Paradigm of Education: Roles for Technology

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The learner-centered paradigm of education requires very different roles for technology, as well as for teachers and students, compared with the teacher-centered paradigm. Rather than almost exclusively serving the teacher for teaching, technology primarily serves the student for learning. It does so through four major roles: (1) keeping records of what each student has mastered, what is within reach to work on next, and what characteristics each student has that should influence instruction; (2) helping to create each student's personal learning plan; (3) providing an immersive, authentic project environment with just-in-time instructional support; and (4) formatively and summatively assessing mastery of each student's learning goals. Secondary roles and system architecture are also described.

Introduction

Much has been written about new technologies and their potential to improve education, from the computer to the Internet, from tablets to mobile computing, from virtual worlds to intelligent tutoring systems. Yet most of the literature describes these technologies as add-ons to the current paradigm—the teacher-centered factory model of schools—under the rubric of "technology integration." This greatly limits the power of technology to improve student learning. To reach its potential to improve student learning, we must think in terms of "technology transformation"—how it can be used to transform education (Reigeluth & Joseph, 2002).

In the teacher-centered paradigm of education, technology's primary role is to serve the teacher. This is done mainly through tools such as PowerPoints and electronic grade books. As such, technology always plays a peripheral role and is more likely to increase the cost of education than to decrease it. In contrast, in the learner-centered paradigm, technology's primary role is to serve the student. As such, it has the opportunity to play a much more central role, as it does in most workplaces and home offices, and to actually decrease the cost of education, as it has improved productivity in most workplaces.

Key to this changed dynamic for technology is its importance as an *enabler* of the learner-centered paradigm of education. This paradigm has several essential characteristics:

- Student progress is based on learning, not time.
- This requires knowing when each learner has learned (personalized assessment).
- It requires keeping a record of what each learner has learned (personalized recordkeeping).
- It requires a personal learning plan for what each learner will work on next (personalized planning).
- It requires teaching different things to different students at any given time (personalized instruction).

In essence, attainment-based* student progress requires a level of personalization or customization that is difficult, if not impossible, for a teacher to manage well. But technology can help tremendously with all four of these tasks: planning, instruction, assessment, and recordkeeping. In fact, without technology, there is good reason to believe that the learner-centered paradigm cannot reach its potential for helping all students to reach their potential.

When we view technology from the perspective of transformation rather than integration, we open our minds to both needs and possibilities that were unseen before. This article explores both the needs and the possibilities, and it presents a vision of the ways technology is likely to be used, and is already being used, in the new paradigm. It describes four primary roles and six secondary roles for technology based on the seminal article by Reigeluth *et al.* (2008). Note that the present tense is used to describe these roles, but I am not aware of any technology system that currently serves all these roles.

Four Primary Roles

1. Recordkeeping for Student Learning

When student progress is based on learning rather than time, keeping track of what every student has learned is a nightmare for teachers. Technology is ideally suited to save teachers huge amounts of time on keeping

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* I use the term attainments rather than competencies because there are important kinds of learning in addition to competencies, especially in the affective domain, such as attitudes, values, morals, and ethics. Attainments include all kinds of learning and human development.

records of student attainments. The recordkeeping function of technology in the learner-centered paradigm replaces the report card or transcript of the teacher-centered paradigm and has three parts: standards, personal attainments, and personal characteristics.

The ***Record of Standards*** includes both required educational standards (national, state, and local) and optional educational standards, broken down to individual attainments, which I call "mini-standards," and arranged in learning pathways when mini-standards build on each other, as is done in the Khan Academy (*www.khanacademy.org/about*). The mini-standards are easily accessed by teachers, students, and parents. The recordkeeping tool presents a list or map of mini-standards that the student should or can master, along with levels and criteria at which they can be learned.

The **Record of Personal Attainments** documents what each student has learned. This tool maps each student's progress on the mini-standards listed in the Record of Standards. It shows when a student met each mini-standard, which mini-standards were required versus optional, and what the next required mini-standards are in each area. This record also provides links to evidence of mastery in the form of summary data, original products (an electronic portfolio), and/or comments from the student, teacher, or outside experts.

The **Record of Personal Characteristics** keeps track of each student's characteristics that influence learning, such as learning style, profile of multiple intelligences, student interests, and major life events. This information is used by the system to customize instruction for each student.

2. Planning for Student Learning

In the learner-centered paradigm, developing a personal learning plan, or contract, for all of their students is difficult for teachers. Fortunately, technology is ideally suited to fulfill this role. The planning tool helps each student, parent, and teacher perform these tasks:

a. **Set long-term goals.** Getting students to think about what career they want to pursue allows instruction to address those interests and enhances intrinsic motivation. The tool helps assess student aptitudes for different careers and explore what different careers are like. This tool is used periodically, because student interests typically change quite often.

b. **Set short-term goals.** Decisions need to be made about what to learn next. The planning tool identifies the full range of attainments that are presently within reach for the student, based on the Record of Personal Attainments. It also identifies required standards that should be addressed at this point in the student's development, and it identifies attainments that are instrumental to the student's current long-term goals. The tool helps the student, teacher, and parents select which attainments to pursue in the next contract period, based on requirements, long-term goals, student interests, and opportunities.

c. **Select projects and roles.** In the learner-centered paradigm, projects are the primary vehicles for students to meet their short-term goals. Therefore, the planning tool searches a project bank and presents a list of projects in rank order based on how many short-term goals (mini-standards) each project addresses and how well aligned each project is with the student's interests. The student, teacher, and parents can then choose from the list or design new projects as means for attaining the short-term goals. If the project requires different students to play different roles, then the tool identifies the role that aligns best with the student's short-term goals. After one project is selected or designed, the list is automatically reordered based on the remaining short-term goals. The tool also helps the student, teacher, and parents decide on the number of projects to undertake during the contract period (which typically ranges from four to 12 weeks, depending on the developmental level of the students and the preferences of the school), using the system's data on the average number of hours per week each project has taken, adjusted by the student's history of time required on projects.

d. **Assemble teams.** Given the importance of collaboration and teaming skills in the Information-Age workplace, family, and other walks of life, most projects are team-based. However, students may occasionally choose to do solo projects, especially if they already have well-developed collaboration skills. When team-based is selected, the planning tool identifies other students who are interested in doing the same project. It also allows the student, teacher, and parents to input criteria for selecting teammates, such as current friends vs. unknown students and degree of diversity on such characteristics as gender, race, ethnicity, age, ability, socio-economic status, and personality. Student, teacher, and parents then adjust the resulting rank-ordering of teammates, and the system makes a best-fit selection from all the students' rank-orderings.

e. **Assign roles.** Next, the planning tool helps the student, teacher, and parents come to consensus about how the teacher, parents, and possibly other individuals might support the student in learning from the project.

f. **Develop contracts.** Finally, the planning tool helps the student, parents, and teacher prepare a contract, or set of project plans, that specifies the short-term goals, teammates and their roles, other

support roles, activities, and a timeline for each project they will undertake in the next contract period.

Students in the learner-centered paradigm must learn to manage their time and meet deadlines, just like people do in the post-school working world. But time available for various projects is flexible based on the number of projects each student takes on, and a student's workload during a given period is thereby tailored to his or her abilities.

3. Instruction for Student Learning

Trying to teach 25 students who are all learning different things at any point in time would be very difficult if teachers had to use teacher-centered instruction. But in learner-centered instruction, student teams work largely independently, with coaching. Furthermore, technology can save much teacher time by introducing projects to students, providing immersive interactive environments for conducting the projects (similar to many computer games), providing just-in-time instructional support (e.g., tutorials) during projects, helping students manage their projects, helping teachers monitor student progress, and even helping teachers and/or students develop new projects and instructional support—all in a learning environment that fosters development of relationships among students and with teachers.

Projects. Technology (computers and mobile devices) can provide a powerful, interactive, project environment, often through simulations, virtual worlds, and engaging, interactive video. The project environment can offer natural consequences for actions taken, much like in computer games, and can allow for unlocking of higher levels as students master tasks on a given level. Being able to select projects relevant to their interests and performing many projects through immersive, engaging, interactive, game-like learning environments do much to enhance students' intrinsic motivation.

Instructional support. Technology provides powerful instructional tools—simulations, tutorials, drill and practice, research tools, and communication tools—to support learning "just in time" during a project and allow each student to spend as much time as needed in learning-by-doing (practicing) to attain each mini-standard (much like the education program at the Khan Academy). Different kinds of instructional support are provided for development of different kinds of attainments (such as higher-order thinking skills, deep understandings, memorization, emotional development) and different kinds of learners (based on their learning styles) (Reigeluth, 2012). While project work makes learning more fun, the instructional support makes the learning experience more effective and efficient and often reduces frustration. According to Reigeluth and Karnopp (2013):

Digital tools offer many benefits, including these:

- They're more dynamic in sight and sound than static resources and thus accommodate a greater variety of learning modalities.
- They offer powerful interaction for active student learning and immediate feedback.
- Internet access connects students and teachers across geographic and cultural boundaries for a greatly enriched learning environment and eliminates the need to physically be in the same place at the same time.
- Staff development is available on demand—even in rural areas where teachers currently receive little support.
- These tools help [teachers] monitor and support student progress on projects, and they help students monitor and reflect on their own progress and manage their time. (p. 40)

Yet high-tech resources are not the only technologies used in the learner-centered paradigm. Low-tech, hands-on resources, like number rods and sandpaper letters (used in Montessori schools), are also useful, especially for younger students, and are selected through the planning tool. Learning resources are frequently designed for several students to use together, to promote learning with and from each other and to build strong relationships among students. Teachers help students, through coaching and tutoring, as they use the resources, and they provide direct instructional support as necessary, complementing the high-tech and hands-on resources.

4. Assessment for (and of) Student Learning

Conducting formative and summative assessments of students on every mini-standard could be a nightmare for teachers in a world where students are demonstrating each attainment at different times and in different ways. Technology helps with these tasks. The assessment tool is fully integrated with the instructional tool. In the instructional support—whether in a tutorial, simulation, or drill and practice—the assessment tool provides formative feedback to the student on every performance, as is done in the Khan Academy.

Also, when the criteria for successful performance have been met on, say, the last 10 unaided performances, the summative assessment is complete, and the corresponding attainment is automatically checked off in the student's Record of Personal Attainments. There is no separate test; the practice is the test, which saves a lot of time that would otherwise be wasted on testing. This is full integration of testing with instruction.

When interactive technology cannot assess a student's performance, an expert observer (perhaps using a handheld device with a rubric for assessment) evaluates the performance and provides feedback. The information from the handheld device is automatically uploaded into the computer system, where it is placed in the student's Record of Personal Attainments.

Beyond student assessment, the computer system automatically analyzes the quality (effectiveness, efficiency, and appeal) of the projects, instructional tools, teachers, and schools; and the information is used for both formative and summative purposes. Finally, technology provides tools to help teachers develop assessments and link them to the appropriate mini-standards in the Record of Standards. These computer-generated assessment tools significantly reduce the amount of student and teacher time that's currently devoted to carrying out assessment activities in the teacher-centered paradigm.

Secondary Roles for Technology

In addition to the primary roles for student learning described above, technology serves these and other secondary roles:

- Communications, including e-mail, blogs, Websites, discussion boards, wikis, whiteboards, instant messaging, podcasts, and videocasts
- Calendar and personal planner to help with planning one's time, scheduling meetings, and tracking deadlines
- Help system and tutorials to help users learn all the system's capabilities
- Administrative access to information and authority to input information based on role and information type
- Documenting general student data, such as address, parent/guardian information, teacher and cluster identification, student attendance, and medical information
- Central resource on educator data, including office address, certifications and awards, professional development plan and records as well as a list of students (and their evaluations and earned awards) and repository of teaching tools they developed

Integration of Tools

The four major and six secondary roles or functions of technology are seamlessly integrated in a single system, which my research team at Indiana University refers to as a Personalized Integrated Educational System (PIES), though such a system has yet to be developed as far as we know. The record-keeping tool informs the planning tool, which identifies instructional tools available to carry out the plans. Assessment processes are integrated into the instructional tools and feed data to the record-keeping tool. The student, parent, and teacher all have easy access to progress reports on each of the student's projects and on the set of standards and individual attainments (mini-standards) currently being pursued in the student's contract.

Architecture of Tools

PIES will hopefully be Web-based, open-source software, similar to Moodle, making it more affordable. Ideally, it will be possible for districts, schools, and individuals to customize and modify the program for their own needs, and it will be modular so that anyone can create Web apps (similar to iPhone apps for free and fee), including teachers and even students, to support specific needs. Those apps will all be interoperable, so they can share information with each other. Users can customize the look and function of their personal pages (portals into the system), controlling the flow of information into their pages with RSS feeds and e-mail, and easily incorporating such features as blogs, discussion boards, and chats.

Conclusion

It should be clear that technology plays a vital role in the success of the learner-centered paradigm of education. It enables a quantum improvement in student learning and likely at a lower cost per student per year than the teacher-centered paradigm. Without a technology tool like PIES, it will be difficult for teachers and their schools to achieve the kind of improvement in student learning that we so desperately need.

For a system like PIES to be developed, two things are particularly important. First, it is essential to think in terms of the functions required by the learner-centered paradigm of education. Tools developed with the teacher-centered paradigm in mind are unlikely to be helpful. Second, an initial investment is needed to create an open-source, interoperable system into which apps (for fee or free) can be plugged to create an inexpensive, constantly evolving set of tools for students, teachers, and parents in the learner-centered paradigm. Since private companies are unlikely to invest in a free, open-source product, private foundations or government agencies will need to make this initial investment.

The learner-centered paradigm can only reach its potential with a powerful technology system like PIES. Similarly, technology can only reach its potential in the learner-centered paradigm of education. And both can only succeed if educators self-organize into networks that actively promote the development of both. □

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Transformational Dialogue for Public Education: Moving from Tweaking to Transforming at the State Level

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The importance of public education has never been greater as we enter the dawn of a new millennium. Innumerable efforts have been focused on improving public education, but the unfortunate result has been an array of fractured, piecemeal efforts. What is needed is a systemic approach to go from *tweaking* to *transforming* through a process known as Transformational Dialogue for Public Education (TDPE). This approach is based on four core tenets: (1) going to the root of the root; (2) re-conceive and optimize at the state level; (3) no organizational transformation without personal transformation; and (4) enduring revolution through persistent evolution. Using these four tenets as the foundation, the TDPE approach is designed to provide coherence to the current piecemeal efforts and help produce results that are far-reaching and sustainable.

Introduction

Public education forms the foundation of our democratic society, and the importance of that role has never been greater as we enter the dawn of a new millennium. We are facing global challenges today that are unprecedented in our history, and, as Einstein advised, "We can't solve problems by using the same kind of thinking we used when we created them." We must look to the next generation for the new thinking we need to create a sustainable future. Public education is thus a vital institution for helping us address the challenges of the new millennium: we must reexamine the way we are educating the next generation in whom we place such hope.

Many people and institutions are focused on improving public education through innumerable efforts that call for a multitude of changes, such as more financial investments, longer school hours, allowing parents to choose schools, letting market forces (as with voucher systems) determine quality, or "going back to the basics." Most such attempts to "fix" the educational system focus on narrow aspects of the larger system and attempt to improve them, believing that the goal is to fix the broken pieces.

The unfortunate result of such tactical approaches to change is an array of fractured, piecemeal efforts that show promise only in an isolated and unsustainable manner, as evidenced by the unsatisfactory evaluation reports of multi-million-dollar education reform programs. However, many of us in the field of systems thinking believe that *our current education system does not need "fixing" because it is not broken; it is performing exactly as it has been designed to perform. If we want fundamentally different and better results, we must go beyond "re-form" efforts and go back to the root of the root to "re-conceive" a whole new system.*

This article lays out a systemic approach to go from *tweaking to transforming* our public education system through a process we refer to as the Transformational Dialogue for Public Education (TDPE). This approach is targeted at the state level because that is how our educational system is currently structured (and unlikely to shift to a national system, given our political divide). The TDPE approach is based on the following core tenets:

1. **Going to the Root of the Root.** This approach is about challenging our prevailing assumptions concerning the relevancy and adequacy of the whole system as it currently stands.
2. **The Need to Re-conceive and Optimize at the State Level.** If we are to truly transform public education, all the stakeholders at the state level must pledge that their individual purposes are subordinate to the larger purpose of the public education system to whose optimization they are all committed.
3. **No Organizational Transformation without Personal Transformation.** Dr. Edwards Deming stated that no organizational transformation happens without personal transformation. By extension, there can be no system transformation without personal transformation.
4. **Enduring Revolution through Persistent Evolution.** This tenet is consistent with one of the laws of systems thinking that states that "slower is faster." Most change efforts that try to create a "revolution" fail because they attempt to impose an artificial set of systems in an arbitrarily short period of time.

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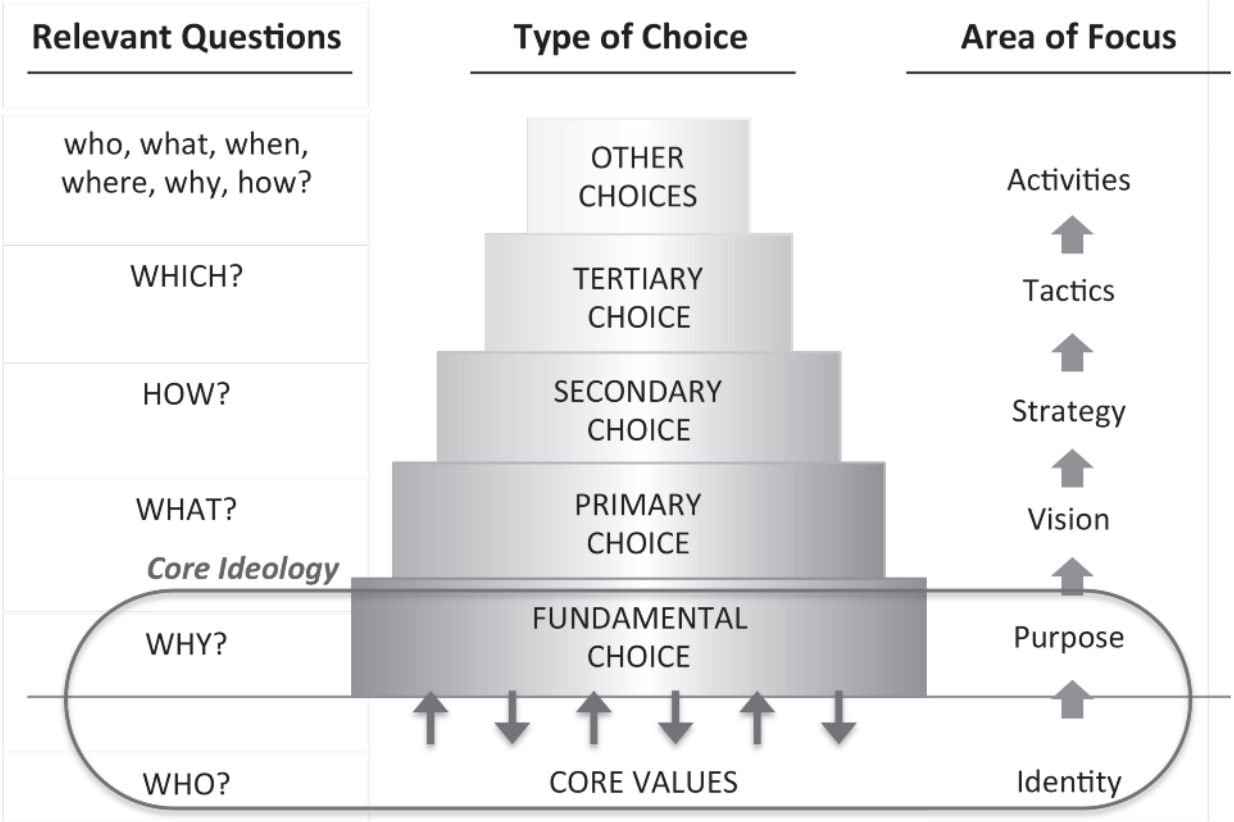

Figure 1. Hierarchy of choices.

Using these four tenets as the foundation, the TDPE approach described in this article is designed to provide coherence to the current piecemeal efforts and to help produce results that are far-reaching and sustainable due to their common roots in shared purpose and shared values.

A Systemic Approach

1. Going to the Root of the Root

The approach being proposed here requires us to go back to the *basics* of what public education is all about. What is needed is a clear and coherent *core purpose* and a set of *core values*—a shared core ideology— to which all the stakeholders in the education system are aligned and which would form the foundation on which to re-conceive and rebuild our public education system for the future. To do that we must go back to the root of the root and ask fundamental questions like "What is the purpose of public education in our democratic society in the 21st century?"

The Hierarchy of Choices framework (see ***Figure 1***) helps us establish a commonly understood hierarchy of priorities in making choices, thereby enabling a group to have a consensus on an essential piece of logic: *purpose precedes core values and vision; vision precedes strategy.* Purpose must come first, and then all other organizational decisions grow out of a commitment to that purpose. Without this kind of understanding, what happens all too often is that education reform efforts tend to gravitate towards the level of Strategy. And when there are disagreements at the Strategy level, people tend to move *up* the hierarchy (because it's generally easier) and try to get some kind of agreement at the level of Tactics or Activities (because the stakes are lower).

Creating the DNA of Public Education: Purpose and Core Values.

Going to the root of the root means to start at the bottom of the Hierarchy of Choices and then to move up the levels in such a manner that each subsequent choice is guided by the level below it. To go beyond traditional "reform" efforts that are relatively superficial and piecemeal means addressing the issue of Purpose (core reason for being) and Core Values (a clear and deep sense of identity as an institution) by working to answer questions like "What is the primary purpose of public education?" and "What values must we live by in order to pursue our purpose most effectively?" We need to tease apart all the varieties of purposes that have been layered onto this thing called public education and ask ourselves the deeper questions about what we as a democratic society really need our public school systems to be in the 21st century.

When we have a firm foundation of Purpose and Core

Values that is agreed upon by all the critical stakeholders of the educational system, it is analogous to having established the DNA equivalent for our public education as a *living* system. It provides the genetic blueprint for creating an endless variety of manifestations of what great public schools can look like, each of them unique, yet each one recognizable as being part of the same great public education system. We can then move to the level of Vision and make primary choices by asking questions such as "If we were truly committed to pursuing our Purpose, what kind of a system would more accurately reflect all that we have learned about learning? What would it look like to have all that learning embodied in the curriculum, the structures, the policies, and the teachers?" We can then move on to Strategy, Tactics, and Activities.

2. The Need to Re-conceive and Optimize at the State Level

Because the causes of our current national educational "crisis" are so complex and deeply embedded, only changes at the most fundamental levels of the system will have lasting results. So, where do we start? How do we even begin to tackle the whole system of public education when it is so enormous in size and complexity? What is needed is a more holistic, systemic approach in which we recognize some important systems principles about the proper level at which to optimize performance.

Systemic We Succeed—Fragmented We Fail

When we engaged with education leaders in many states, virtually everyone agreed with the diagnosis that their states were not failing due to a lack of attention and effort, but due to fragmentation. While every stakeholder cared about the education of their state's children, each was operating in ways that were designed to "optimize" their piece of the system rather than the whole system.

In the early history of the United States, during the War of Independence, Americans understood the deeper truth of our situation from an intuitively systemic perspective when they rallied around the call "united we stand, divided we fall." They may have been acknowledging the truth of these two systems axioms:

- ***Systems Axiom 1***
  Everything is connected to everything else.
- ***Systems Axiom 2***
  If you optimize the parts of a system, you are guaranteed to sub-optimize the larger system. If we optimize the larger system, we are guaranteed to sub-optimize (or re-optimize) some of the parts some of the time.

If we rephrase for our education context, it would say that "*fragmented we fail, systemic we succeed.*" That is why lengthening school days won't help, if students are not learning during the time they already spend in school. Testing teachers won't improve their skills, if they are not well trained, just as tightening standards will not make any difference if the standards are irrelevant to today's needs. Engaging in high-stakes testing will only lead to a focus on teaching to the test, with everything else going by the wayside. Pouring more resources into the system will not necessarily improve the quality of teaching or the level of student learning, if the additional resources amplify the bad with the good. Each effort tends to focus on a narrow part of the system in pursuit of that ever-elusive *silver bullet* solution that will somehow fix everything.

Perhaps the biggest silver bullet myth of them all is the belief that more money will cure all ills. Yet, how many billions of dollars have we poured into the existing system since the *Nation at Risk* report came out in 1986, with little to show for it? This is not to say that money is not important. It's just that the infusion of money is rarely enough, on its own, to make any substantive and lasting change. A case in point is the self-assessment by a major national foundation that concluded that their biggest funding failure in their organization's history was the hundreds of millions they poured into education initiatives that produced no real lasting impact.*

Optimizing at the State Level

So, what will it look like to take a systemic approach that works in harmony with the two systems axioms? It will require all the key stakeholders of a given system to pledge that their individual purposes are subordinate to the larger purpose of the whole system to which they are all committed. In other words, an important part of everyone's purpose (or role in the system) is to optimize the purpose of the whole system.

This is why the basic belief undergirding this approach is that the proper level at which to draw the system boundary for school transformation belongs squarely at the state level. For true transformation to take place, state education, political, and community leaders need to go back to the root of the root and personally engage in a fundamental re-examination of the basic assumptions on which their current public education system is based. Thus, we will need to convene these multiple stakeholder groups in education in each state to engage in a process of deep dialogue to re-conceive together what the purpose and core values of the public education system ought to be for the 21st century.

The intent in creating these state-level dialogues is not to form yet one more committee whose task it is to problem-solve our way to the future. Nor is it to create a

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* The Annenberg Challenge spent $1.1 billion on public school improvement over more than eight years. The final report, *The Annenberg Challenge: Lessons and Reflections on Public School Reform* (Annenberg Institute for School Reform, 2002) recounted difficulties including "repeated setbacks, rapid turnover in leadership and sudden changes in direction" (p. 9), stating, "We encountered problems and policy reversals in some places that took everyone by surprise" (p. 9).

bureaucratic body through which all coordination and/or approval must flow. The primary purpose is to provide a place where all the relevant stakeholders can come together, suspend their individual organizational objectives, put our children and their future (and by extension our own future) in the center of our attention, and co-create a new future by collectively working to optimize the whole system. Once everyone understands his/her unique role as a *part* of the larger whole (rather than seeing his/her specific work as a system unto itself), each can begin to operate in ways that do indeed put our children first in our priority as a society. This is the way out of the fragmentation trap.

3. No System Transformation without Personal Transformation

There is an old adage that says, "if you are not part of the solution, you are a part of the problem." Unfortunately, this puts an overemphasis on the "solving" part and not enough on the "problem" part, so everyone tends to focus on and rush to put forth their solutions. These are often done from a stance of "I am above the problem or I am not a part of the problem, therefore I can provide a 'clean' objective solution to your problem." Most of these solutions, however well intentioned, tend not to produce sustainable long-term results, as numerous studies of such interventions can attest (Senge, 1999).

A colleague in the field of organization development, Bill Torbert, turns the traditional adage on its head by saying "if you are not a part of the problem, you can't be part of the solution" (Kahane, 2004, p. 105). This is a much more systemic approach to addressing change in complex systems, because it recognizes that the changes to any system must be carried out by those who are a part of the system. So, if you do not identify yourself as part of the system that you wish to change, you will be blind to the ways in which you yourself are a contributor to keeping things the way they are.

Any true transformational journey must always be comprised of two parallel journeys of organization development and leadership development. By definition, a transformational journey must be a learning journey: otherwise, each of us is simply rehashing what we already know and nothing new can be created. The organization/system changes because the individuals in the system change, and the leaders must lead by example by learning and developing themselves first. Gandhi was right when he said, "You must be the change you wish to see in the world."

It is not enough, however, for the individual leaders involved in the process to learn and grow. They must, in turn, lead the change in their respective organizations by creating a similar parallel learning and development process with their own people. For true transformation to occur statewide, every organization in the system must be engaged in its own transformation work.

4. Enduring Revolution through Persistent Evolution

In *Good to Great*, Jim Collins (2001) identifies a number of myths about what it takes to achieve greatness. One of them is the "Myth of Revolution: Big change has to be wrenching, extreme, painful—one big, discontinuous, shattering break." He states rather emphatically that "dramatic results do not come from dramatic process—not if you want them to last, anyway. A serious revolution, one that feels like a revolution to those going through it, is highly unlikely to bring about a sustainable leap from being good to being great."*

Most "revolutions" fail because they attempt to impose an artificial set of systems in an arbitrarily short period of time. Neither the systems nor the schedule is sustainable *without the infusion of massive amounts of resources to prop up the so-called revolution*. This is why demonstration sites prove to be of limited use—they work under the artificial conditions for producing a demonstration, but very little about a demonstration has the basis for building something sustainable. Or, there is no willingness to do what it really took to produce the demonstration, and a diluted form of "roll-outs" follow that cannot replicate the success of the original demonstration. We keep trying to get others to "buy in," which means we have to do a lot of selling. We would achieve more success inviting people to a process of engagement that built true ownership, because they would arrive at their own understanding of the need for change.

There are no shortcuts to producing lasting change. Stated another way, "*the shortcut is to not take shortcuts*." When we take shortcuts, what gets "cut" are the very things that are required to sustain the change over the long term. So, in the end, the shortcut takes longer because the results are short-lived, requiring us to keep applying more shortcuts.

By way of analogy, let's say you admire the beautiful tree that your neighbor has in his backyard, which has taken years to grow to its present size, and you wish to have one of your own. There are several options. You could plant a sapling, which would be easy to do, but it would take years for it to grow to the same size. You could transplant a fully grown tree, but that would entail a lot of money and effort to transport the whole tree, root system and all, not to mention the excavation required to dig the appropriately sized hole. Or, you could take a shortcut and simply cut the tree at the base just above the ground and prop it up with supporting poles and guy wires. You would instantly have that full-grown tree to enjoy by watering and fertilizing it regularly. The tree would look fine for a few days but we know that the tree will eventually wither and die because it has no root system to sustain it. However, in the short

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* From a Web interview in *Fast Company, No. 51, October 2001; http://www.fastcompany.com/guides/backissues.html* .

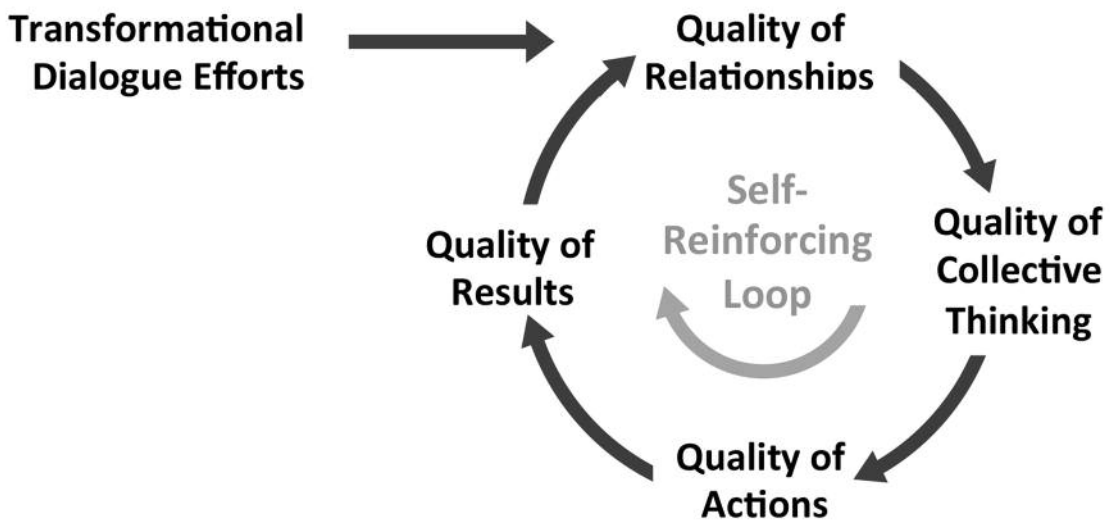

Figure 2. Core theory of success flywheel.

term, it appears as if we have successfully transplanted the tree without expending a whole lot of money and effort.

The above tree shortcut analogy illustrates how most benchmarking and best practices end up being used, because it is always easier and quicker to focus on copying the results (the ends) produced by the organizations that succeed at change without necessarily understanding the process (the means) by which they achieved those results. This is not saying that benchmarking and adoption of best practices are in and of themselves bad. Indeed, when done well, with a deep understanding of the underlying processes that led to the benchmarked successes, it can be one of the most effective ways to transfer learning from others' successes.

Unfortunately, in the name of expediency, people often pursue what will produce the quickest visible results, without attending to what will produce lasting results. This is also how most change efforts get "rolled out" to the rest of the organization. If we refer back to the Hierarchy of Choices framework, the root system is like the Purpose, Core Values, and Vision levels, while the trunk, branches, and leaves are like the Strategies, Tactics, and Activities. All too often, people try to take the shortcut of simply copying strategies, tactics, and activities without really understanding that those were effective because they were rooted in and emanated from a deep shared sense of purpose, core values, and vision. So, if we are truly interested in enduring change, we must resist the temptation to take such superficial shortcuts and attend to developing the root system of our change efforts.

Transformational Dialogue for Public Education

The above four tenets were put into practice under the initiative we called the Transformational Dialogue for Public Education (see "The Ohio Experience" sidebar). Why dialogue? Most people make the mistake of believing that dialogue is nothing more than just talking, so it is worth clarifying here what we mean by dialogue. Too often, the practice of communication involves just two modes: talking and waiting to talk. In talking, there is often very little listening, and, according to Adam Kahane, the biggest obstacle to listening is *knowing*. The discipline of dialogue is as much about creating the space inside ourselves to listen as it is about creating the space outside ourselves for others to speak. It requires suspending what we believe we know so that we can truly hear what others might have to say on the same subject. If we go back to the root meaning of the word, we find that it is made up of two words, *dia* (meaning *through* as in diameter) and *logos* (meaning *word* or *meaning*). Thus, to engage in dialogue means allowing the word or shared meaning to flow through us. When we truly engage in dialogue, where shared meaning flows through us, our view of the world is affected, which, in turn, affects the actions we take.

If we listen from a different place, the conversation itself becomes transformative. We will become a bit different, act differently, and make different decisions. Our day-to-day actions will change because we'll start to talk to and interact differently with people. In other words, true dialogue is action.

Core Theory of Success Flywheel

The core theory that undergirds our dialogue approach is depicted in ***Figure 2***. This core theory of success posits that an increase in the quality of relationships (all else being equal) causes an increase in quality of collective thinking, which, in turn, causes an increase in the quality

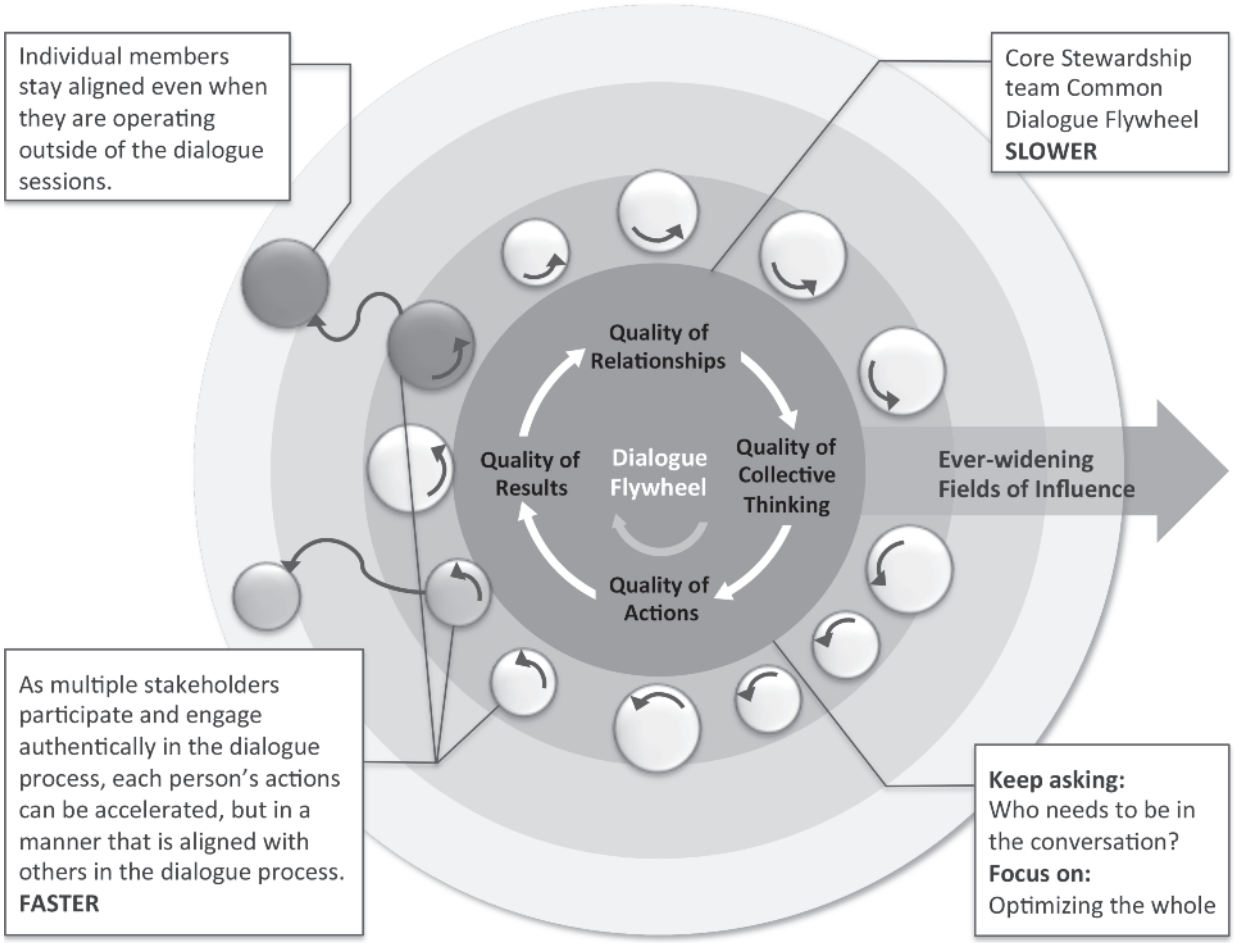

Figure 3. Flywheels of dialogue.

of actions and results. This, in turn, reinforces the quality of relationships. This success loop can be likened to a flywheel, in which each successive lap around the loop increases the momentum of the wheel such that it becomes almost self-sustaining, requiring very little external input to keep it going. The transformational dialogue initiative provides the initial investments needed to get the flywheel going and then sustains the momentum with regularly scheduled sessions.

The flywheel analogy helps explain the role of dialogue and why it can lead to the "slower is faster" phenomenon. When a group of people takes the time to slow down and talk intensely with each other about what really matters to them and what they deeply value, they end up building a deep common base of understanding upon which they can engage in other conversations in and out of the dialogue process. When they do this, they discover that the spin-off conversations and actions (represented by the smaller wheels) can go much faster *and* that all the different members' actions are in sync and together as if invisibly orchestrated. What people notice is that their interactions with each other in the day-to-day work environment go more smoothly. Within the dialogue process space, things may look as if they are going slower—but that slowing down can actually spur the external actions to go at a much faster *and* more aligned pace.

Just as a flywheel at rest will require a fair amount of force to break it free from its inertial state, the "wheel" of dialogue will also require a substantial amount of effort to get it moving from a standing start. With each rotation of the flywheel, the angular momentum builds, and it requires less and less energy to keep the flywheel turning. So, too, with each "turn" of our dialogue flywheel, the progress we are able to make increases, while the effort required decreases (relative to the complexity and difficulty of issues we are trying to address).

Another way to think about the dialogue effect is to see the core dialogue wheel as producing a dialogic field (analogous to a magnetic field) which helps all the parts of the larger system align towards a common vision (depicted

The Ohio Experience

We initiated the TDPE process in three states—Ohio, Kansas, and North Carolina. The first one was Ohio, which lasted the longest. The second one was Kansas, in which the initial group of state leaders (state commissioner of education, governor's office, and the teachers' union) were whole-heartedly in favor of the approach. However, shortly after the first meeting, the collapse of the U.S. financial system occurred and the state became overwhelmed by its own financial crisis. The third one was North Carolina, where again there was great support for the concepts by the key stakeholders, but the Great Recession that had set in also took its toll in that state as well. That one lasted one year, after which funding ran out. Ohio was the longest-lived, lasting from June of 2007 to the end of 2012. It was able to weather the financial shocks primarily due to the sustained funding by the KnowledgeWorks Foundation with additional funding by the W.K. Kellogg Foundation as well as the member organizations and individuals themselves. However, when the incumbent governor was not re-elected, the TDPE could not remain effective when the new administration did not sustain the same level of engagement and commitment.

All of the tenets and principles described in this article were fully implemented in Ohio. We started with a nucleus group that included the governor's education policy person, the state superintendent, and the leadership of the two teachers' unions. They fully embraced the logic of the TDPE initiative and experienced the value of the dialogues through the improvement in the quality of their relationships. They then identified a wider circle of key educational organizations (20 or so) that also needed to be a part of the dialogue so that we could bring all the fragmented parts together into one whole system conversation. This group came to be called the Core Stewardship Team (CST), whose purpose was to provide steadfast commitment to continually strive to put the optimization of the state education system above that of their individual organizations. By their own assessment, the CST believed that the TDPE process was instrumental in accomplishing several things collectively that they likely could not have done in their old fragmented ways.

However, in the end, the TDPE flywheel was not able to establish enough momentum within one governor's term to be able to sustain it through an administration change. The politicized nature of our education system makes it too vulnerable to shifts in direction whenever there is a change in administration. As one state senator then pondered, if that is the biggest impediment to sustained focus, then perhaps the first step should be to work on de-politicizing public education in our states. That would be a worthy goal and one that may need to be the first focus of a future TDPE.

by the concentric circles radiating outward in ***Figure 3***), even as individuals are pursuing their own objectives within their own part of the system. As each part of the system takes its own local action, it is aligned with the greater whole and so is more likely to add to the common vision (vs. canceling out movement toward the common vision by taking actions going in different directions).

Concluding Remarks

Although this initiative is squarely being focused at the state level, we also know that we are a nation of 50 *united* states. So, even as each state pursues its own questions of purpose, core values, and vision, we must also help the states link up together so that they can learn from each other and begin to get a sense of the commonalities among them in order to *form a more perfect union*. What may emerge from (not be imposed on) the learning and sharing process is a clearer picture of what is needed at the federal level. This will be a case of the states becoming clearer about what needs to be owned by the states and what is better handled at the federal level. As the states collectively become clearer about the federal government's role, this may in turn call for a policy change—perhaps even a constitutional amendment—regarding the federal responsibility for public education.

If we extend the systems axiom about optimizing systems to the larger context of our interdependent global community, we can ill afford to simply view public education as another dimension of competitive advantage with respect to other nations. Ultimately we must shift our frame from creating the best public education system in the world to helping each nation pursue the creation of the best public education system for the world. Therefore, this initiative should be conceived of as operating within the multiple contexts of the local, state, national and global levels, even as we begin by pursuing transformation at the state level. □

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Paradigms, Mental Models, and Mind-Sets: Triple Barriers to Transformational Change in School Systems

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This article presents a simile for understanding the power of paradigms, mental models, and mind-sets as religion-like phenomena. The author clarifies the meaning of the three phenomena to help readers to see how the phenomena become significant sources of resistance to change. He concludes by outlining a paradigm-shifting process to assist educators in opening their minds to the possibilities embedded in the Knowledge-Age paradigm for educating children.

Introduction

Anyone with an interest in creating paradigm-shifting, frame-breaking change in school systems is probably familiar with the terms "paradigm," "mental models," and "mind-sets." But what exactly do those terms mean? Are they distinct phenomena? Are they interchangeable synonyms? How powerful are they? And, importantly, if they are triple barriers to transformational change, how can change leaders influence these phenomena to create a paradigm shift? This article offers some interpretations of the meaning of these terms and why knowing how to work with them is so important for any effort to create transformational change in school systems.

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Paradigms, Mental Models, and Mind-sets in Use

Here's what we know about the dominant paradigm controlling the field of education and four of its attendant mental models. For more than a century the American education system has been guided by an Industrial-Age paradigm that controls how school systems are designed and how these systems organize and deliver educational services to children. That paradigm is supported by four key mental models within a school district. The four mental models are:

- *Mental Model 1:* how teachers teach and how kids learn; and how support services are designed, managed, and delivered (core and support work);
- *Mental Model 2:* how the internal social infrastructure of school systems is designed and how it functions;
- *Mental Model 3:* how school systems interact with their external environments; and
- *Mental Model 4:* how educators approach change.

The dominant paradigm and its four key mental models are stubbornly resistant to change. Yet, there is an inescapable consequence of this Industrial-Age paradigm and its attendant mental models, especially "mental model 1"…they leave some children behind—they always have and they always will.

The Industrial Age world-view alluded to above is derisively referred to as the factory-model of teaching and learning. There is a growing movement in the United States to displace this world view—this paradigm—by replacing it with a world-view of teaching and learning better suited to the demands of our Knowledge Age society and better suited to the learning needs, interests, and abilities of individual children. The new paradigm is sometimes called the Knowledge Age paradigm of teaching and learning. More commonly it is referred to as the Learner-Centered paradigm. This new paradigm is built on the heart-felt beliefs that:

1. A student is one child with one mind who deserves a learning experience that is tailored to his or her personal learning needs, interests, and abilities so that he or she can achieve required standards of learning and become a successful and productive citizen in our society.
2. Adults working in a school system deserve a worklife that is motivating and satisfying, that provides opportunities for professional growth and development, and that empowers and enables them to make appropriate decisions about how they do their work.
3. School systems should be opportunity-seeking rather than "crisis-reacting" in relationships with

external stakeholders.

4. Change processes must focus on the whole-system rather than on individual pieces of the system.

Creating this kind of paradigm-shift, however, is so challenging that it is quite a bit like trying to get an entire religious community to convert to a new religion.

Creating a Paradigm Shift is Like Converting an Entire Religious Community to a New Religion

Christianity is a religious paradigm. Within that paradigm there are many different denominations (which are mental models); e.g., Catholicism, Presbyterianism, and Evangelicalism. There are also other religious paradigms: Islam, Judaism, Hinduism, and so on.

As people practice their religious faith (their paradigm) in accordance with their denomination (their mental model) they make up their minds about how much they value their faith and their particular denomination; i.e., they develop mind-sets about their paradigm and mental model, how much they like or dislike other denominations, as well as other completely different religions (other paradigms).

Their attitudes (their mind-sets) toward their faith (their paradigm) and denomination (their mental model) motivate them to develop behavioral strategies for how to behave so that they can hold true to the tenets of their faith and denomination. As they implement their behavioral strategies, they can be observed practicing their faith and denomination in their chosen ways.

Creating a paradigm shift within this framework (paradigm, mental models, mind-sets, behavioral strategies, and observable behaviors) would require having an entire religious community (e.g., Christians) shift to a new religion (e.g., to Islam). Can you imagine that happening? At best, it probably only would be possible to motivate individuals to change their mental models (e.g., to convert from Catholicism to Presbyterianism; or for individuals to convert to another religious paradigm; e.g., a person converting from Islam to Christianity). But convincing an entire religious community to shift paradigms (to adopt a new religion) would be an extraordinary event.

Now, let us enter the world of education. The current dominant approach to designing and managing school systems in the United States is controlled by the Industrial-Age paradigm and the four key mental models influenced by that paradigm (identified earlier). The paradigm and its four key mental models are very much like a religion, and educators develop attitudes (mind-sets) about the paradigm and its four key mental models. ***Table 1*** shows some examples.

As educators work within school systems designed to comply with the controlling paradigm and its four key mental models, they make up their minds (that is, they create mind-sets) about the value of the paradigm and its mental models, and they develop mind-sets about the value or lack of value of other competing paradigms and mental models. Their attitudes (i.e., their mind-sets) toward their preferred and non-preferred paradigms and mental models motivate them to create behavioral strategies for how to do their work. As they implement their behavioral strategies, they can be observed teaching, managing, leading, and so on, in ways that are aligned with the dominant paradigm and the attendant mental models.

If we want the entire profession of education to adopt a new paradigm and new key mental models, this will require moving educators, policymakers, and parents toward a tipping point where the required changes gain unstoppable momentum. The field of change management suggests that tipping points are reached when approximately 25% of a target population enthusiastically embraces a proposed change (Jones & Brazzel, 2006; Rogers, 1995). Since there are more than 14,000 school systems in the United States, more than 3,500 of them would need to embrace the new paradigm and its related mental models in order to reach a tipping point that would create and sustain the desired paradigm shift. Impossible? No. Challenging? Extraordinarily so!

Paradigms, Mental Models, and Mind-Sets: The Rock-Solid Foundation of Resistance to Change

The literature on systemic change frequently includes information on paradigms, mental models, and mind-sets. The distinctions among these three phenomena, however, are unclear and it is easy to become confused trying to sort out the meaning and importance of each one, especially since the terms are often misused as synonyms. I offer an interpretation of what these phenomena mean to me, why I think they are important, and how I believe they can be changed. Having a clear understanding of their meaning, importance, and changeability is very important because as a single phenomenon each one is a powerful barrier to transformational change. As an interconnected triad, these phenomena can become an insurmountable and impenetrable barrier to change.

I am proposing that paradigms, mental models and mind-sets are tightly interconnected, but different. Argyris and Schön (1978) would call these three phenomena "espoused theories of action." The phenomena interact to influence educators' behavioral strategies for how to succeed within their profession and in their school systems. Behavioral strategies result

Table 1. Examples of paradigms, mental models, and mind-sets.

Paradigm	Four Key Mental Models Supporting the Paradigm	Examples of Features of the Mental Models	Possible Mind-Sets about the Paradigm and Mental Models (defined as a collection of attitudes)
Industrial-Age	• Mental Model 1: Teaching and learning and support services	• Group-based instruction • Time-based assessment of student progress	• Positive attitude (mind-set) • Negative attitude (mind-set) • Neutral attitude (mind-set)
	• Mental Model 2: Internal social infrastructure	• Bureaucratic organization design • Command and control from Central Office	• Positive attitude (mind-set) • Negative attitude (mind-set) • Neutral attitude (mind-set)
	• Mental Model 3: Relationship with external environment	• Adversarial relationships • Crisis-orientation	• Positive attitude (mind-set) • Negative attitude (mind-set) • Neutral attitude (mind-set)
	• Mental Model 4: Change management	• Continuous improvement to maintain status quo • Piecemeal	• Positive attitude (mind-set) • Negative attitude (mind-set) • Neutral attitude (mind-set)
Knowledge-Age	• Mental Model 1: Teaching and learning and support services	• Personalized learning • Attainment-based assessment of student progress	• Positive attitude (mind-set) • Negative attitude (mind-set) • Neutral attitude (mind-set)
	• Mental Model 2: Internal social infrastructure	• Organic organization design • Distributed leadership	• Positive attitude (mind-set) • Negative attitude (mind-set) • Neutral attitude (mind-set)
	• Mental Model 3: Relationship with external environment	• Community engagement • Opportunity-seeking	• Positive attitude (mind-set) • Negative attitude (mind-set) • Neutral attitude (mind-set)
	• Mental Model 4: Change management	• Transformational change • Whole-system change	• Positive attitude (mind-set) • Negative attitude (mind-set) • Neutral attitude (mind-set)

in observable behaviors. The observable behaviors are "theories of action-in-use" (Argyris & Schön, 1978).

Currently, educators create or adopt mental models that are aligned with the Industrial-Age paradigm. This alignment reinforces and sustains the paradigm and its four key mental models. As educators conform to the requirements of the paradigm and related mental models, they develop mind-sets (attitudes) about the value and effectiveness of the paradigm and the related mental models. The mind-sets influence educators' choice of behavioral strategies; that is, their attitudes toward the paradigm and mental models help them to devise strategies for how to do their work. As they implement their strategies, observable behavior is manifested. Successful behaviors are rewarded, which, in turn, reinforces the mind-sets, mental models, and the paradigm. This interconnectedness and reciprocal reinforcement is unavoidable and powerful.

Clarifying Meaning

In the literature and in professional discourse there is often confusion about the meaning of paradigm, mental models, and mind-sets. Frequently, the terms are used as interchangeable synonyms. I do not think that they are synonyms. I perceive them as distinct, but interconnected, phenomena. Below, I attempt to clarify the differences that I see among the phenomena.

Paradigms

Kuhn (1962) is credited with first using the term "paradigm" to characterize the dominant theories, core values, beliefs, assumptions, concepts, principles, and practices guiding the hard science professions of his time. He defined a paradigm as

> …accepted examples of actual scientific practice, examples which include law, theory, application, and

> instrumentation together—[that] provide models from which spring particular coherent traditions of scientific research....Men whose research is based on shared paradigms are committed to the same rules and standards for scientific practice. (p. 10)

Capra (1996) defined a paradigm as "…a constellation of concepts, values, perceptions, and practices shared by a community, which forms a particular vision of reality that is the basis of the way a community organizes itself" (p. 6). For both of these definitions a paradigm seems to be situated at the level of a profession, discipline, or field of study and serves as a powerful framework for helping practitioners make sense of the reality of their profession.

Barker (1992) provided another definition of paradigm. Although he defined a paradigm as "a set of rules and regulations (either written or unwritten) that does two things: (1) it establishes or defines boundaries and, (2) it tells you how to behave inside the boundaries in order to be successful" (p. 32), he seemingly situated his definition at the level of organizations and individuals. In my opinion, because of where Barker situated the concept of paradigm, his definition actually describes mental models.

Mental Models

The concept of mental models was substantially defined by Craik (1943). He said, "…the mind constructs 'small-scale models' of reality that it uses to anticipate events, to reason, and to underlie explanation" (cited in Johnson-Laird, Girotto, & Legrenzi, 1998, Introduction, para. 1). Johnson-Laird (1983) is another of the foremost authorities of mental model theory. He believed that people construct cognitive representations of what they learn and what they think they know. He called these representations "mental models." Senge (1990) described mental models as "…deeply ingrained assumptions, generalizations, or even pictures or images that influence how we understand the world and how we take action" (p. 8).

In school systems the mental models-in-use protect and sustain the dominant paradigm, and they exert significant influence on the behavior of the educators who work in them. Further, because the dominant Industrial-Age paradigm and the four key mental models influenced by it are so pervasive, it is extraordinarily difficult for educators to think outside the boundaries that define and influence how they do their work.

Mind-Sets

Given the dominant Industrial-Age paradigm in the field of education and the four key mental models influenced by the paradigm (described earlier), individuals and teams begin to make up their minds about what works and what does not work and about what has merit and value and what does not. "Making up one's mind" is another way of saying that a person's mind is set; in other words, a mind-set has been established. These mind-sets are, in fact, really attitudes hammered in hard by a school system's internal social infrastructure that rewards and reinforces behaviors that conform to the controlling paradigm and mental models. These attitudes can be either positive or negative.

As a mind-set hardens it creates a predisposition to think, believe, and do things in a particular way; that is, mind-sets create powerful incentives for individuals and groups to behave in ways that are congruent with the controlling paradigm and mental models.

Behavioral Strategies and Observable Behaviors

Behavioral strategies. Given the dominant Industrial-Age paradigm in the field of education, the four key mental models influenced by the paradigm, and the attendant mind-sets, people begin to devise strategies for how to do their work in ways that conform to the paradigm and mental models. These strategies, when implemented, create observable behaviors.

Observable behaviors. As individuals and teams implement their behavioral strategies, observable behaviors are manifested. For the most part, these behaviors are clearly and unequivocally aligned with the dominant paradigm and mental models that govern the profession of education. These behaviors, when manifested effectively, move school systems toward their paradigm-driven visions.

Paradigm Shifting Strategy

Let us say that we want to create a paradigm shift for the entire field of education. How would we do that? The initial target of paradigm-shifting efforts must be the mind-sets (or attitudes) of educators and stakeholders with the goal of motivating these people to open their minds to new possibilities, to increase the malleability of their mind-sets, and to introduce new ways of thinking, believing, and doing. A process that might help to do that is outlined below.

Phase 1: Prepare

The following activities must be completed *before* attempting to influence the mind-sets of educators:

1. Create simple, concrete, powerful, and compelling language to describe the four new paradigms (described earlier) and their mental models.
2. Construct descriptions of the four new paradigms using simple, but compelling language.
3. Design and test mental models that support the four new paradigms described earlier.
4. Design the new mental models so they are cost-effective, simple to use, and do not make

educators' work lives harder.

Phase 2: Educate

Phase 1 focuses on preparing for Phase 2. The ultimate outcome of Phase 2 is to help educators open their minds to new possibilities by expanding their mind-sets. Expanding mind-sets is the absolute starting point for paradigm change because, before shifting to a new paradigm, educators first need to be "willing" to consider the new paradigm and its supporting mental models. "Willingness" (or unwillingness) is a consequence of a mind-set.

5. Provide educators with inservice opportunities to learn about the new paradigm and four new key mental models to support it (i.e., core and support work, internal social infrastructure, environmental relationships, and change management transformed to comply with the requirements of the Knowledge-Age paradigm).
6. Demonstrate the effectiveness of the new paradigm and mental models.
7. Provide access to other educators who are effectively using the new paradigm and its four key mental models.
8. Design and deliver educational activities that help educators learn about the philosophy, theories, concepts, principles, and research underpinning the new paradigm and its mental models.

Phase 3: Commit

9. Influence carefully selected school systems with the capacity to engage in transformational change to commit to using a new Knowledge-Age paradigm and its mental models on a small-scale (see Christensen, 2003; Christensen, Johnson, & Horn, 2008). Design the implementation of these small-scale initiatives so they do not compete head-on with the dominant paradigms (see Christensen, Johnson & Horn, 2008, for an explanation of why this non-compete principle is important).

Phase 4: Expand

10. Gradually expand the successful initiatives created for Phases 1 and 2 to include more programs within each participating school system with the goal of achieving a tipping point for the initiatives launched in Activity #9, above, so that they will displace the old paradigm and its mental models.

Phase 5: Tip

11. Replicate the above process (Activities 1–10, above) in an increasing number of school systems. Use educators from transformed school districts as emissaries and advocates of the new paradigm and its mental models.

Phase 6: Shift

12. Always keep in mind that the paradigm-shifting goal is to reach a tipping point in the field of education (about 25% of all school systems) at which point a cascade of school systems shifting rapidly to the new paradigms could be triggered, which will be perceived as a sudden and dramatic revolution in thinking, believing, and doing.

Conclusion

The terms paradigm, mental models, and mind-sets are commonly used in the field of school improvement. The terms are not synonymous, yet they are interconnected and they are mutually reinforced in ways that forge stiff resistance to new ways of thinking about teaching and learning, new ways of designing the internal social infrastructure of school systems, new ways of managing relationships with external stakeholders, and new ways of creating and sustaining change. This article described why I think these phenomena are distinct, but interconnected; how they influence thinking, believing, and doing; and, how to change them. □

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Engaging At-Risk Populations in the Systemic Educational Transformation Process

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At-risk student bodies in public school districts have very different cultures of learning from mainstream learning communities. Policies and practices in schools tend to isolate these student bodies for convenience in administration and instruction, and little consideration is given to whether these experiences of isolation from the larger community are positive or negative. This article discusses the importance of including the at-risk student populations in educational systemic transformation efforts and discusses their role within an educational transformation process. The article also provides recommendations for systemic transformation theories and transformation efforts that can help at-risk students to become active agents of educational transformation processes.

Introduction

"At-risk students" generally refers to students who may be more likely to experience educational problems than others. This article defines at-risk as an inclusive concept that refers to (1) youth who are in danger of failing at school, in a general sense, to children and youth from disadvantaged backgrounds (Day *et al.*, 1997), and (2) disadvantaging processes, that is, processes that cause the production and reproduction of disadvantage for people and places (Snyder *et al.*, 2002).

There is a variety of risk factors that can be implicated in the notion of "at risk" students. For example, Schorr and Schorr (1988) define a number of major non-school, family, and community risk factors, such as growing up in persistent or intense poverty or in a family of low social class; being born unwanted; growing up with unemployed parents; among others.

While not all children in poverty are educationally at-risk, Schorr and Schorr (1988) identify poverty as the most important risk factor of all, claiming that virtually all other factors are found disproportionately among poor students. Natriello *et al.* (1990) also identify five similar key indicators of the at-risk as racial/ethnic identity, poverty status, family composition, mother's education, and language background.

School risk factors are also found to be important in the literature: poor standards in the planning of instruction, poor assessment and evaluation of learning, students' attitudes and motivation in regard to learning and education in school, low expectations of the students from their teachers, and the prevailing anti-school attitudes or culture among peer group towards learning and schools are daunting obstacles to learning and education (Cox, 2000).

The learning cultures established by these students and their teachers are quite distinctive from the mainstream learning communities within a school community. Policies and practices in schools tend to group and separate these student bodies to increase convenience in administration and instruction, and little thought is given to whether the experience of being grouped and separated from the larger learning community is positive or negative for these students.

School change for higher standards in the absence of fundamental transformations that address the critical needs of the at-risk students only increases dropout rates for those students who can scarcely meet current standards. It is clear that while there is an urgent need for transformation for the educational system as a whole, transformation efforts need to be more attuned to the needs of the at-risk and address those issues with special consideration, or the transformation effort will again be neglecting this population (Levin, 1986).

Among current educational transformation movements, systemic school transformation or systemic educational transformation is a movement that strives to transform school culture so that schools meet all learners' needs, rather than only the majority of learners' needs (Reigeluth, 1994; Watson & Reigeluth,

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2013). Scholars of systemic transformation movements argue that the current factory-model, industrial-age, school system has highly compartmentalized learning into subject areas, and students are "treated as if they are all the same and are all expected to do the same things at the same time" (Reigeluth, 1994, p. 204). The current school system, with its standardization and norm-based grading system, is not designed to meet individual learner needs; it rather results in sorting or "weeding out" students. Systemic educational transformation seeks to shift from a paradigm in which time is held constant, thereby forcing achievement to vary, which is a sorting-based paradigm, to a paradigm designed specifically to meet the needs of learners and their communities by allowing students as much time as each needs to reach proficiency and to move on as soon as each is ready. In order to achieve that goal, systemic educational transformation argues that the school system must move from a paradigm focused on standardization and sorting to a completely different paradigm that supports customization to meet individual learner needs (Reigeluth, 1994, 1997; Reigeluth & Karnopp, 2013).

However, even systemic school transformation efforts in school districts that are committed to, and strive to transform school culture so that schools meet all learners' needs, have difficulty engaging at-risk student populations in the transformation process. The special attention at-risk student bodies need is often overlooked, because of the focus on the systemic, broader principles and overall process of transformation as a whole. Furthermore, as at-risk student groups are typically isolated, either physically, psychologically, or both, from the rest of the learning community, it can be difficult for their voices to be represented and their needs recognized in a transformation effort that involves the rest of the mainstream learning community.

This article provides a theoretical framework for the argument for the at-risk and their teachers to become active agents of educational transformation processes and provides recommendations for systemic transformation efforts that should offer support to ultimately provide better learning environments for all students, including those who are at-risk.

Theoretical Framework and Background

One of the most important underlying values of systemic educational transformation theories and guidelines is to meet the needs of all learners. Systemic educational transformation is closely connected to critical systems theory (Watson & Reigeluth, 2008), which is dedicated to human emancipation for full development of all human potential (Jackson, 1991b). Liberating systems theory, which stemmed from critical systems theory, is also closely aligned with systemic educational transformation theory, and seeks to emancipate humans in systems that promote subjugation and dominance (Flood, 1990). Critical systems theory (CST) originated from systems theory and critical social theory. Systems thinking evolved into a critical approach to systems thinking based on the epistemological and ontological views of Habermas (Flood & Jackson, 1991; Jackson, 1991a, 1991b), and is defined by three core values: critique, emancipation, and pluralism (Schecter, 1991; Flood & Jackson, 1991). CST's approach to organizational transformation and its core concepts offer considerable insight to organizational transformation, including educational systemic transformation efforts. And systems researchers will find these concepts of particular importance when considering systems wherein inequality of power exists in relation to opportunity, authority, and control.

Commitment to Critique

The notion of critique helps a transformation effort to critically consider the methods, practice, and underlying theory that are used in organizational transformation. It cautions against putting together a toolkit of "proven," dominant methods, and is also against the choice of "isolationists" who pick a single theory as solely legitimate (Flood & Jackson, 1991). Instead, the value in critique advocates for having a broad understanding of different methodologies to uncover hidden assumptions and conceptual traps to which transformation efforts might be subjugated.

For example, while systemic educational transformation processes call for consensus-building by all stakeholders, using soft-systems methodology (primarily dialogue) to generate true mutual understanding and sharing of goals by all stakeholders can be impossible in systems where one or more groups has little interest in considering the other groups' points of view, and this is particularly problematic when one group has more power than another. Thus, the concept of mutual understanding through dialogue can be a conceptual trap to the practical solving of problems in systems when unwillingness to see others' viewpoints does not allow for mutual trust or respect to be built (Flood & Jackson, 1991).

Therefore, it is necessary to undertake a critique of dialogue and the process of communication in order to evaluate the potential for mutual understanding, especially in regard to cultural norms and the significance of objectivity and fairness. This will help expand viewpoints and build the mutual trust and honest communication that is necessary in order to ensure that the transformation process does not support the replication of existing problems in the system.

Commitment to Emancipation

A second key value of CST is emancipation, which includes the notion of freeing of the system and the

system's individuals from any kind of oppression that disables them to critique and fully develop their potential. This directs the transformation effort to recognize the barriers to human emancipation: the unequal power relations and the conceptual traps that exist and can be easily overlooked, and to incorporate processes in the transformation effort to address them. Jackson (1985) explicitly calls for an emancipatory systems approach, and Flood (1990) identifies his discussion of CST as systems theory that calls to "liberate and critique." Oliga's (1991) examination of stability and transformation in social systems, which he calls "empower and transform" (Schecter, 1991), and Ulrich's (1987, 2003) critical systems discourse are both commitments to emancipation in order to work towards full human potential development via free and equal participation in community.

Commitment to Pluralism

CST also focuses on pluralism, which is the notion that organizational transformation efforts should employ a creative design of methods by appreciating all methods and using multiple methods, grounded in appropriate theory. Schecter (1991) argues for taking on a pluralistic approach rather than the pragmatist approach of using a toolkit of only "the verified or proven" methods. He also disagrees with the isolationist approach of picking one theory as exclusively suitable or adequate. The pluralistic approach encourages reflection on the organization's intentions in transformation and develops cross-cultural understanding and communications with other groups in the system.

Ulrich (2003, 2006) discusses how methodological pluralism and complementarism are indispensable, but also cautions against superficial pluralistic approaches of complementarism that "rely on a positivistic concept of methodology choice" (Ulrich, 2003, p. 340). He calls for "deep complementarism" that is differentiated "by not subordinating emancipatory reflection and boundary critique to methodology choice" (2003, p. 340). And he cautions against the challenges that prohibit the transformation effort from engaging in boundary critique (Ulrich, 2003), a process that helps the system to gain accurate understanding of the scope and design of the system and what members, facts, and norms are to be considered relevant in that particular system. Boundary critique is a crucial notion in systems thinking that helps make boundary judgments explicit by illuminating the present state of the system (what it currently is) and the desired state of the system (what it should be) in order to create an idealized design of the system and include all stakeholders as part of the system design (Ulrich, 2003).

Recommendations for Transformation Models and School Policies

Ensuring that at-risk populations are engaged in an educational transformation process and confirming that they have their needs met are very challenging tasks for transformation leaders and facilitators. The inherent culture of existing educational systems and the fundamental problems and isolation faced by at-risk students and their teachers can often constrain them from becoming active agents within the transformation process and therefore becoming active beneficiaries of the transformation (Watson & Reigeluth, 2013).

In order to facilitate the effective engagement and participation of these students and their teachers, systemic educational transformation theories and models need to incorporate more specific guidelines for district and school level policies in regard to at-risk students. These guidelines and policies should focus on: (1) making sure that at-risk students' teachers are involved in the transformation process; (2) providing support for the parents of at-risk students to participate in the transformation process; (3) providing support for all student voices, including the at-risk students, to be heard in a systemic educational transformation effort; and (4) reconsidering school policies for ability-grouping programs. Each of these implications is discussed in the following section.

1. Making Sure At-risk Students' Teachers Are Involved in the Transformation Process

The current systemic educational transformation literature calls for broad stakeholder involvement and argues that the exclusion of critical stakeholders would bring substantial challenges to truly changing the educational system for all learners (Duffy, 2006; Jenlink *et al.*, 1996, 1998).

Teachers of at-risk students are more likely to understand the unique challenges these student populations face, and they are the most experienced stakeholders in implementing the kind of learner-centered approaches for which the system's vision likely calls. Yet, they are often not involved in a systemic transformation effort, because they are viewed as being on the outer fringes of the system. With their exclusion, transformation leaders miss powerful opportunities to learn from learner-centered experts. Recruiting these teachers to hold meetings in their classrooms and scheduling meetings or activities to be led by these teachers on topics related to learner-centered instruction will do much to improve the outcomes of the transformation effort. Having the teachers and staff aware of the successes and lessons learned by their peers can help to create a true collaborative learning community that brings viewpoints fully representing all stakeholders to the transformation process (Duffy, 2006; Jenlink *et al.*, 1996, 1998).

2. Providing Support for the Parents of At-risk Students to Participate

The parents of at-risk students also are often unin-

volved in transformation efforts. The second recommendation of this article is that, because the parents of at-risk students often face greater challenges to participating in a transformation effort, they should be provided with additional support for involvement.

These parents often have considerable obstacles that prevent them from being able to share their viewpoints and participate in any school activities, including transformation efforts. Furthermore, these parents, much like their children, often have the perspective that the district does not truly wish to hear their point of view. Therefore, it is important that significant effort be placed in encouraging them to be involved and share their experiences and viewpoints, with a focused strategy to involve them.

Special efforts are needed to help these parents participate in the process, such as providing monetary support for the hours they put into the effort, childcare, transportation services, and scheduling meeting times for a variety of work schedules. Recruiting these parents to hold meetings in their neighborhood churches or other meeting places can go a long way to demonstrate that their opinions are not only valued, but also needed.

3. Providing Support for All Student Voices to Be Heard

The third recommendation is to ensure that all students, particularly at-risk students, are given an active role in the systemic educational transformation process. Students are the stakeholder group most likely to be overlooked, as there is a strong tradition of telling students what to do, whether it is their parents, teachers, or administrators making the decision. If changing the learner-centered paradigm is indeed the goal of the school, as the educational transformation literature calls for (Duffy *et al.*, 2000; Reigeluth, 1994, 1997; Reigeluth & Duffy, 2007), then learner-centeredness needs to start in the transformation process itself and not only be reflected in the new instructional paradigm.

At-risk students exhibit great enthusiasm for sharing their perspectives and lending their voices to transformation efforts; and as students who had largely failed in the existing educational system, they have much to share to help other students who are facing learning difficulties (Watson & Reigeluth, 2013).

Given the critical need to involve at-risk students, their parents, and their teachers as active agents in the transformation process, it is important that systemic educational transformation guidelines and theories provide detailed methods to ensure that those stakeholders become involved. For example, such methods might include engaging students to be reflective about their own learning processes, and engaging them in active discussion about learning with their peers and teachers as equal collaborators (Watson, 2011; Watson & Reigeluth, 2013).

4. Reconsidering School Policies on Ability Grouping Programs

Reconsideration of ability grouping or tracking is also important. Although public education systems are based on the ideology of common schooling that promotes equal access and opportunities to all learners, widespread and deeply rooted patterns of tracking and ability grouping in schools often result in different classroom learning environments and opportunities for students (Braddock & Dawkins, 1993; Oakes, 1992). Sorting students by ability or achievement narrows the range of diversity in a classroom and isolates different kinds of students from each other.

However, the practical challenges of teaching heterogeneous classes should be discussed by all educators to search for learner-centered instructional approaches that cater to diverse students, rather than advocating for ability grouping policies (Oakes, 1985, 1992; Slavin, 1990), as learner-centered educators call for schools to move towards a more personalized and inclusive school atmosphere rather than sorting students.

Ability grouping studies overall show that its effects on student achievement are non-existent (Betts & Shkolnik, 2000; Slavin, 1990; Zimmer, 2003). Literature also shows that practitioners feel uncomfortable making decisions that could segregate schools by socioeconomic or racial standards, because the creation of such schools has been shown to cause significant negative long-lasting effects on students' self-esteem and life goals and opportunities (Oakes, 1985, 1992).

The research on ability grouping shows that it is time to move beyond examining whether ability grouping is effective or not, and instead consider how schools can meet the needs of a heterogeneous student body through a learner-centered paradigm that focuses on personal learning plans, attainment-based student progress, and project-based learning, without the artificial structures of grade levels and isolated subject classes. These instructional approaches are not only a natural fit for the at-risk students, but for all students, including the gifted and talented that have to wait during class time for others to catch up.

Conclusion

At-risk student bodies in public schools have different cultures of learning and instruction than the mainstream learning community. Many school policies and practices tend to separate these student bodies to gain convenience in administration and instruction, and little consideration is given to whether these experiences of separation are actually effective and positive for all students.

This article has argued that systemic educational transformation efforts can be much more successful by making a core commitment, through tangible activities

in the transformation process, to ensuring the input of at-risk students, their parents, and teachers, and it made recommendations for some of those activities. Further research on systemic educational transformation and school culture for at-risk students is needed to identify more actionable support and policies for these students, their parents, and their teachers to be more active agents in the systemic transformation process. □

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Transforming Education with Self-Directed Project-Based Learning: The Minnesota New Country School

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To achieve truly learner-centered instruction and assessment, Reigeluth (1994) and Reigeluth and Karnopp (2013) pointed out the importance of schools providing a caring environment. They indicated that such an environment could be ensured with better interaction and relationships among students and teachers in a small learning community. How can a school become a caring environment? What roles do students, teachers, and parents play in such an environment? How can instruction and assessment be based on individual learners' preferences? More importantly, are there schools like this anywhere in the world? This article describes and highlights one such school, the Minnesota New Country School (MNCS). Four design principles of the school—making this school unique—are explained: (1) small learning community, (2) self-directed project-based learning approach, (3) authentic assessment, and (4) teacher ownership and democratic governance. Some success stories of the school are presented.

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Introduction

The urgency of paradigm shift in K–12 education has been noted by several researchers (McCombs, 2003; Reigeluth, 1994; Reigeluth & Karnopp, 2013; Schlechty, 2003; Software & Information Industry Association, 2010; Thornburg, 1999). Despite the transition from the industrial age to the information age in our society (Toffler, 1980, 1990), most of today's K–12 schools are still more aligned with the industrial age (Watson, Watson, & Reigeluth, 2008). Such an alignment supports a sorting-oriented and factory-model approach in which all students are expected to gain the same learning outcomes in the same amount of time (Reigeluth, 1994). Reigeluth defined the features of the new paradigm of education by comparing it with the current paradigm as illustrated in ***Table 1***.

Based on this comparison, two major differences between the industrial-age and information-age paradigms are evident: instruction and assessment. Similar to the "learning paradigm" (Barr & Tagg, 2000, p. 198), the information-age paradigm of education requires a shift in mindset: the focus should be on learning and learners. This focus should be reflected in instruction- and assessment-related tasks. Therefore, learner-centered instruction and assessment are the two cornerstones of the new paradigm, and they are seamlessly integrated with each other (Reigeluth *et al.*, 2008).

To achieve truly learner-centered instruction and assessment, Reigeluth (1994) pointed out the importance of schools being caring environments. He indicated that such an environment can be ensured with better interaction and relationships between students and teachers in a small community. He revealed additional features of the new paradigm to facilitate schools being caring environments:

1. A 'teacher' is responsible for a child for a period of about four years.
2. That teacher is responsible for educating the whole child.
3. Each school has no more than 10 teachers, to

Table 1. Industrial-age paradigm vs. information-age paradigm of education (Reigeluth, 1994, p. 8).

Industrial-Age Paradigm	Information-Age Paradigm
Grade levels	Continuous progress
Covering the content	Outcomes-based learning
Norm-referenced testing	Individualized testing
Non-authentic assessment	Performance-based assessment
Group-based content delivery	Personal learning plans
Adversarial learning	Cooperative learning
Classrooms	Learning centers
Teacher as dispenser of knowledge	Teacher as coach or facilitator of learning
Memorization of facts	Thinking, problem-solving skills, and meaning-making
Isolated reading/writing skills	Communication skills
Books as tools	Advanced technologies as tools

create a smaller, caring environment.

4. Each student develops a quarterly contract with the teacher and parents. (Reigeluth, 1994, p. 10)

How can a school become a caring environment? What roles do students, teachers, and parents play in such an environment? How can instruction and assessment be based on individual learners' preferences? More importantly, are there schools like this in the world? The remainder of this article will describe and highlight one such school, the Minnesota New Country School (MNCS).

What Is Unique about the MNCS?

Imagine a school with no classrooms, teachers, classes, and many other things that are seen in a traditional school. When entering the MNCS, one sees a large room with individual desks and computers. Instead of students going from one classroom to another for different classes, all students are located in this room. It looks at first sight like a busy open office instead of a school.

Thomas, Enloe, and Newell (2005) referred to the MNCS as "the coolest school in America" in their book, due to its non-traditional approaches to instruction and assessment. A group of people including educational entrepreneurs and reformers founded this school in 1994 to change our perceptions about schooling. They designed it in a way that learners are always the starting point for instruction and assessment through self-directed project-based learning.

Since its foundation, the school has been receiving a lot of attention from communities, organizations, and other education-related entities. In 2000, the school was recognized by the Bill and Melinda Gates Foundation. The foundation awarded $4 million to have this school model replicated. Based on the four major design principles of the school—(1) small learning community, (2) self-directed project-based learning, (3) authentic assessment, and (4) teacher ownership and democratic governance—60 other schools have replicated the MNCS design (Minnesota New Country School, 2013, Design Elements section). However, it is important to note that, as the first of these innovative schools, the MNCS is still the leading school in this network.

In addition to the recognition from the Bill and Melinda Gates Foundation, in 2006, the United States Department of Education, Office of Innovation and Improvement, identified MNCS among the top eight charter schools. Tom Vander Ark recently posted in an EdWeek blog that MNCS is one of 35 schools in the U.S. that should be visited. *Ladies Home Journal* listed the school as one of "America's most Amazing Schools." The Hewlett Foundation has recently included MNCS in their deeper learning network and will be posting videos on the Teaching Channel.

MNCS annually hosts visitors from around the world. Teachers, professors, legislators, parents, and school board members visit MNCS to observe a fully student-led, project-based school. The uniqueness of the school provides a model for others to observe and replicate. People from Japan and Iceland visit the school annually and have created learning environments that replicate the school model as research and development sites.

The remainder of this article will discuss the four major design principles that make this school unique, and at the end we will highlight some of the success stories of the school in terms of student achievement.

Four Major Design Principles

1. Small Learning Community

One of the major design principles of the MNCS is being a small community of about 110 students in grades 6–12 with 10 advisors. This means each advisor has about 11 students to work with in his or her "advisory." Considering that all advisors spend a substantial time with students in their advisories, they are able to build strong relationships with their students. This creates a mentor-protégé type of interaction instead of the teacher-student interaction typical in traditional schools today. Therefore, the advisors are not only responsible for academic support but also emotional and psychosocial support that their students might need.

Based on this strong relationship, the students call their advisors by their first name and have the opportunity to select their advisor for the following year. Some students change advisors each year; others remain with the same advisor for seven years. Utilizing time in the morning for "advisory group" gives the advisor a chance to know if a student will have a good day or bad day just by the way they greet each other. The advisor plays a key part in assisting the student to be college focused and bound.

The school operates in a democratic mode with many decisions being made by the students. New policies are presented to the staff from the Student Congress, and negotiations are implemented to get everyone to agree on the new item. Also, the process works in a reverse order, with staff presenting new policies to the Student Congress, and negotiating. The small school size allows multi-age advisories, mentoring for all students, and the use of Restorative Justice when disagreements arise.

2. Self-Directed Project-Based Learning Approach

As pointed out earlier, the MNCS implements a self-directed project-based learning approach. Although there are various project-based school models, the MNCS model has a strong emphasis on individual projects and full-time "self-directedness." In other words, students in the school are given opportunities to actively design, develop, and monitor their own projects. More importantly, the school encourages students to design projects that they are passionate about. Therefore, the role of the advisors is to ensure that academic standards are addressed through these projects.

Most of the projects require a number of planning activities. First and most important is an initial planning session between an advisor, an individual student, and possibly his/her parents to identify the student's characteristics and needs in order to guide him/her to set short- and long-term goals. The advisor, student, and parents then plan for projects that enable accomplishment of the short-term goals that are also in line with their long-term goals.

The next step is to complete a project proposal using an electronic form on Project Foundry, the project management software the school uses. The student fills in the proposal from before beginning to work on the project. Next, the advisor reviews the project proposal form and suggests revisions if appropriate. If not, the advisor approves the project and sends it to the student's parents for approval. Once all approvals are received, the student starts working on the project. The role of the advisor and parents is to guide the student whenever necessary during the project work. In order to keep track of what the student learns throughout the project, the student is asked to enter time logs each day, where s/he reflects on what has been accomplished for the project.

Once the student completes the project, a group of advisors (2–3) and sometimes community experts meet with the student. The student is expected to give a presentation and demonstrate the artifacts completed as a part of the project work. The group of advisors assesses student learning based on the student's presentation, time logs, and clarifying questions that they ask during the presentation. Finally, the advisor group decides on the earned credits and learning standards attained. Transparently, the advisors ask for the student's comments about their assessment and number of credits and standards earned. If there are any objections, they engage in a conversation with the student to clarify the issues and reach consensus.

3. Authentic Assessment

The advisors in the MNCS do both formative and summative assessment of learning. Each project requires using a rubric or a set of standards that are jointly developed by student and advisor. This has two potential benefits: (1) Each individual student is actively involved in the assessment process, facilitating learner-centered assessment, and (2) the student knows the particular criteria or standards for success in advance.

For formative assessment, the advisors use their observations throughout the day as well as time logs that each student enters on a daily basis. This enables the advisors to provide immediate feedback to students. Without teaching preps and a curriculum to follow, learning is fluid and demonstrated throughout the day. Advisors monitor the learning by questioning students daily to make sure that the project is making progress and authentic learning is happening.

Students are required to present their projects at least twice per year to an audience of parents, relatives, and community members. Rubrics are used by the visitors to help provide quality feedback to the presenters. Students are required to complete 10 projects per year to advance. A project credit is determined by time, quality, ability level, presentation, and documentation of learning through daily time logs. Students negotiate their learning and credits with a minimum of two staff. They develop a keen sense of negotiation through this process.

4. Teacher Ownership and Democratic Governance

The founders were the first in the country to create a public school educator cooperative, which continues to serve a dozen schools and over 200 teachers in Minnesota. The EdVisions Cooperative supports teachers in 14 schools in the Minnesota region through

such activities as providing them with staff development when requested, assisting a school with personnel issues if they have legal questions, and bringing together multiple sites for "conversation days," where they can share strategies and work together on projects or other issues. In addition, EdVisions Schools is a nonprofit organization that supports startup efforts using the four Design Principles. Both of these organizations encourage teacher leadership and management of their schools, using the "teacher professional practice" concept, which supports the teachers as leaders in decision-making in all aspects of the school. They study and plan for academics, finances, transportation, building, special services needed, testing, and any other issue involved with running a school. Many of the key individuals in these two organizations have been involved since the creation of the New Country School in 1994, or since EdVisions' new school development work began in 2000.

The advisors at MNCS maintain a stake in the success or failure of the school. The staff/owners are accountable for the success of the school, leadership in administrative and academic areas, and full commitment to the mission and vision of the school, much like the responsibilities of a partner in a law firm. This ownership entails much more sacrifice, risk, and hard work, but the advisors feel that the benefits outweigh the challenges. In return for "owning" the program, there is an increased sense of professionalism, actual input into the learning program for the students, actual input into administrative decision-making, and constructive and supportive continuous improvement.

Becoming an owner in the field of education does not fit the paradigm of the industrial-age educational structure. MNCS has found that breaking the paradigm in the methodology of interacting and educating students must be accompanied by the recreation of a professional field of educators.

Success Stories for Student Achievement

Eighty percent of the MNCS students have been postsecondary bound. Of those students, 80% complete postsecondary. An average of 35% of the students have a diagnosed learning disability and still are postsecondary bound. On national college testing (i.e., the ACT), students have performed very well with project-based learning. Since 2005, MNCS students have consistently scored several points higher (up to 5.4 points) than both the ACT national composite and the ACT state composite (up to 4.3 points) with the exception of one year.

Students have shown overall a 15% increase in math scores and a 13% increase in reading scores since 2010. Students also maintain a high enrollment in Post Secondary Enrollment Options courses, work in apprenticeships with numerous businesses, run a number of successful student-run businesses, and complete 300-hour senior projects. MNCS continues to be impressive in both traditional and nontraditional assessment measures. □

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Implementing Learner-Centered Educational Strategies: The Bloomington Project School

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The Bloomington Project School (BPS) is a charter school that has successfully adopted and implemented several learner-centered educational strategies. This case study offers a glimpse into its student-centered, collaborative, and interdisciplinary learning and teaching processes; its mastery-based assessment process; and its successful technology adoption and implementation initiative that is user-driven and, therefore, relevant to all stakeholders.

Introduction

The Bloomington Project School (BPS) is a teacher-designed public charter school in Bloomington, Indiana, that serves students from kindergarten to the eighth grade. Chartered in 2009, the school consists of multi-age classrooms with 4–5 teachers and assistants in each class and with a student-to-teacher ratio of approximately 18:1. Several teachers at BPS were interviewed and observed in an effort to develop a detailed picture of a school that has successfully adopted learner-centered educational practices.

The BPS educational approach is different from traditional, grade-based educational models. It represents a change of paradigm from teacher-centered systems. Therefore, in order to get a clear and detailed understanding of BPS, three main educational functions—learning, assessment, and the use of technology—are described in this article, as they were observed in the school.

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Learning Process at BPS

Working with State Standards

The learning process at BPS begins with identifying state standards that are to be accomplished in each grade. Teachers meet with students and parents to craft unique learning goals for each student that help meet not only the state standards, but also other learning goals. Throughout the academic year, the goals are routinely revised, during which either new goals are added or existing goals are altered. These revisions take place through continuous evaluation of student performance and/or during parent-teacher conferences.

In addition to repurposing state standards to meet unique student educational outcomes, the teachers at BPS also believe that state standards should be organized in ways that are meaningful and relevant. Therefore, at the beginning of each academic year, the teachers organize standards in an effort "…to tie them together in some kind of meaningful way. It is not just lesson after lesson after lesson; they really complement each other, build [on each other]…[and] give kids context and schema." (BPS Teacher, Personal Interview, April 13, 2012).

Once the learning goals have been identified and the state standards have been organized, the next step is to create the instructional content on which the students will be working.

Project-Based Learning

Learning at PBS is project-based with a focus on authentic, interdisciplinary education through community participation. In order to create and sustain such a learning environment, the school uses the *P3 Curriculum Framework*, which is a project-based, problem-based, and place-based (community-based) curricular framework. In this framework students, teachers, families, and community members collaborate to identify projects that address direct needs in the community.

To start building this project-based curriculum, at the beginning of every academic year, teachers and administrators collectively decide on a theme for the year. Learning objectives that students will accomplish and projects and instructional activities in which they will partake are based on the selected theme. For example, the theme chosen for the year when the school was being observed was Social, Political, and Cultural Power. All projects were designed to make students understand how power was used, how it changed, and how it was transferred from one individual or group to another.

In addition, all theme-based projects were integrated through the entire curriculum—a curriculum

that is guided by state standards. The projects are also designed such that they have a positive and constructive impact on the community surrounding the school.

Interdisciplinary Instruction

At BPS, teachers collaborate across disciplines to implement curriculum and instructional materials driven by both state standards and the overarching academic and/or social theme. As one of the teachers who was interviewed noted, "we spend a lot of time here making sure that each subject really complements the other—a lot of cross-curricular stuff." I observed that teachers collaborated using Google docs to create instructional content. Each teacher was well aware of the contents taught in the other classes, and they used that information to inform the creation of content in their own classrooms.

Seamless Integration of Direct Instruction and Project-Based Learning

Just-in-time, direct instruction is integrated with project-based learning at BPS. Once the projects are finalized, students participate in different projects and activities to master their selected learning goals for a given week. To get a better understanding of how that is achieved, consider the following example: In one of the multi-age BPS classrooms, the goal for one of the weeks during which the observations took place was to learn about feudalism in Europe. In Social Studies for that week, students learned about feudalism and the legacy of Rome. In Writing, they wrote a play on the topic of feudalism. In Science, they learned about organisms that caused diseases in Europe during the same time period. As the students continue working on these different projects and activities, teachers create short instructional sessions where the students learn new skills needed to complete the projects. Below, a quote from one of the teachers illustrates the seamless integration of direct instruction and project-based learning.

> I think in all units…our goal is to be inquiry- and project-based. But there are some things that we need to teach directly. There is some direct instruction that has to happen.…So maybe an overarching question [is]—how has colonization affected [Africa]? But in order to [answer that question], we have to know how colonization started in Africa. So then maybe there are a few direct instruction lessons to get to the heart of that, and then the kids can do some discovery. (Personal Interview, April 12, 2011)

Working Solo and in Self-Selected Teams

At BPS, students work both individually and in teams. Teams are sometimes self-selected, while at other times they are selected by the teacher. The teachers function under the belief that the students need to be able to identify their own needs. They believe in building an environment where students are able to carefully understand and vocalize their needs. Students at BPS have the autonomy to decide if they want to work individually or in a team. According to the teachers at BPS, students do have an acute awareness of their needs as learners. They can successfully identify what works and what doesn't. Teachers also noted that students initially tend to do what they want rather than what they need to do. So, for example, "you will have a kid who will work with his friend even if that's not the best thing for him as a learner. We are teaching them that there are times when I need to say that I can't work with you" (BPS Teacher, Personal Interview, April 13, 2012).

The learning goals at BPS are not just restricted to accomplishing state standards; rather, students also develop the ability to identify their own learning styles, strengths, and weaknesses and also effectively communicate their needs, disagreements, and differences.

The Assessment Process at BPS

Evaluating Student Performance

BPS students are formatively and summatively evaluated to determine learning gaps and identify instructional interventions. The results of the formative and summative evaluations help the teachers, students, and parents, chart each student's academic growth and progress.

> I make sure I serve learning. I feel that assessments also help me as an educator perfect my practice. It is not necessarily to pass or fail kids. It's to see where they are and how to better improve instruction. (BPS Teacher, Personal Interview, April 9, 2012)

Because BPS is a charter school, students there have to pass the state-mandated standardized assessments. Therefore, students are routinely administered tests similarly formatted to the standardized tests. The purpose of these tests is to ensure that the students are comfortable taking tests in the given format and subject. The results from these tests, along with the results from the various projects, help the teachers determine the students' educational progress. Teachers and administrators at BPS aim to get their students to master their individual learning goals. To determine if a student has mastered a particular skill, teachers assess student performance in multiple ways to ensure greater understanding and transfer.

In addition to multiple forms of assessment, just-in-time feedback is also very important for ensuring that students have successfully mastered their learning

goals. To ensure that teachers are able to effectively provide immediate feedback, lessons in BPS classrooms are short, and student activities and project performances are continuously monitored.

Reporting Student Performance

Student performance at BPS is reported through *Progress Reports*. Some argue that *Progress Reports* are comparable to a Report Card because they both report a student's academic performance. However, that is the only thing they have in common. A traditional Report Card is greatly different from the *Progress Report* used at BPS. The differences lie not only in the content of the report card but also in its purpose.

Progress Reports list learning goals, unlike traditional report cards that simply list the subjects and the grades acquired in them. These learning goals are identified at the beginning of the year in a parent, teacher, and student conference, along with the level of mastery to be attained in the listed learning goals. The learning goals are organized according to the different subject areas (e.g., Community, Math, Reading, Writing, Science, and Humanities).

One of the biggest differences between a *Progress Report* at BPS and a traditional Report Card is that the *Progress Report* does not include grades. Instead, it includes teacher narratives that describe the process in which the said student has worked towards attaining his listed learning goals. The purpose of the *Progress Report*, unlike the traditional Report Card, is not to compare, with help of letter grades or percentages, how one student has fared against another. Rather, its purpose is to chart the student's learning trajectory. The teacher narratives describe how the student is growing, what areas she has worked the hardest in, what skills she still needs to work on, her learning style, interests, personality, strengths, and weaknesses. These narratives form the backbone of the learning process at BPS. It is through the creation of these detailed narratives that teachers know how to help a particular student progress in his educational career at BPS.

Technology Integration at BPS

Technology solutions in BPS classrooms are seamlessly integrated into daily curricular activities. All teachers are provided with personal laptops. All classrooms at BPS have computers, giving students easy access to technology resources. Back in 2011, the school "received almost $200,000 to implement systems thinking using technology throughout the curriculum. The computer/mobile device ratio will be 1 to 1 next year in grades 4–7" (*The Project School*, n.d, para 1). All students in BPS now have iPads. Their student-to-computer ratio is 1:1. BPS has also adopted several measures, discussed below, to ensure successful and seamless technology integration school-wide.

User-Driven Technology Integration

BPS technology integration initiatives and decisions are made by the teachers in collaboration with administrators. Teachers select and implement technology tools; in other words, teachers have the autonomy and the freedom to select and reject the technology solution in use. To support and maintain technology integration, BPS organized a group of teachers as a "Technology Fusion Team." This team is given the task of (a) introducing new cutting-edge technology solutions in the school; (b) staying abreast of the latest research in implementation and adaptation of technology in educational environments; and (c) adopting new approaches and strategies to successfully integrate technology into their curriculum.

This technology team is responsible for making suggestions to the teachers regarding new technology solutions and their implementation. All technology integration decisions are ultimately decided upon and implemented collectively by all teachers. Administrators do not make decisions regarding digital media that the teachers should be using. Teachers and administrators at BPS collectively make decisions regarding technology choices.

Need-Based Technology Integration

Decisions regarding technology use are also influenced by the needs of the school, its teachers, its students, and its parents. BPS has created an environment where technology is viewed as a tool that empowers teachers and enables them to efficiently accomplish routine administrative tasks. To create such an environment, during weekly staff meetings, BPS teachers and administrators discuss technologies that they recently discovered and/or implemented. They discuss if the newly discovered technologies/applications are helpful and if they would recommend the new technology to their colleagues. They discuss issues regarding beta-testing, ease-of use, user-experience, and advantages and disadvantages of using the recommended application/software. If technologies in use do not meet the needs of the teachers and the students, teachers have the freedom to find alternatives. For example, RenWeb, a Learning Management System (LMS) that BPS uses, allows users to manage all student-related, administrative information. It also gives teachers the ability to manage grades.

Teachers at BPS, however, have chosen not to use the RenWeb grade book because it does not give them the flexibility and the functions they desire and does not allow them to evaluate without grades. As described earlier, BPS progress reports include detailed, descriptive narratives of how students are progressing

in reference to their learning goals. They do not give grades. The grade utility on RenWeb does not provide teachers with the opportunity to enter detailed narratives and therefore is not used by the teachers. Teachers, instead, have chosen to use a combination of applications, such as *Google Docs, Google Spreadsheets,* and *Endnote,* to manage and chronicle student learning gains.

Technology solutions at BPS are also viewed as means through which they can effectively implement the school's policies, mandates, and philosophies. For example, because of BPS's guiding philosophy of building a community that is conscientious about the environment and its preservation, school policy mandates that use of paper-based media be kept to a minimum. As noted in the Family Handbook, which is given to families of all children enrolled in BPS:

> The Project School uses e-mail as a primary form of communication. Using e-mail not only saves precious time, since we can hit send instead of standing in front of the copy machine, but more important is the BPS core belief to use resources wisely and be committed to using technology well. By not using paper, ink, toner, and all of the dollars/resources that go along with making copies, we save BPS and the planet valuable resources. We understand that not everyone has access to e-mail and are happy to make copies for anyone who needs this. (The Bloomington Project School, 2012, p. 12)

To support the "use-less-paper" initiative, the school ensures that all individuals at BPS have easy access to computers and useful software/applications on their premises. All activities that can be accomplished digitally are completed digitally. RenWeb, the LMS, is used by administrators to maintain student, parent, and teacher information (e.g., family information, emergency contact information, attendance, and lunch requirements). Parents are encouraged to access the system and ensure that all information is up to date. Teachers communicate with parents using weekly digital newsletters and e-mails, in addition to conferencing and phone calls. They use Web-based applications such as *Google Docs* and *Evernote*, which is a free Web-based application that helps users organize data for easy and effective retrieval, to collaborate with their colleagues and share resources and information with all stakeholders. *Google Calendar* is the teachers' application of choice when it comes to scheduling meetings with parents and students.

> Something that I really love—and Google has just started doing it—is the ability for parents to schedule conferences with teachers without me having to do it. So I can set up available times and they can come in, and they can sign up, and it just shows up on my calendar. (Personal Interview, April 13, 2012)

Foregoing the Local Client-Based Model of Data Storage

In an effort to continue a seamless integration of technology, BPS, in contrast to using a local client-based model for data storage, where data are stored on a server physically housed within a school or an office building, has opted for using Web-based and cloud-based applications, where data is stored on third-party servers. Doing so frees administrators at BPS from the issues of onsite maintenance, back-up, and server security. Companies that offer Web-based and cloud-computing services take necessary precautions to prepare for events that can lead to loss of data, such as natural disasters and server damage caused by hackers and viruses. Employing such services not only allows users to access information from any place as long as they have access to a computer and Internet connection, but also it saves valuable state budget money from being diverted towards setting up expensive IT centers and specialists. In addition, most cloud-based services are free or, if not free, then available to educational organizations at discounted rates.

Teachers and administrators at BPS use Web-based applications to address all technology needs. For example, as mentioned earlier, almost all the teachers use gmail and other *Google* applications, such as *Google Docs, Google Forms,* and *Google Calendar,* and Evernote to manage instruction-related tasks. General student information, such as attendance, lunch, family, and contact information, are maintained using a Web-based, LMS, RenWeb.

Some Caveats to Technology Integration

Caveat #1. BPS has certainly integrated technology in an effective and seamless manner. All its teachers and students are comfortable using and leveraging technology to meet their educational needs. However, there are some deterrents that teachers at BPS continue to address. For example, although teachers at BPS understand the importance and necessity of firewalls, they believe that technology use could increase if students have uninterrupted access to online information.

Caveat #2. Teachers sometimes view instruction using the online medium, such as online courses, slightly apprehensively. They do consider online instruction as a viable option but do not believe that online instruction can replicate the dynamic nature of teaching and learning.

> I think teaching is really dynamic. I think learning is really dynamic. Do I think that kids can access lectures

online? Absolutely! But I think it is hard and maybe this is just with my experience of participating in online teacher development where we are like listening to a lecture and then maybe like typing in what we think. I have experienced those e-classes. I think you lose what is relational in the learning process. I think learning is in part relational. I really do. (Personal Interview, April 12, 2012)

Caveat #3. In addition to questioning the social aspect of computer-based instruction, BPS teachers are also wary of the subjectivity of computer-based assessment systems. This issue is even more relevant at BPS because BPS does not give grades. Most computer-based assessments simply assign students a number based on their performance on a test with no commentary on how the student has progressed or where the student needs to improve. The teachers find these assessment results to be of no use when attempting to chart the students' learning goals.

Conclusion

The BPS reveals nuances that are distinct to a learner-centered school, where learning is driven collaboratively by all stakeholders. Unlike the traditional teacher-centered education system, where students learn what the state or district mandates, students at BPS have the opportunity and the support to craft their learning goals, in collaboration with the state, their teachers, and their parents. At BPS, students are not evaluated in comparison with their peers; rather, they are evaluated based on their accomplishments and individual goals. They learn more than just what the state standards have mandated. They learn about collaboration through project-based teamwork; they learn about respectful and effective communication; and they learn how to identify their own educational needs, thus evolving into life-long, independent learners. They also learn how to leverage technology to continue on the path to life-long learning. □

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Redesigning Higher Education: Embracing a New Paradigm

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Higher education is under enormous pressure to transform itself and embrace a new paradigm. Operating under an outdated model that no longer aligns with the realities of modern society, institutions of higher education are recognizing the need to drastically remake themselves or possibly cease to exist. This article explores the current landscape of higher education reform and describes characteristics of a much-needed new paradigm.

The Need for Transformation

Higher education is increasingly finding itself the target of critics. Parents are upset with the increasingly untenable cost of obtaining a degree; politicians are dismayed by the poor graduation rates of state funded universities; industry representatives lack confidence in the ability of college graduates to do the work for which they are being hired. These criticisms are in some cases recognized by the higher education institutions themselves, as a Pew study found that more than a third of college presidents felt that American higher education was headed in the wrong direction (Taylor *et al.*, 2011).

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Trow (2007) identifies three models in the history of higher education institutions, to describe how these models and their transformations include all aspects of the institutions, including size, accessibility, and selection and diversity of the student body. The first model is the *elite model* which represents the traditional "ivory tower" that focuses on preparing a small portion of the population, the "ruling class," for elite roles in society. The mass influx of men returning from war after World War II led higher education, particularly in the United States, to shift to a *mass model*, as a much higher percentage of the population began to attend higher education institutions—from 4–5% prior to the war to 30–50% by 2000 (Trow, 2007). The mass model therefore focuses on transmitting skills to prepare a larger percentage of the population for a broader range of elite roles.

The pressures faced by higher education today represent the current need to transform from a mass model (and in the case of some institutions, from an elite model) to the third model of higher education: a universal model. Higher education is now charged with educating virtually the entire population, including increasing numbers of students from around the world, and helping to adapt this population to rapid social and technological change (Trow, 2007). Some 94% of United States parents expect their children to go to college (Taylor *et al.*, 2011).

With this shift to an expectation to educate a much larger number of students, requiring a shift from a mass to a universal model, the role of higher education in society is being pressured to change. Institutions operating under a one-size-fits all model of instruction were traditionally well aligned with the goals of an elite model—only the elite were expected to graduate. However, a universal model is tasked with educating the vast majority, if not all, of the population. No longer are universities operating in industrial economies where the goal is to sort learners into the elite leaders and all others as workers who would operate under the direction of the elites (Reigeluth, 1994). In today's knowledge economies, higher education is instead expected to educate large numbers of knowledge workers—critical thinkers and problem solvers. However, only a little more than half of American students entering college earn a Bachelor's degree (Selingo, 2013). If higher education is charged with universal education, clearly it is failing in its mission.

In addition to a much larger percentage of the population planning on college, the diversity of students is also increasing. Only slightly more than one third of students enrolled in college are aged 18–24 (Selingo, 2013). Furthermore, the numbers of international students continues to increase, with more than 2.5 million students studying outside of their home countries; a trend expected to grow to an estimated seven million by 2020 (Altbach, Reisberg, & Rumbley, 2009). This increased diversity puts further pressure on higher education institutions already struggling to graduate students to put aside their elite approaches to education. They are failing students, and with so many part-time students who take a course at a time while continuing to work, and international students challenged with earning degrees while studying in a non-native language, the elite approaches to instruction, which focus more on sorting of students rather than ensuring their mastery of competencies and attainments, are only likely to result in ever-decreasing graduation rates. This is further exacerbated by the increased mobility of students who wish to take courses from multiple institutions and craft learning more in line with their specific needs, rather than be forced to accept the inflexible requirements of existing degree programs.

Apart from the expectation to educate a much greater number of increasingly diverse students, who exert increasing demands for more personalized and customized approaches to education, higher education is also tasked with producing knowledge workers ready to engage in the jobs of a knowledge economy. The content-focused approach of the traditional elite and mass models no longer suits the knowledge-skills requirements of knowledge economies. Workers are needed who are able to self-educate, solve new and complex problems, communicate and collaborate with others, and locate, evaluate, and effectively implement information (Reigeluth, 1994). The traditional division of degree programs into often isolated subjects and disciplines often results in graduates who have absorbed content knowledge but lack the skills to apply that knowledge in a meaningful way. This has led to some employers expressing skepticism of college credentials' meaningfulness for evaluating the employability of an applicant (Belkin, 2013).

With these pressures to better educate significantly more and increasingly diverse students than before, higher education is also facing additional pressures to transform. Public funding continues to shrink (Bruininks, Keeney, & Thorp, 2010), in some measures to levels not seen since the 1960s, when student enrollment was vastly lower (Selingo, 2013). This in turn increases competition among institutions, while promoting the commercialization of higher education. The resulting increase in tuition, coupled with poor graduation rates, has raised the ire of many, including parents and lawmakers, with tuition costs rising at three times the rate of inflation since the 1970s (Selingo, 2013). So at the same time that higher education institutions are seeing significantly less public funding than they are used to, they are also being pushed to maintain or cut tuition costs, resulting in

great pressure to generate new funds or reduce budgets.

Finally, technology is also exerting significant pressures on higher education. For some institutions, distance education has been a path to increased commercialization as larger numbers of students can be taught with fewer or less qualified instructors. However, at the same time, there is a growing availability of open educational resources (OERs), including Massive Open Online Courses (MOOCs), which offer free classes to thousands of students at a time, and there is increased competition resulting from available distance education degrees, bringing global players into the once geographically local marketplace. These are direct threats to the traditional manner in which universities have conducted business. With all of these highly visible pressures highlighted by the concerns of numerous stakeholder groups, the need for higher education to transform itself is very pressing, and the significance of these transformations has perhaps never been so drastic.

The Need for Systemic Transformation

Advocates of systems theory believe that the application of systems thinking is necessary to transform an outdated system from one paradigm to a new paradigm, designed to meet changed needs. Systemic transformation utilizes systems and design theory to design both a new system and the process for transforming it from the current paradigm (Watson, Watson, & Reigeluth, 2008). Given the significant differences between the needs, expectations, and environments of an elite or mass model and a universal model of higher education, a significant transformation is necessary in order to implement a universal model that is suited for the realities of today. The need to educate a large and diverse body of students while navigating the economic and technological realities and the social and industrial needs of today's knowledge economies requires significant transformation to a new model—a new paradigm of higher education.

Systems theory is appropriate to address the challenges of higher education because institutions of higher education are very complex systems, requiring a complex and difficult transformation process (Bromage, 2006). Universities now operate at a global level, with campuses all around the world, and courses offered both locally and online. They have complex missions to conduct research, serve society, and educate the populous. These missions are often at odds with each other, and, along with the other pressures discussed, result in a great deal of push and pull from all directions.

A system is composed of relationships among components that comprise the system as a whole. However, systems themselves are not precisely defined as they relate to other systems, are comprised of sub-systems, and exist within supra-systems. Therefore, an analysis of the system must first be conducted in order to define its boundaries. Duffy and Reigeluth (2010) cite others in recommending that these boundaries be defined by drawing a circle around all units that work together closely on a daily basis in order to deliver a product or service. In doing so, it is likely that for most institutions of higher education, the university will be the system of transformation; and the transformation process will require mindset change for all stakeholders and transformative paradigm shifts, including work processes and change processes, for all parts of the system (Watson & Watson, 2013). Systemic transformation requires a focus on idealized design and the implementation of an iterative process of transformation that self-evaluates as the system pursues its ideal design (Watson, Watson, & Reigeluth, 2008). An ideal design would by necessity need to implement a new paradigm to meet current challenges. Therefore, it is important to consider what a new paradigm of education would look like.

The Nature of the New Paradigm of Higher Education

The very pressures pushing higher education to transform also can indicate what the new paradigm should be like. The previous discussion of the diverse and growing student body is a strong indicator of one of the key attributes that the new paradigm will need to embrace. Given the diversity of students, including part-time students and students seeking to include coursework from numerous universities (and potentially even certification from MOOCs and other OERs), there is a strong need for a more personalized or customized instructional process. Trow (2007) argues that the shift from mass to universal higher education includes a focus on lifelong learning and largely unstructured personalized education that subordinates the teacher and provides broad exposure to varied and novel perspectives, often utilizing technology.

The need for improved critical-thinking, problem-solving, and knowledge skills, such as communication, collaboration, and information literacy, requires a shift to the learner-centered paradigm (Watson, Watson, & Reigeluth, 2008) that is customized and supported with systemic application of technology to the entire learning process and for all stakeholders in that process (Reigeluth, Watson, & Watson, 2012). A significant aspect of this customized approach to education will be the unbundling of the learning process. This means that higher education will have to transform from the inflexibility of its current degree

programs and even break away from the restrictions of its semester and course-based nature. These approaches are institution-centric rather than learner-centered.

The learner-centered paradigm will support diverse learners by accommodating their availability, meaning removing the barriers of semester entry to learning content. It will furthermore remove the time-based barriers incumbent in standard courses, which adhere to these semester and content-oriented restrictions. The adoption of attainment- or competency-based practices of education focuses on skills and is therefore better suited to the needs of the information age. Courses typically have broad and vague learning objectives, and students completing the course are given a letter grade, which functions as a means to compare students rather than an indicator of what a particular student is actually capable of. The dissatisfaction of employers with the college transcript has already been discussed. A collection of course titles and letter grades does little to actually indicate the skills and knowledge of a graduate.

A move to e-portfolio and digital badge systems puts the focus on discrete learning attainments or competencies that are project-based and supported by evidence. Rather than a letter grade, a student who has earned a digital badge has very precise learning competencies that have been demonstrated, a description of what was required to earn the badge, and evidence in the form of the actual work submitted to meet those requirements. Employers seeking to hire graduates would be able to see for themselves precisely what the graduate was capable of; the graduate would have ownership of the e-portfolio or digital badges that had been earned and the university had certified, and the university itself would have evidence of the quality of its graduates as well as a valuable resource in the form of data to not only improve the quality of the education it provides but also inform employers looking to hire graduates with very specific skill sets.

The attainment-based nature of such a paradigm would also support students in customizing their own learning programs, allowing for the development of very specific skillsets. It would also support certification of attainments through alternative means, including informal educational experiences or volunteer work, and certification of pre-existing skills and knowledge, and those gained through alternative education, such as through MOOCs or other OERs.

Such a fundamental and dramatic shift to a customized, unbundled model that is attainment-based rather than course-based would be greatly aided by leveraging such technology as an e-portfolio or digital badge system as part of, or the core of, a systemic application of learning technology (Reigeluth, Watson, & Watson, 2012). This learner-centered, customized paradigm will better meet the distinct needs of such a large and diverse student population, while also better serving employers and society as a whole.

Despite the mission of universities involving a social contract for equity, the reality is that higher education has been becoming less of a meritocracy with more and more students at top institutions coming from wealthy families (Selingo, 2013). The unbundling of education and the transparency of an attainment-based system may not only result in a renewed commitment to equity and social mobility, but also support cost savings and creative earnings for institutions seeking to find a foothold in an increasingly challenging economic landscape. A better understanding of what students are truly capable of and prepared for will result in cost savings for students, who will be better supported in their learning in a learner-centered and customized environment, which will result in less wasted resources for universities in the form of reduced dropouts and more flexible infrastructures.

This sort of shift would also require a significant shift in both mindset and practice of how higher education approaches instruction. As previously mentioned, higher education has multiple competing missions. The research mission of a university can often be in direct conflict with the teaching mission. Faculty who are renowned researchers may be disinterested in or unskilled at instruction. Oftentimes, research institutions focus on research as the core component of faculty earning tenure. It is therefore not in the best interests of untenured faculty to focus more than the bare minimum required on their instruction of students.

Consequently, a rethinking of faculty roles and institutional approaches to education is needed. Recognition of the need to hire educators who are foremost excellent teachers is needed. Researchers can focus on their research with their instruction primarily reserved for graduate students in areas directly linked with the researcher's research. Those faculty hired as educators would see a significantly different role as well, from content providers in lecture halls, to facilitators of the learning process, helping students plan their customized learning paths, guiding their learning, helping to identify and evaluate projects to meet attainments, providing feedback, and mentoring groups of students over a period of years.

This sort of fundamental shift will require mindset change across the university, as well as significant policy and process change. This can be particularly difficult in higher education, which has a culture of autonomy and everyday communication more

typically centered on social rather than professional activity (Hopkins, 2002). Ultimately, higher education institutions will need to embrace a culture of participatory, engaged leadership, promoting mindset change across all stakeholder groups. This culture will also need to embrace a shift to implementing an ongoing, iterative transformation process that is designed to respond to pressures and continuously innovate and transform towards the idealized design (Duffy & Reigeluth, 2010).

From Reactive to Proactive

The pressures on higher education are very real and recognized. Dissatisfaction runs high, but this dissatisfaction and frustration are also spurring innovation. Some critics predict that ultimately higher education, not known for its ability to be innovative about itself, will continue its history of slow change, continue down its path of obsolescence, and ultimately fail and be replaced by a novel alternative (Christensen, Horn, & Johnson, 2008). While this is plausible, numerous institutions are already implementing innovative practices. The challenge to these and all units of higher education is to recognize the need to target systemic transformation rather than limiting change to piecemeal interventions.

Systems theory tells us that a system exists to survive. Piecemeal interventions do not result in significant change to the system. For example, the introduction of computers to instruction often results in the replication of current processes in a new format (presenting presentation slides with PowerPoint instead of on an overhead transparency, or uploading handouts to a course management system instead of handing them out in class). A system asked to address needs for which it was never designed is a system under stress, and therefore must be significantly transformed, by undergoing a systemic transformation effort, to truly fulfill its mission and therefore survive. In order to fully realize a new paradigm, an intentional and focused systemic transformation effort is needed that uses these interventions as targeted leverage points (Meadows, 1999) or strange attractors (Reigeluth, 2006) to exert pull on the unchanged parts of the system resistant to change and build momentum to shift the entire system to the new paradigm. Ultimately, threats can also result in opportunities, and those systems of higher education that make a commitment to be proactive rather than reactive in this climate of pressure and dissatisfaction have the greatest chance to transform themselves to the new paradigm necessary to meet their evolving missions and thrive in the current environment as well as those to come. □

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Paradigm Change in Military Education and Training

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All branches of the U.S. military are moving toward education and training that is tailored to meet individuals' needs wherever they are and whenever they are ready to learn. The result will be a culture of continuous, personalized learning with learner progress that is based on proficiency and a greater emphasis on technology-enabled immersive learning environments. This article identifies challenges for military education and training, followed by a description of the ways the Army, Air Force, Navy, and Coast Guard are transforming their education and training systems to address those challenges. Finally, common threads, representative programs, and impediments to paradigm change are discussed.

Introduction

Today information technology creates the opportunity for individuals to acquire knowledge and skills from multiple sources. These sources include peers, mentors, and traditionally structured learning environments as well as evolving sources, such as social media, mobile devices, and other electronic means that allow on-demand access to information and experts who address specific questions and problems. The result is expanded models for education and training that can be tailored to meet individual needs and delivered at time of need.

A new military education and training paradigm is emerging in which individuals will enjoy unprecedented access to learning facilitated via computers, virtual environments, and hand-held mobile devices. That learning will be individually tailored using advanced learning management systems, and the resources will be updated not only by "instructors," but also by individual service members based on real-time changes to tactics, techniques, and procedures as they occur in operational environments. The result will be a culture of continuous, personalized learning with a reduced emphasis on traditional learning infrastructure, such as formal classrooms and lectures, and a greater emphasis on technology-enabled learning, such as simulation and gaming and virtual instruction.

The Department of Defense and each of the military services has long sponsored research and development involving both training technologies and training methods. These efforts have included instructional system development, simulation and gaming, advanced distributed learning, and intelligent tutoring systems. The Assistant Secretary of Defense (Research & Engineering) has identified personnel and training as a science and technology focus area. The objective is to discover, develop, and demonstrate advanced training methods and technologies that will improve military readiness and reduce cost. In order to achieve this objective, the Service laboratories are focusing their science and technology efforts on the principles of training design, the development of scenario-based training, and the establishment of "persistent integrated training" (Tangney, 2013).

The switch from the sorting-focused, standardized paradigm of education in which learner progress is based on time, to the learning-focused, customized paradigm in which learner progress is based on proficiency is every bit as important in the military defense sector as it is in the K–12 and higher education sectors. This article describes recent activities in pursuit of paradigm change in U.S. military education and training systems.

Military Education and Training

Military education and training is a big enterprise. It occurs throughout the career of military members and is conducted in two different venues: formal educational and training institutions and operational units. In this article, we focus on institutional education and training rather than operational training. However, it is important to remember that, while institutional training provides the basic knowledge and skills needed for each Service member, advanced competencies and expertise are

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currently developed mostly within the operational portion of the Services. In ships, Marine companies, Army battalions, and Air Force squadrons, individuals learn the advanced skills, tactics, techniques, and procedures and engage in the deliberate practice needed to successfully perform their military mission. Many of the same changes associated with institutional military education and training are also becoming a part of operational training.

According to the U.S. Army Training and Doctrine Command (TRADOC), over half a million individuals annually complete course-based training in the US Army alone (TRADOC, 2011a). Those courses span a wide range of learning (e.g., basic military skills, complex technical training, national security policy and strategy) and audiences (from basic recruits to senior officers).

Initial military training for each of the Services follows the same general progression from basic training to skill training. Basic training is an intense eight to twelve week period of indoctrination and instruction designed to transform recruits into disciplined Soldiers, Sailors, Marines, Coast Guardsmen, or Airmen who are physically fit and possess basic military knowledge and skills. Basic training provides recruits fundamental training that includes core values, weapon maintenance, military customs and courtesies, drill and ceremonies, first aid, marksmanship, and military justice.

Following the completion of basic training, service members enter specialty training, where they develop skills in a designated specialty that will prepare them for one of the many military career fields (e.g., aircraft mechanic, infantryman, sonar technician) available within each Service. Assignment to specialty training is determined by the needs of the Service, scores on the Armed Services Vocational Aptitude Battery, and individual preferences. The length of specialty training varies widely from only a few weeks to as long as two years. Following completion of specialty training, individuals are assigned to units and begin performing their military jobs. As they progress in their career field, individuals receive both on-the-job and formal skill training.

Each of the Services also provides Professional Military Education (PME) opportunities for officers and senior enlisted personnel. While education and training are not mutually exclusive, PME differs from skill training in that it emphasizes material that has a more traditional academic flavor. Military education is intended to help military personnel develop the good judgment to decide when and how to apply their knowledge and skills in the larger military, political, and social context, and it provides educational opportunities within the Services and at external academic institutions.

Challenges for Military Education and Training

Given both the cost and the importance of producing a well trained and well educated military, "efficiency (time and resources expended) and effectiveness (production of human competence) are critical" (Fletcher, 2009, p. 72). However, there are several challenges involved in providing efficient and effective training and education for our military. These challenges include:

- less money available to maintain and update classrooms and courses as the overall defense budget declines;
- the need to provide training for a wide variety of missions, each requiring its own set of competencies;
- increased complexity of modern weapon systems;
- rapid changes in doctrine, tactics, and equipment;
- frequent deployments away from home-station that limit opportunities for in-resident training and education; and
- increased workload as the military continues to perform the same jobs with fewer people.

As a result, each of the Services and the Department of Defense are reevaluating their training and education paradigms in order to gain greater efficiency and effectiveness.

US Army Education and Training

Systems change in response to their systemic environment. Small changes in the environment are handled by piecemeal reforms in a system, whereas dramatic changes in the environment require paradigm change in a system. The U.S. Army's environment has changed dramatically over the past decade or two. Complex technologies now pervade all aspects of the Army's operations. Also, the war on terror has made it far more difficult to tell who the enemy is and to find the enemy. These new conditions require much more sophisticated and well-trained soldiers, more adaptability (i.e., distribution of decision-making authority to lower ranks), more problem solving, and more cultural sensitivity, collectively referred to as "operational factors."

In recognition of the dramatically changed needs for its education and training, the Army's Training and Doctrine Command (TRADOC) produced a pamphlet (Pam 525–8–2) in January 2011 calling for dramatic changes in its education and training systems. Called *The U.S. Army Learning Concept for 2015* (TRADOC, 2011a), this pamphlet:

- Describes the need for a new learning model that meets the All-Volunteer Army's need to develop adaptive, thinking Soldiers and leaders capable of meeting the challenges of operational adaptability in an era of persistent conflict.
- Describes a continuous adaptive learning model that instills 21st century Soldier competencies through a learner-centric 2015 learning environment, supported by an adaptive development and

delivery infrastructure that enables career-long learning and sustained adaptation. (p. 2)

The pamphlet suggests that designers and instructors could start making the following changes right away:

1. Convert most classroom experiences into collaborative problem-solving events led by facilitators who engage learners to think and understand the relevance and context of what they learn.
2. Tailor learning to the individual learner's experience and competence level based on the results of a pre-test and/or assessment.
3. Dramatically reduce or eliminate instructor-led slide presentation lectures and begin using a blended learning approach that incorporates virtual and constructive simulations, gaming technology, or other technology-delivered instruction. (p. 9)

In other words, *The U.S. Army Learning Concept for 2015* calls for a transformation to the learner-centered paradigm of education and training. Continuous learning, adaptive instruction, competency-based learner progress, authentic task-based learning, and personalized learning are central to this concept.

The U.S. Army Training Concept 2012–2020 (TRADOC Pam 525–8–3) was also released in January 2011 (TRADOC, 2011b). It describes a vision for a training system that spans from the institutional learning environment to the operational environment to provide the training capabilities outlined in Pam 525–8–2. The vision features a central role for flexibly adaptive technology (a networked Integrated Training Environment–ITE) to offer high-fidelity simulations of "full-spectrum" operations. These simulations "can provide rapid training content updates and are responsive to the operational commander's training needs" (p. 23). The technology also offers distributed learning anytime and anywhere in the operational as well as institutional environment.

Clearly, the need for paradigm change in education and training is every bit as important in the U.S. Army as it is in PreK–12 and higher education. Another case in point is the U.S. Air Force.

US Air Force Education and Training

Much like the Army, the U. S. Air Force has also documented the need to update its approach to education and training, given expanded opportunities to bring new approaches and technologies into the learning environment and budget pressures that demand innovative ways of creating and sustaining well trained Airmen. Air Force Doctrine Document 1–1, *Leadership and Force Development* (Department of the Air Force, 2011), identifies the need for a deliberate continuum of learning involving education, training, and experience to develop the competences needed to meet operational needs. This continuum of learning requires access to learning environments that are adaptive to both the individual and to their rapidly changing world, based on sound theory, and enabled by technology.

In 2008 the Air Education and Training Command (AETC) issued a vision of continuous and collaborative learning (AETC, 2008). It focuses on creating a new learning culture for the Air Force based on a paradigm change from *"education and training to…learning and the learner"* (AETC, 2008, p. 11). This paradigm change is based on the creation of precision learning opportunities that are tailored to the learner and delivered using a variety of formats. Critical to creation of such precision learning environments is the development of a new generation of learning management systems linked to a dynamic, enterprise-wide knowledge repository that provides accurate and timely content.

In February 2013 the AETC expanded on that vision with the release of An *AETC Vision for Learning Transformation,* which expressed the need to "change the paradigm of how we deliver education and training to our Airmen" (AETC, 2013, p. v) in order to provide personalized, interactive, anytime, and anywhere instruction in which learners accept responsibility for their own learning and are able to progress at their own pace. This vision is supported by the *Air Force Global Science and Technology Vision* (DAF, 2013), which calls for a "state-of-the-art information technology communication backbone [that will] facilitate full-spectrum use of virtual learning technologies…where students learn on demand by interacting with combinations of real and avatar/virtual teachers" (p. 34) to enable faster and more effective learning.

In support of this vision, AETC has undertaken a project to update the guidance in Air Force Manual 36-2234 (DAF, 1993) for the development of education and training systems. Among the changes being considered for the update is to add guidance for designing learner-centered, project-based, and anytime anywhere instruction. The little guidance that is currently provided for instructional strategies in the manual does not address learner-centered instruction, project-based instruction, or anytime anywhere instruction.

US Navy Education and Training

Although the Navy has not issued the same kind of broad, overarching documentation regarding the need to improve its education and training paradigm, the same themes are reflected in a variety of documents. For example, the Navy views itself as a learning organization that must deliver training in a timely, modular manner throughout a Sailor's career (U.S. Navy, 2010). *The Naval Education and Training Command Strategic Plan 2013–2023* (NETC, 2013) has identified a number of

education and training focus areas to include:

- exploiting instructional design and technologies such as simulation and virtual reality;
- reducing training time and cost;
- assessing training effectiveness;
- developing training delivery capabilities that increase access to training material; and
- developing effective cognitive learning strategies.

Furthermore, the Office of Naval Research is developing innovations that support both the Navy and the Marine Corps.

US Coast Guard Education and Training

In the US Coast Guard the Advanced Distributed Learning (ADL) work group is developing a tool that identifies and prioritizes potential resident training to an ADL environment that includes facilitated online training, self-paced e-learning, electronic performance support systems, and structured on-the-job training, according to the ADL charter.

In the Senior Enlisted Leadership Course, four modules were converted to facilitated online training, so that the overall focus of the course became much more learner-centered, where students assumed total control of their learning experience from the minute they posted their biographies online. Consequently, the students' intrinsic motivation toward the subject matter and themselves as leaders increased.

One additional effort described in the FORCECOM 2013 Business Plan is to launch a new "Virtual Training Center" via a learning management system. This will enable members to have full access and control of their learning and development, whether completing a required skills resident training, an e-learning mandated training, or on-the-job training and qualification. This transition puts each member at the helm of their own development, which is a major part of paradigm change.

Common Threads

The Department of Defense and each of the Services clearly see the need to modify their historical approaches to training and education. Common themes include:

- the need to move from an Industrial-age model of skill training to a more cognitively oriented model;
- more rapid and responsive development and modification of learning resources;
- bended learning environments;
- optimization of training times and elimination of idle time;
- increased use of information technologies;
- more targeted personalized and adaptive training; and
- increased emphasis on human competencies.

However, while the military clearly seeks to shift from an industrial-age to an information-age model of learning, this shift may not be appropriate across the entire spectrum of military education and training. For basic military training (e.g., Army Basic Combat Training, Navy Boot-Camp), standardized training may typically remain a more appropriate paradigm for several reasons: (1) the recruits all need to learn mostly the same common military skills, such as first aid, drill and ceremony, marksmanship, and basic combat tactics; (2) the experience establishes a culture and mindset based on traditional military discipline and courtesy that would be difficult to establish in a more personalized setting; and (3) it serves a sorting function for recruits who are not well suited for the service. However, basic training has become more learner-centered within a standardized content environment. For example, the Coast Guard has used tablets to deliver information-rich content in e-learning modules for its Direct Entry Petty Officer Training (DEPOT), and some of these modules are used in a personalized way in basic training via a student learning resource center.

Representative Programs

Intelligent Tutoring Systems

While it is well established that a computer-based or intelligent tutoring system (ITS) can be as effective as human tutors (VanLehn, 2011), their use is still not widespread. Reasons for the limited use of this technology include development costs, difficulties in modifying or reusing content, and inflexible pedagogical strategies. However, decreases in the cost of information technology and new techniques for developing and updating the underlying models and content of a tutoring system offer the promise of a new generation of cost-effective, flexible ITS.

Each of the Services continues to invest in advancing the state-of-the-art for ITS. For example, the Air Force Research Laboratory recently issued a Small Business Innovation Research topic for the development of goods that would allow more efficient production of simulation-based intelligent tutors and adaptive instruction (Department of Defense SBIR Topic AF141-025, n.d.). The goal is to develop tools that are user-friendly for subject-matter experts and instructional specialists to design and update training materials.

Another example of the military's desire to improve its ability to deliver training using ITS is the Generalized Intelligent Framework for Tutoring (GIFT) program led by the Army Research Laboratory. GIFT is an open-source, publicly available, Service-oriented, ITS architecture that is intended to create a modular framework and standards to increase the application of ITS by providing enhanced authoring capabilities, to support alternative training strategies, and to lower overall costs (Sottilare, Graesser, Hu, & Holder, 2013).

GIFT is specifically designed to include ITS compo-

nents for the creation and delivery of training, a learning management system, and a testbed component that will evaluate how well alternative ITSs approach training methods, strategies, and content to achieve the desired learning outcomes. The long-term goal is to empirically evaluate learning outcomes and to use those outcomes to modify leaner models, training strategies, and content based on the analysis of those outcomes.

Virtual Worlds

The U.S. Air Force Squadron Officer College (SOC) is designed to provide lieutenants and captains professional military education that will foster their leadership skills. Providing both resident and nonresident instruction, SOC is working to eliminate "day-long lectures and unending decks of PowerPoint slides" (Air University, 2013).

As part of its educational transformation, SOC purchased a *Second Life* region and created an immersive virtual campus (Arenas & Stricker, 2013). SOC has developed a series of immersive learning activities for SOC students. One example of these learning environments allows students, as embodied avatars, to interact with one another in a decision-making game. The learning objective of this game is to develop the collaborative skills need to complete a complex mission (e.g., hostage rescue) involving critical thinking, problem identification, analysis of alternatives, risk assessment, and performance monitoring during an interactive, continuously evolving exercise.

Individualized Learning Models

To help meet the need for technologies and methods to improve Marine training, the Human Performance Training and Education in the Office of Naval Research, Code 30 (2012), sponsors research and development efforts targeted toward accelerating the knowledge and skill learning necessary for adaptive thinking and decision making. The long-term goal of this program is to develop the capability to create individualized learning models for each Marine. These learning models will then be used to create and tailor individual and small-unit training based on the specific needs of the individual or unit, rather than relying on one-size-fits all training (Office of Naval Research Code 30, 2012). Similar research and development programs targeting longitudinal, individualized training models are also being pursued by the Air Force and the Army and are consistent with the National Academy of Engineering's identification of advanced, personalized learning as a major challenge for the 21st century.

Impediments to Paradigm Change

While it is obvious that the United States Military is aware of the need to change its education and training paradigm, there are a number of impediments to such change. Just like any other transformation, changing the paradigm of military education and training is a complex activity that must occur within an incredibly complex system of systems.

One impediment to changing military education and training is that it requires resources. Money, time, and manpower are required to translate the vision for more effective, personalized learning into reality. Unfortunately, there is no new money for that translation. Therefore, paradigm change will be a gradual, evolutionary process that occurs in small steps as the Services seek to maintain a steady output of qualified individuals while attempting to move toward the new paradigm.

The military personnel system is also a potential impediment, since it is not currently designed for individualization. When training is calendar-driven for a set period of time, the personnel system knows that those individuals will be the responsibility of the school for that time, and upon successfully completing that training, they will be available for duty at a new station on a fixed date. If, on the other hand, training is individualized, trainees might enter training on different dates and complete training on different dates.

The Instructional System Design (ISD) process and the instructors are another potential impediment to change. Because trainees, instructional media, and content are dynamic components within the instructional system, it is difficult to perform a one-time, front-end analysis with enough breadth and depth to support a robust, continuous, personalized learning system that meets the changing needs of learners as their operational hardware, software, and knowledge evolves. As a result, continuing reanalysis and rapid prototyping are likely to occur throughout the entire instructional cycle of future education and training systems.

Personalized learning will also place new challenges on the instructors. They will have to be prepared to deal with widely divergent levels of learner knowledge and experience on a continuous basis. And their role will need to change from "sage on the stage" to "guide on the side." □

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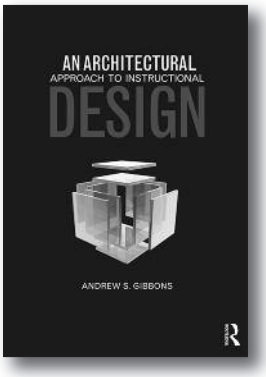
Book Reviews



Advancing Design for Education: The Maturing of Instructional Design

Book Review: Andrew S. Gibbons. ***An Architectural Approach to Instructional Design.*** *Routledge; 478 pages; 2013; $59.95 (hardcover, $160.00; e-book, $47.36).*

Reviewed by Brad Hokanson

An Architectural Approach to Instructional Design is an encyclopedic and valuable exploration of ideas and theories about the design field and its role in instruction. Andrew Gibbons takes a broader and more nuanced view of the concept of instruction—and instructional design—than most in the field, exploring concepts that are both theoretically strong and directly applicable on a number of levels of learning.

The book is well suited to an audience that includes professors, researchers, and graduate students in the field. It would be invaluable for graduate students in exposing them to a wide range of ideas, while at the same time providing a strong background in designing for the use of educational technology. As an educational effort in itself, it is a deeper and more thoughtful book than many texts that focus on more dogmatic processes, as it

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connects a range of architectural and design concepts to the field of instructional design.

Most books are generally a linear experience; there's a start, an end, and a structure that organizes the volume. Some books are read for entertainment and are best experienced front-to-back in an orderly manner, while others examine ideas as a more complex form of resource that need a closer examination, as is the case here.

Close reading, as developed by Adler and Van Doren (1941, 2011), encourages first an examination of the complete book to understand the structure and argument. With *An Architectural Approach to Instructional Design*, that approach is worthwhile in addressing an extensive examination of the topic. The book has an orientation that is not focused solely on little used design methods but explores an open and detailed comparison with other design fields. And the book itself is structured to support better retention and learning.

In this case, the author has provided a number of explicit guideposts to encourage the reader. Much of the organizational framework and theory is clearly outlined in the Introduction, providing a base for understanding the work. One extremely helpful aspect of the book is the inclusion of reflective questions throughout the chapters, helping the reader to examine ideas presented in a more applicable manner. These "Application Exercises" are very helpful means of engaging readers more fully in the content of the book. Written by an educator and not a novelist, the book is structured as a learning experience.

Reframing Instructional Design

Recognizing the complexity of the task facing instructional designers, Gibbons presents a reconceptualization of the role of "instructional designer" as being an "instructional architect." He contends renaming would better recognize the broader involvement needed in all the aspects of instructional design, of synthesizing all the various aspects of the design into a coherent whole. The instructional architect is seen as responsible for a complete yet dynamic and organic system. The metaphor is apt and recognizes the nature of complex and substantial design work, whether in built form or in educational systems.

Beyond Process: Layers and Conversation

As a resource and as a textbook for instructional design, the book will be a great new resource for the field, providing a new, more developed view. It does not focus on the details of ADDIE or other instructional models but examines deeper thoughts and theories of the process of designing. A number of new ways of structuring the epistemology of instructional design are included, which could have been developed as a book in their own right. Perhaps the most innovative topic deals with the concept of layers in design.

For me, coming to instructional design from the field of architecture, and as a practicing architect, the idea of layers organizing functions in a building is well understood and can be literally and figuratively imagined as the sheets of construction documents (or "plans"). A structure may be delineated on one layer, with heating and ventilation systems on another. Originating as semi-transparent paper drawing sheets, this organizing method is now a staple of CAD systems. As many in the field of instructional design have experience with layer-capable programs, such as Adobe Illustrator or Photoshop, the concept of layers is easily accessible.

Gibbons takes this idea further, using the concept of layers to examine other, more abstract issues of design, revealing and recording the thinking of the design process. How the layers are represented, communicated, and shared remains a challenge; in architecture, drawing of concrete structures is simple, whereas representing the abstract structures of learning and instruction is much more difficult. In the field of instructional design, this capability for communication will come through practice as the concept of layers is more fully accepted.

Gibbons also examines newer trends and changes in the field of education. Within the chapter on the "new learning," the examination of learning as conversation recognizes the engagement that is necessary in the learning process. It is a non-delivery approach: accepting of back-and-forth communication and involvement of the learner, whether through problem-based learning, design-based research, or the coaching of the individual learner. While Donald Schön's work is examined, giving a strong background to the concept of education—and designing—as a conversation, that area could be expanded as a recognition of a substantial and effective form of teaching.

Design Thinking

Even with the extensive sources cited, however, there are areas which could have been addressed further, areas which are discussed deeply in other fields, such as architecture and interactive media. One of the leading areas of discussion in design fields of late is the concept of design thinking. *The Design Way* by Nelson and Stolterman (2003) and Nigel Cross's work (2006) both examine the concept of design thinking, which could provide a strong underpinning to re-purposing of an architectural approach to the field of instructional design. And design thinking has been an essential part of the work of Ideo and the Stanford D-School. Their premise is that design thinking comprises a "third way" of thinking, a different epistemology, which is conceptually different from the work of either humanists or scientists.

Going beyond the artifacts, examining further how one could connect instructional design to the thinking and theory of other design fields would have been valuable. Does the value of examining the *products* of a design field provide sufficient insight for the field of instructional design to advance? Or are the theoretical examinations from within those fields needed to move instructional design to another level? Are design examples sufficient to understand the process, value, or epistemology of design?

For example, Löwgren and Stolterman, in *Thoughtful Interaction Design* (2004), provide a persuasive argument for the concept of problem seeking or finding as central to the practice of the designer. This expands the simple concept of Newell and Simon (1972) of problem solving as a direct rational effort, and this pro-active concept would have fit well into Gibbons's writing.

One major conceptual difference between instructional design and the broader design fields illustrated by Gibbons's writing is the continuing strong tendency for including or referencing systems theory and analysis. Within design fields such as architecture, a view of holistic, sustainable understanding is highly valued, but it does not center on systems thinking. There is also a more current, or even "post-modern" view of complexity, dynamic context, and wicked problems, which is exemplified by Jane Jacobs. Her *Death and Life of Great American Cities* (1961) deplored the systems thinking, planning, and rebuilding of American cities in the post-war era, finding greater value in the rich interplay of urban life. The "unpredictable world" of Nelson and Stolterman is what we see every day in our cities and on our screens. Systems approaches promise an answer, which I often consider to be an illusion, and Gibbons to his credit begins to forecast some of the unintended or unanticipated consequences of systems and technological change.

Overall, Gibbons takes an expansive view of "design," one which is a complex, non-linear, and dynamic process. This is seen in his description of more complex or mature ways of examining the design process: the concept of many layers to the work of the designer; or understanding education as more than the effective dissemination of information; or that education must be more of a conversation. These are the tacit and experience-based skills of the skilled designer, and their recognition through this writing may help others to leading to the maturing of instructional design. □

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Using a 'Best Practices' Approach to School Reform

Book Review: Christopher M. Moersch. ***Improving Achievement with Digital Age Best Practices.*** *Corwin; 194 pages; 2014; $34.95.*

Reviewed by Steven Hackbarth

This book credits implementation of a set of instructional and administrative strategies with enabling one school district to overcome "institutional inertia, poverty, and gang violence to elevate student and teacher performance," in the context of dwindling resources (p. xi). Its stated purpose is to "tantalize and inform the reader with suggestions, illustrations, examples, and strategies aimed at elevating the teaching and learning experience" (p. xii). Author Christopher Moersch (Executive Director of LoTi Connection and "lead consultant" on this project) "and our qualified pool of educational consultants have provided a variety of educational staff development, teacher/principal evaluation, assessment, and coaching/modeling services…in the Atlantic City Board of Education over the past decade" (personal communication, Dennee Saunders, Assistant Executive Director of LoTi Connection).

Digital Age Best Practices

Dr. Moersch identifies a set of strategies, grounded in published research, that are key to achieving academic success and have been implemented since about 2006 in the Atlantic City Public School District in New Jersey. These are:

- Bolstering purposeful inquiry through student questions.
- Promoting shared expertise with networked collaboration.

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- Personalizing and globalizing content by making authentic connections.
- Accelerating individual growth through vertical and horizontal differentiation.
- Anchoring student learning with digital age tools and resources.
- Clarifying student understanding with formative assessments.
- Implementing student-centered learning environments. (p. x)

Section I (pp. 5–17) defines each principle and presents evidence justifying its inclusion. This is followed by seven chapters, elaborating on each concept in turn, with focus on classroom applications.

The Wider Context

Section II (pp. 101–135) covers such timely topics as teacher evaluation, technology integration, and high-stakes testing. And one chapter is devoted to describing implementation of Moersch's plan within the Atlantic City school system, a theme that pervades every other chapter. Data are presented to support claims of wide-ranging improvements over the years 2006–2011.

Section III (pp. 137–157) elaborates on implementation of Moersch's plan, with focus on professional development and a model for systemic change. The book concludes with a description of what Moersch deems essential characteristics of effective school and district-level leaders.

Focus on Pedagogy

It is refreshing to read a school reform text that places emphasis on instructional and administrative strategies, rather than merely on the latest developments in computer technology. While Moersch claims to base his selection of strategies on empirical evidence, there is a clear bias toward "student-centered" approaches, to the neglect of systematic direct instruction, where proven most effective. He even buys into the presumption that the role of teachers is changing from "*sage on the stage* to co-facilitator in the learning process" (p. 159).

Moersch's advocacy of sound pedagogy, much of which has become commonplace in our nation's public schools, is a welcome contrast with those who perceive and justify developments in computer technology as the driving force. We are spared all reference to new paradigms demanded by mobilism, disruptive technologies, and emerging epistemologies based on links and tags. Yet it was disappointing not to read a bit about unique affordances of smartboards, tablets, and mobile devices in a book about the "digital age." The challenges and opportunities of cloud computing are hardly mentioned.

Theory-Free, Research-Based?

Moersch's dismissal of "well-intended theories…kept to a minimum" grates a bit on this reviewer, who majored in the philosophy of education, especially when the quoted phrase is followed by "the book relies on pragmatic examples (p. xii), and makes references to the "constructivist" movement, learning model, and theory (pp. 14, 15, 20, respectively). The bias towards "student-centered" approaches in itself is a matter of passionate debate, with considerable evidence documenting its inefficiency (Kirschner, Sweller, & Clark, 2006; and alluded to by Moersch on page 99). Furthermore, it is not unusual to hear blame for public school failings of the past two decades placed on a constructivist orientation pervading teacher training institutions, an orientation now being strongly countered by wide adoption of the Common Core curriculum (Hirsch, 1999, 2007).

In an apparent "slip," Moersch himself lauds an apparent gain in "students solving teacher-directed problems" over "students collaborating" (p. 3). Especially in a school district like the one described here, with a "98% Title 1 [of the U.S. Elementary and Secondary Education Act, pertaining to low income] population" (p. xi), one would expect *greater* reliance on teacher-led systematic and pervasive direct instruction, not less.

The Challenge of Identifying Potent Variables

Accounting for widespread and significant gains in teacher performance and student achievement can be a bit tricky. Innovation in itself is a powerful factor. Increased attention motivates all concerned, and in this case the mandated weekly administrator "walkthroughs" are going to rattle some cages. Clear guidelines about what is expected, with well-aligned assessments, surely narrows the curricular focus, with consequent neglect of areas not counted in school rankings. Add to this the utter lack of any comparison groups, especially during a period of sharp economic recovery nationwide, and all claims of success need to be carefully scrutinized.

Potentially circular claims add little to credibility, for example: A cited article claimed to have identified "research-based instructional strategies that when implemented 'correctly' produced a reported statistically significant effect on student achievement…" (p. 1). A paraphrase from a speech asserts that: "even incremental change in teacher effectiveness can have a statistically significant impact on student achievement" (p. xii). And "Collectively, these best practices, when implemented with a high degree of fidelity, have improved student academic achievement" (p. 99).

These claims seem odd, with "correctly," "effective," and "high fidelity" potentially confounded with the desired outcomes. So much of Moersch's claims of success rest upon documenting increases in what teachers and observers have been directed to emphasize, which should be no surprise. Nevertheless, reported gains in more "objective" measures—attendance, rankings, and "dramatic increases in student academic achievement" (p. 99)—are impressive, though not reflected in data reported for 2005–2009 at *http://www.theatlantic.com/misc/global-report-card* . A look at New Jersey state data for 2013 reveals just one Atlantic City school listed 9th among several lists of top 10 specifically under the category "low income student performance" (*http://jerseycan.org/sites/jerseycan.org/files/report_cards/JerseyCAN-Top-10s.pdf*).

Conclusions

Christopher Moersch and all participants in his ambitious undertaking merit much credit for the past, and con-

tinuing, reported pervasive improvements in the Atlantic City Public School District (Haye, Cohen, & Moersch, 2011). His approach is amply justified, takes into account the many demands on schools today, includes all stakeholders in the process, and is expressed clearly in this book. Moersch provides a balanced alternative to those who advocate "data-driven" (O'Neal, 2012) and "cage busting" (Hess, 2013) concepts of school administration.

Nevertheless, it was a bit disconcerting that the connections of Dr. Moersch and his LoTi team with the Atlantic City schools was not made explicit in this book. The book gives the impression of a relatively objective appraisal, while the Board of Education's Annual Financial Report for 2010 reveals a very hands-on role, with Moersch providing professional development to teachers twice a month, and meeting with district administrators several times each year (retrieved from *http://www.state.nj.us/education/finance/fp/cafr/search/10/0110.pdf*). In addition, the report notes that there has been a LoTi math coach working in every elementary school, one of five, ensuring a bump in those test scores. Thus, all claims of success beyond that solidly documented need be taken in light of interested parties, with possible influences of novelty, good will, and shifted curricular priorities.

Largely absent (even in the chapter on "digital age tools" pp. 65–77) are discussions of mobilism, cloud computing, and emerging issues that characterize the "digital age" (e.g., Norris & Soloway, 2011). Absent are descriptions of "lessons learned" from inevitable failings (one case study, pp.145–148), and how adjustments were made to maximize achievements, the essence of educational technology as an ongoing process. And the title is a bit misleading in that Moersch's "best practices" are not derivative of the digital age, but are rooted in common practice, with a bias towards "student-centered" and much faith in the validity and generalizability of highly selective soft science research. □

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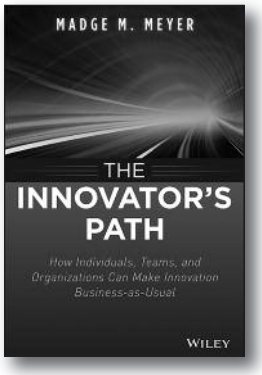

Compelling Stories and Disciplines of Innovation

Book Review: Marge Meyers. ***The Innovator's Path: How Individuals, Teams, and Organizations Can Make Innovation Business-as-Usual.*** *Wiley; 256 pages; 2013; hardcover, $49.95.*

Reviewed by Gordon Rowland

The Innovator's Path is partly a personal story of a highly accomplished innovator, the author Marge Meyers, and partly a synthesis of her interviews with other similarly accomplished innovators. It stands out among many recent books on innovation for these stories and synthesis. Were it to include connections and references to others' scholarly work on the topic, it would be even stronger.

Eight Disciplines of Innovation

As the title indicates, the focus is not on products–innovations themselves—but on innovative people and processes, and their impact on large organizations. And rather than a linear or standard approach, the "innovator's path" is described as a set of eight important competencies or "disciplines" that Meyers believes constitute "fundamental ways of making innovations happen" (p. xvi). She clarifies that these are not the only eight things someone needs. Rather they are the things she has "seen even the most competent, skilled, and hardworking people struggle with" (p. 8).

The disciplines are based on Meyers's personal experiences as well as interviews with innovation leaders in industry, government, education, and the military. Consequently, while she argues for generality, the disciplines emerge primarily from experiences in large organizations. She states that they are "tried and true, fashioned and fine-tuned during my decades long career in executive leadership positions at IBM, Merrill Lynch, and lastly at State Street, where I served as executive vice president, chief innovation officer and technology fellow" (p. xvi).

The eight disciplines include: listen, lead, position, promote, connect, commit, execute, and evolve. While there are some nuances to her use of terms such as position and connect, for

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the most part the disciplines are defined in a straightforward manner that anyone familiar with the literature on innovation, design, and planned change would recognize.

Strengths

There are a number of things that strengthen the book and contribute to its trustworthiness. First is the author's credibility. As she describes, Meyers is former Chief Innovation Officer and Technology Fellow at State Street Corporation, where she served as Executive Vice President for over a decade, first vice president for Merrill Lynch's Enterprise Technology Services, and, earlier in her career, a scientific programmer for IBM on the NASA Gemini Orbital Spaceflights. Meyers's personal and professional histories, both of which she shares throughout the book, are fascinating. Similarly, Meyers was able to interview a very high level group of 15 innovators for the book, including widely recognized individuals, such as Dr. Tenley Albright, Director, MIT Collaborative Initiatives; Dean Kamen, inventor of the Segway; Admiral Michael Mullen, former Chair of the US Joint Chiefs of Staff; Nathan Myhrvold former chief strategist and chief technology officer at Microsoft; Samuel J. Palmisano, former chairman, president, and CEO of IBM; and John Swainson, President, Dell Computer.

Aside from bringing the insights of this group together into a single coherent framework, perhaps the greatest strength of the book is the current examples that Meyers and others provide. The book is not groundbreaking in terms of offering powerful new ideas, and the principles that are cited are fairly well known, for example, countering resistance to change, and embracing and learning from failure. However, the nuanced applications described in the examples alone make reading the book worthwhile.

Special Features

Meyers includes a number of special features: easy-to-review summaries of key points at the end of each chapter; two appendices, one summarizing the disciplines, the other giving biographies of the interviewees; and Chinese ideograms with each chapter that are intended to "represent and help describe and explain the terminology I have chosen for each of the eight disciplines of innovation" (p. xix). She also includes descriptions of levels of competence in each discipline, for example, selective listening, engaged listening, and deep listening for the discipline "listen." These levels seem informative in some chapters and forced in others.

Limitations and Overall Value

In terms of limitations, it is surprising to read a current book on innovation with so little attention to design. And, more generally, there are no references to others' published work, scholarly or otherwise. This is certainly not a reference book for anyone looking to explore the literature on innovation.

Overall, though, *The Innovator's Path* is interesting, highly accessible, and a good synthesis of principles. It fulfills the promise of the title, offering a highly informed view of "how individuals, teams, and organizations can make innovation business-as-usual." It is worth reading for the personal stories of accomplished innovators. □

Q & A with Ed Tech Leaders

Interview with David Dockterman

Michael F. Shaughnessy
Contributing Editors

1. How did you become involved in the field of educational software development?

While majoring in History, I completed the Teacher Preparation Program at Yale in 1979. After a few years teaching high school, I entered the doctoral program at the Harvard Graduate School of Education. During the summer of 1982, a friend introduced me to Tom Snyder and Rick Abrams, who were in the early phases of starting an educational software company. I joined them and helped build Tom Snyder Productions while completing my doctorate. My early formal academic research focused on contemporary and historical efforts to integrate technology into schools. In addition, I did a lot of formative research on how students interacted with technology, particularly the programs we were building at Tom Snyder Productions.

Now I'm an avid consumer of research, drawing from neuroscience, behavioral economics, educational and cognitive psychology, and just about anywhere to gain insight to guide innovative product development for learning

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2. What are some of the games and simulations you have participated in developing?

Throughout the 1980s, Tom Snyder Productions was one of the leading educational game and simulation companies in the country. Snooper Troops and In Search of the Most Amazing Thing were ground-breaking "hits" in the early days of educational microcomputing, and many other titles followed. Decisions, Decisions, a series of classroom simulation/games, set the standard for the one-computer classroom of that period. So I've been at this for a long time. Most recently, I developed a collection of games in FASTT Math, a math fact fluency program for grades 2–9+, to address Common Core math fluencies. Sushi Monster, one of those games, is available for free for the iPad and iPhone.

3. Do you focus on a specific grade or subject area?

've guided the development of software for history and social studies, reading, and science. For the last 5+ years, my focus has been math. I suppose my grade level sweet spot is middle school.

4. How do teachers keep students involved over a long period of time with educational games?

In general, the assumption is that teachers use games to engage students. But the whole conversation is off-focus. The goal isn't students using games or students using technology. That's just not the point. The goal is learning. Games and other uses of technology are potential vehicles for learning. A better question might be: "How do you make sure that students are learning from the games they play in school?" It's also good to question whether the skills students develop playing games transfer to other academic and life tasks.

5. Tell us about what you consider to be a good educational game and why.

We played a lot of board and card games with our son when he was growing up. The discussions of strategy, the cross-checking of accuracy, the negotiation over rules and turn-taking, and, in many cases, the content of the games themselves had educational value. Any game that does all that gets two thumbs-up from me.

6. Are there specific thinking skills that you focus on through the use of computer games?

Let me respond with a few questions of my own. Are there generic "thinking skills"? Are thinking skills in math different from thinking skills in history or literature? The Common Core State Standards for Math include eight standards of mathematical practice that reflect how mathematicians think. Some of those thinking standards sound pretty generic on the surface, like persevere in solving problems or using tools strategically. However, in practice, the application of these practices is pretty specific to math knowledge and skills. Like the CCSS, I see thinking skills as embedded in content. You really shouldn't do one without the other.

7. Are there any games that help with creativity, originality, imagination, fluency, flexibility, etc.?

Sure. We get better at what we practice. Games, like those in FASTT Math, that encourage replay of targeted skills can build fluency. An app like Sushi Monster, with multiple solution paths and puzzles, encourages flexibility with what the player already knows. Will playing Pictionary make someone a creative artist who wasn't already one? Probably not by itself, but with good coaching and models, who knows? You need to have or develop the knowledge or skill before you can get good at it with repeated practice.

8. Walk us through the development of an educational game—from start to finish. What are some of the obstacles that you might encounter?

Check out the blog I wrote for Mashable *http://mashable.com/2012/05/18/educational-video-games-how-to/* — the key is to hold the learning objective and learning mechanics sacred. The "game" must support and enhance the learning, not compete with it..

9. Have you studied the games of other countries?

I look at good games, puzzles, and challenging tasks—electronic and otherwise—from all sources. Puzzles are a regular part of the math curriculum in Singapore. The Shell Centre in the UK has created challenging math tasks to push students' thinking. We all need to build the capacity and will of our students, particularly the struggling ones, to tackle demanding cognitive challenges. Creating smart games and systematically leveling students up is one way to get there.

10. What are some of your recent projects?

There are several casual games, like the iOS version of Sushi Monster, that provide informal opportunities for practice. Its fun, lots of kids use it, and it has benefit. Most of my focus though is supporting more comprehensive, integrated systems. For instance, in FASTT Math Next Generation, a math fact fluency program, the Stretch-to-Go games are driven by each student's individual performance in the core FASTT Math program. The game content extends facility only with what each student has already learned. Games support the learning. We're doing the same thing on a much larger scale with MATH 180, a new comprehensive math intervention program we're building.

11. Do you use the term "educational gamification"? Is it appropriate?

I use it because it's out here, but I put it in the context of solid behavioral psychology research. It's the science and deep structure of games that I'm most fascinated with and that I think have the most potential for transforming learning. □

New Issues, New Answers

Marc Prensky

Doing What We Believe
When We Don't, Our Students Pay the Price

A conversation I recently had on the phone with an educational vendor has caused me much reflection. The exchange went something like this:

Me. "What you are doing is really old fashioned and is not right for the kids."

Him: "I totally agree with you, but that's what our clients [publishers and school systems] request."

Me: "So why do you do something you don't believe in?" [stunned silence]

Later feedback from another person on the call: "You really put him in an awkward position."

Not really—*he put himself* in an awkward position. It's the same position that far too many of us in education have put ourselves in.

Far too many of us in education—not just vendors, but also teachers, administrators, ministers, and secretaries of education—are, daily, doing things we know in our heads and hearts are wrong for our students—and *not* doing things we know to be right for them. We do this for a variety of rationalized reasons: "It's what the system asks of me." "It's what they pay me for." "It's what the parents want." "I'm a team player." "I'll get fired it I don't." "I'm following x's (or x country's) example." 'It's what's politically feasible," etc.

This has to stop.

I accept that there are differences of opinion and alternative beliefs. And I accept that people may have to, at times, temporarily compromise some of their beliefs for various reasons.

But what I don't get—and won't accept—is that so many people, doing a task so crucial to the world (i.e., educating our kids), compromise their deep-felt beliefs and continually do something they know is not helpful, while claiming they can't (or don't have time, or they're just a sub-contractor) do what they know is right. And, worse, that this behavior is considered OK.

We all know that unnecessary tests are sometimes ordered in medicine just to "cover behinds," and medications are occasionally prescribed just to placate parents. But at least there everybody agrees that going against one's professional beliefs is wrong. Nobody expects, or wants, medical professionals to go on doing something they believe is not right just because someone else says they should, or because it provides them employment.

But we accept this in education.

This is partly, I believe, because education is so top-down—judgment is too often reserved only for those who run the show. I can't count the number of teachers who have told me "I know it's not what my kids need, but I have to teach what they tell me to." Some of our curricula are even required to be taught word-for-word. Our teachers either don't have, or have not been made to feel they have, any agency at all with regard to what they teach.

But relying on top-down is only good if the people at the top get it right. And those at the top of our educational systems are, today, too often getting it wrong. This is mainly, I believe, because we are now doing education in a wholly new world context, one that all the "pre-Internet world" experience of these people has not prepared them for. The education that we have been offering for the last several centuries—that once worked—is no longer effective at preparing people for their future in our new post-Internet, technology-laden world.

Most of us know and believe this at some level. Yet we refuse to abandon the past. We continue to "plaster on" fixes to our old education—more measurement, more data collection, more analysis, more testing, higher standards—in the mistaken belief that we are doing something useful.

We are not.

Better statistics, higher grades, and higher PISA scores may bring some short-term benefits. We should not be fooled. Teaching the old stuff "better"—i.e., the wrong stuff—does NOT help anyone long-term.

Education today teaches a woefully narrow, outdated curriculum. Yes, advanced learning about science, technology, engineering, and mathematics is useful for some of our kids, as are advanced language skills, and many skills in the arts. But here's a (partial) list of some of the things we don't teach systematically today in most places: Creative Thinking, Problem Solving, Inquiry Skills, Argument Skills, Design Thinking, Systems Thinking, Judgment, Aesthetics, Habits of Mind, Self-Knowledge, The "Habits of Highly Effective People," Mindset, Resilience, "Grit," Entrepreneurship, Innovation, Improvisation, Breaking Barriers, Project Management, Communication & Collaboration in Families, in Communities, at Work, and Online, Relationship-Building, Empathy, Ethics, Politics, Citizenship, Negotiation, and Conflict Resolution.

We actually know how to teach many of these important things, but we choose not to. The skills we do teach, as Professor Yong Zhao of the University of Oregon comments wisely, are neither "common" (i.e., the same for everyone), nor are they "core" (in the sense of being the most important ones).

So what's an alternative?

Up to now there really hasn't been one. But I am preparing a new curriculum that, I believe, will better serve all the students in the world. It is based on four new top-level subjects: **Effective Thinking, Effective Action, Effective Relationships,** and **Effective Accomplishment** (with technology as an underlying foundation). I will examine this in more detail in the next issue of this magazine. □

Marc Prensky, *a Contributing Editor, is the founder of* ***The Institute for Global Future Education****, a not-for-profit organization devoted to promoting Future-Oriented and Accomplishment-Based Education, and a better worldwide curriculum. He is also the co-founder of Spree Learning Games, a new "curricular games" company, and is the founder and CEO of Games2train.com . Contact Marc at* ***marcprensky@gmail.com*** *.*