Learning for the Future

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Introduction

In the December 10, 2006, issue of *Time* magazine, Claudia Wallis presents an anecdote about Washington Irving's fictional character Rip Van Winkle. Wallis proposes that rather than a 20-year nap, Rip Van Winkle actually awakens 200 years later in the 21st century. Everything he sees, of course, utterly bewilders him, until he walks into a school building. He immediately can tell where he is—classrooms have not really changed that much. This cruel joke, as unfair as any generalization, also has some painful elements of truth. Schools all over the world have somehow managed to remain impervious to the passage of time and, in particular, technological advances.

But some classrooms are different, and perhaps even Rip Van Winkle would have a hard time figuring out his whereabouts in these. Consider the following scenario:

> Students walk in and greet the teacher, who is welcoming them at the door. He goes to his desk and takes attendance at the laptop. Instead of the customary call for attention and lecturing, students log into their computers and pull up the class blog, where they read the day's assignment, or continue with previous work. Then, they set themselves up with their partners, since there is no individual work assigned, and discuss how to approach the task at hand, which may entail investigating a new topic, finding appropriate links and references to guide their study, working on a current presentation or video investigation, or writing an assessment instrument for themselves or their peers. In the meantime, the teacher divides his time between responding to students' queries and offering advice and guidance when he perceives—by centrally monitoring the progress of their work through classroom management software—that students are stuck in their progress. When not engaged in these virtual and face-to-face interactions with the students about the day's work, the teacher calls students in their small groups to give them personalized feedback about assignments that they have handed in, since no grades are awarded until after multiple iterations designed to improve student work occur. In some cases, grades result directly from students' scores in games or simulations that interactively teach them about topics in the syllabus. There is minimal lecturing in this class, and students are gradually released into independent collaborative learning, with a view to learn skills that go beyond the required content in this International Baccalaureate class on Information Technology in a Global Society.

The preceding description depicts an actual 11th-grade class at St. Andrew's Scots School in Buenos Aires, Argentina; however, it is just one example of how teachers are attempting to reshape the teaching and learning landscape to face a unique and unprecedented challenge:

harnessing the power and responsibility of being the first generation in history to have access to the full array of accumulated human knowledge.

In effect, in the space of little over a decade, a mere blink of an eye in historical terms, the whole educational paradigm has been turned upside down. The advent of the Internet, with an exponential growth of online content, has transformed the age-old pedagogy in which the teacher was the sole repository and administrator of knowledge into an open scenario, where knowledge is almost universally accessible to anyone with an Internet connection. The implications of the new knowledge era are tantalizing and still difficult to fathom, but clearly effect schooling in very profound ways. Suddenly, the old skill set that follows a school curriculum heavily focused on content no longer serves students well. This predominant model and pedagogy proves to be woefully inadequate in the face of the 21st century demands.

The Flat World

In *The World is Flat*, the bestselling book on how information technology has changed the economy and the workplace, Thomas Friedman (2005) analyzes the interweaving relationships between education, the workforce, and the economy, and he vividly depicts the fast-changing conditions of the economy. He refers to today's world as "...a global, Web-enabled playing field that allows for multiple forms of collaboration on research and work in real time, without regard to geography, distance or, in the near future, even language" (p. 204). In this new flat world, requirements for school graduates entering a job market have changed. The question in the digital age is not, "What do you know?" Rather, employers are asking, "What can you do with what you know, and how do you update your knowledge continuously?"

The first problem that needs to be solved by every student graduating from school is how to find their niche in a fast-evolving workplace. Globalization, as a consequence of advances in telecommunications, not only allows people to learn and interact with a myriad of cultures, but has also leveled the playing field and spurred an ongoing and irresistible outsourcing trend that sees many tasks and jobs being awarded to workers in economies with cheaper, well-trained workforces.

An explicit goal of any educational system is to prepare students to be able to respond to societal demands and integrate seamlessly into the prevalent external environment, and, more specifically, to develop the knowledge and skills needed to be able to find their way into the workforce. Despite what may be differences of opinion or appraisals to the degree and extent of the gap, it can be safely acknowledged that schooling has lagged in developing to the evolving needs of a world that has changed. Meeting this challenge will clearly constitute one of the main drivers in school efforts to reassess teaching and learning practices towards an educational model that responds to the new paradigm of the knowledge era.

The Ohio Context

The Ohio Leadership Advisory Council (OLAC) has devised a framework to ensure that Ohio's educators are prepared to address the 21st century challenges facing today's learners. The *Leadership Development Framework* provides systemwide structures that optimize the implementation of effective leadership and teaching practices through the aligned district work of the superintendent, the District Leadership Team, Building Leadership Teams, and Teacher Based Teams. In the document titled *Ohio's Leadership Development Framework*, Rick Lewis, the executive director of the Ohio School Boards Association (OSBA), is quoted as saying:

> As an organization that serves school district leaders, OSBA is keenly aware that robust, innovative leadership is essential to public education's success. Only by cultivating a highly capable cadre of leaders will our schools, state, and nation thrive in the 21st century global economy. By inspiring, guiding and teaching, today's education leaders can create the leadership of tomorrow (p. 8).

In order to provide the direction that today's leaders in education need to guide their students—who are future leaders—OLAC has provided specific guidelines in the following six core areas:

- Area 1: Data and the Decision-Making Process
- Area 2: Focused Goal-Setting Process
- Area 3: Instruction and the Learning Process
- Area 4: Community Engagement Process
- Area 5: Resource Management Process
- Area 6: Board Relations and Governance Process

Although these areas are inextricably interlinked, the area on which this module most specifically focuses is Area 3: Instruction and the Learning Process. This area emphasizes the importance of:

> Focusing on 21st century skills, ensuring that all children combine core subject mastery with other significant skills, including critical thinking and problem solving, creativity and innovation, communication, and collaboration skills; information and communication technology literacy; life skills (leadership, ethics, personal productivity, self-directed learning); and 21st century content (global awareness and business fundamentals and economic literacy) (p. 22).

The 21st century skills itemized in the Area 3 OLAC description are largely supported in the words of Andy Hargreaves and Dennis Shirley (2009) in *The Fourth Way, the Inspiring Future for Educational Change.* "The vital 21st century skills that will drive new knowledge economies are integral to the agenda of personalized learning. Creativity, innovation, intellectual agility, teamwork, problem solving, flexibility, and adaptability to change are essential to the new economy"(p. 85). In addition, Hargreaves and Shirley also emphasize the importance of deeper virtues such as "courage, compassion, service, sacrifice, long-term commitment, and perseverance" (p. 85).

The remainder of this module is dedicated to helping educators determine how they can most effectively guide their students in the development of these 21st century skills. The subsequent sections address the following topics:

- Technology and the Future of Learning
- Characteristics of the 21st Century Learner
- Transforming Instruction for the 21st Century
- Transforming Assessment for the 21st Century

Technology and the Future of Learning

The great enabler of the new era is computer and information technology. Technological advances resulting in the ability to communicate across borders and platforms and the growth and generalization of the Internet are developments that have resulted in a disintermediation process in granting open access to unlimited knowledge. It is somewhat paradoxical, then, that even though schools are in the business of transmitting and recreating knowledge, that the introduction of computer technology in the classroom has proven to be such an overwhelmingly difficult task.

In 1993, Stanford University Professor Larry Cuban published a seminal paper on the difficult inception process of technology in the classroom, whose title says it all: "Computer Meets Classroom: Classroom Wins." In this paper, Cuban analyzes how rigid school structures are a recipe for disaster in terms of gaining inroads in the use of technology in teaching and learning. Cuban offers a perspective on why schools have been resistant to electronic technologies: "Certain cultural beliefs about what teaching is, how learning occurs, what knowledge is proper in schools, and the teacher-student (not student-machine) relationship dominate popular views of proper schooling" (p. 2).

In addition, the failure of technology to make an effective impact in education may also be attributed to the ineffective introduction of computer and information technology, which has largely focused on purchasing the tools, and not on carefully thought out plans for meaningful implementation. Lured by the bright promises of multimedia and other would-be dazzling applications of computers and other technical products, schools have progressively invested more and more in equipping classrooms with ever-changing, state-of-the-art equipment. There are expectations that these tools should be used, without a clear understanding or rationale on how these items will enhance and improve the teaching and learning process. Inevitably, the focus on technology as an end in itself leads to frustration, and can account for the lack of progress in making effective use of computers and software in classrooms. The educational benefits of technology derive from the ways in which the technology is used. Within the classroom, "The technology itself is not transformative, it is the school (the pedagogy) that is transformative" (Byron, 2008, p. 60).

The 21st Century Student

As educators consider the transformation that schools must undergo to remain vital and to truly move learning forward in this digital age, it is necessary to reflect on the current young learners sitting in today's classrooms. In *Digital Natives, Digital Immigrants*, Marc Prensky (2001), a well-known author and thinker, coined the term *digital natives,* describing a younger generation that a has grown up amidst a technology-rich world, and developed habits, reflexes and even thinking patterns that allow them to incorporate technology in every aspect of their lives. Adults, on the other hand, who have embraced technology later in life are, by contrast, *digital immigrants*. The majority of today's educators are in this category so it is little wonder that they are struggling with methods and approaches for teaching today's learners.

Consider the implications for the classroom teacher of the following description of 21st students by Ian Jukes (2010), a former educator and, currently, a noted thinker on 21st century education.

> The student who spends most of his or her time focused on a specific pursuit, say sports or academics or the arts, will hard-wire and insulate those specific neural connections. But if the same student spends that time

> lying on the couch playing games or watching TV, those are the cells that will flourish. Connections that are most used or useful develop into a complex, high-speed neural network. Today, even the youngest kids are exposed to many digital devices, and it's this digital bombardment creating the cultural brains in our children. As such, they process information differently than we do. Visual memory, processing, and learning skills are being enhanced in particular (p. 6).

Because of digital bombardment, the brains of today's children are changing physically and chemically (p. 5). Jukes (2010) proposes that students today have developed a "cultural brain" profoundly affected by the digital culture. Jukes identifies eight preferences of these digital learners:

1. Receiving information quickly from multimedia sources
2. Parallel processing and multitasking
3. Processing pictures, sounds, color, and video before text
4. Random access to hyperlinked multimedia
5. Networking simultaneously with many others
6. Learning "just in time"
7. Instant gratification and delayed rewards
8. Learning that is relevant, active, instantly useful

It is imperative that educators consider how the new patterns of thinking and preferences for learning experienced by today's students, these digital natives, will effect the design and organization of schools as well as teachers' approaches to instruction. The choice is simple, less so the solutions; either schools, classrooms, and instructional methods embrace these new challenges, or schools and teachers continue to persevere with outdated approaches, therefore suffering the consequences of increasing irrelevancy from their student clientele.

Transforming Instruction for the 21st Century

The International Baccalaureate syllabus for Information Technology in a Global Society includes as one of its topics the effects of technology in education. At St. Andrew's Scots School, the students in this class are required to develop a short video documentary on how technology is applied in their own school. After completion and analysis of their projects, the students are asked to describe the typical profile of the teacher who best uses technology in the classroom. Contrary to prior expectations—which would point to a rather stereotypical image of a younger teacher from one of the scientific subjects who would probably be more naturally drawn to use technology—the students come up with distinct characteristics: the teachers who make more relevant use of technology are those who love learning themselves and whose passion for their subject clearly permeates their teaching.

Whether one thinks about the 21st century or past centuries from which we have emerged, the success of all schools rests in the hands of teachers who have a passion for gaining and imparting knowledge. As Bennett and Rolheiser (2001) note in *Beyond Monet: The Artful Science of Instructional Integration*, "The complexity of teaching is beyond the complexity of being Monet or Emily Carr. It is the artful integration of the science in teaching. It is about getting better, it is about being wiser, it is about making a difference" (p. 9). In the current era,

imparting knowledge must also factor in the robustness in learning that computer and information technology can provide. Great teachers who want to make a difference in their students' learning are wise enough to know this.

In addition to computer and information technology's potential to transform instruction in this digital age of connectivity, there are other instructional opportunities that teachers who are dedicated to their students' future successes will want to consider. This section on Transforming Instruction for the 21st Century also addresses the impact of problem solving and inquiry, the balance gained from creativity and the arts, the imperative of a multidisciplinary emphasis, and the power of collaboration.

Technology and Instruction

Schools may very well choose to ignore reality and attempt to isolate classrooms from computer and information technology and the use of cell phones and other portable devices. But, outside the four walls of the classroom some powerful and unstoppable forces are at play, powered by the marketing drive to sell new products, which is increasingly granting access to portable technology to students. As can be easily perceived by just browsing advertisements for the latest technological gadgets, the main selling point is focused on gaming, multimedia entertainment, and the potential to use these devices for messaging and social networking.

It is no wonder then that when teachers attempt to develop a pedagogy that harnesses the potential of new technologies for learning, students find it difficult to overcome a preconception that technology is just for play and socializing, and are largely unable to translate their everyday informal experience into the realm of formal learning. As a result, it is essential that students are trained in using state-of-the-art tools for formal learning so that they develop technological study habits that bring them fully into the knowledge era.

Despite the fact that the development of relevant computer applications for the classroom has lagged that of other fields and that computer technology has not yet fully capitalized on the promise of enhancing the instructional process, there is a very promising future for technology in schools. Gradually, educational software in the form of games and simulations that address engaging educational content is being developed and tested in classrooms.

Thomas Guskey (2008) makes a powerful case for the use of computer simulations in the learning context, when he recalls that two of the most critical applications that can be thought of in society—surgery and the piloting of high performance planes—are not learned in the sterile testing of the classroom environment, but rather through endless simulation sessions in which aspiring practitioners fine-tune their skills through multiple instances of trial and error, learning as much from failures as from successes. What is still heralded as the highest technical accomplishment in history—the moon landing—was accomplished through brutal simulation sessions in which astronauts were drilled to perfection by relentless simulation supervisors (simsups) who deviously thought out all kinds of fatal scenarios until the astronauts developed a second-nature set of skills that allowed them to command their spacecraft almost to perfection.

Games and simulations in the classroom can also allow students who often refrain from participating in class discussions or who are not good oral learners to progress at their own pace. These computer programs provide a one-to-one interactive environment that provides relevant feedback and that encourages students to safely take risks without fear of ridicule or low grades. In an academic environment that has, sadly, systematically stigmatized mistakes, a well-planned dose of computer-based learning can stimulate creativity and provide gateways for some of the students to progress in their learning.

The key role of technology in facilitating access to lifelong learning through the Internet can finally hold the key to a successful integration of technology into the classroom environment.

Accessing and processing knowledge is, after all, the core business of schools, and the development of a true 21st century pedagogy that embodies lifelong learning needs to draw upon computer and information technology to access that knowledge.

Problem Solving and Inquiry

In John, Hattie's (2009) scholarly work *Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement*, he summarizes the results of meta-analyses noting specific actions that effect student achievement. Simply stated, Hattie illustrates the influences on student achievement using a four-part barometer showing *reverse effects*, *developmental effects*, *teacher effects*, and the *zone of desired effects.* Any influence on student achievement that has a 0.4 effect size or greater is significant and in the *zone of desired effects*.

Out of 138 influences on achievement that Hattie investigates, he notes that *problem-solving teaching* has an impressive effect size of 0.61. In addition to positively influencing student achievement, problem-solving teaching is also an effective instructional strategy for developing 21st century learners. Hattie states that "problem solving involves the act of defining or determining the cause of the problem: identifying, prioritizing and selecting alternatives for a solution; or multiple perspectives to uncover the issues related to a particular problem, designing an intervention plan, and then evaluating the outcome" (p. 210).

Inquiry-based teaching is closely related to problem-solving teaching. According to Linda Darling-Hammond (2008), in inquiry learning, one might also include project-based, problem-based and designed-based learning, all of which have similar attributes but do differ in application. Inquiry-based teaching involves "creating challenging learning situations in which students are asked to observe and question phenomena; pose explanations of what they observe; devise and conduct experiments in what data are collected to support or contradict their theories; analyze data; draw conclusions for experimental data; design and build models or any combination of these" (Hattie, 2009, p. 208).

There are many examples across the country, indeed around the world, of innovative instructional approaches that use inquiry-based teaching as the preferred method in the classroom. Take as an example the innovative classroom of teacher Brian Lien from the Princeton City Schools in Cincinnati, Ohio. In his Engineering Your Future Class at Princeton High School, Lien's students are engaged in an engineering project where they will conceive, design, and build an actual model of a cell phone by applying the principles of isometric and orthographic design that they have learned in their class. Homework for Lien's students is to listen to lectures by engineering professors from The University of Cincinnati with whom Princeton High School has a partnership. One of the distinguishing features of Lien's class is the extent to which he tries to incorporate hands-on learning, a signature of the inquiry-based model.

This cell phone project is designed by Lien to incorporate critical thinking, collaboration, and creativity in each phase. Not only is the project engaging because of its hands-on practical application approach, but it also relates to the world of the students, many of whom own cell phones. Students can earn college credit for Lien's class, which provides them with additional motivation to persevere. Lien makes the claim that his students are not only more engaged, but they perform at higher levels when he uses this inquiry-based, problem-based approach. Hattie substantiate the observation made by Lien when he states, "Overall, inquiry-based was shown to produce transferable critical thinking skills as well as significant domain benefits, improved achievement, and improved attitude toward the subject" (pp. 209-210). School Tube link here.

Both problem-solving and inquiry-based teaching inspire students to think more critically. The word "critical" comes from the Greek word *kritikos*, meaning "to judge." Critical thinking is useful in making wise decisions and, therefore, implies that a person must be aware of his or her

own flaws in thinking and in actions (Bennett & Rolheiser, 2001). It is essential to understand that critical thinking, a close cousin of higher-order thinking, requires greater attention than it presently receives in schools. Bennett and Rolheiser (2001) offer a better understanding of the implications when they suggest that "the challenge in the area of critical thinking is to make it come alive. From our experience, when educators do not have the powerful pedagogical process into which they can integrate or enact the critical thinking skills, the result can be a superficial application of these skills" (p. 326). The 21st-century calls for students to solve problems, to engage their power of inquiry, and to think critically and at higher levels.

Creativity and the Arts

In addition to critical thinking, 21st century learners also need to develop the skill of creative thinking. Certainly, the strongest advocate for increasing attention to teaching for creativity in schools comes from Sir Ken Robinson (2001). As he says:

> Raising academic standards alone will not solve the problems we face: it may compound them. To move forward we need a fresh understanding of intelligence, of human capacity and of the nature of creativity. Human intelligence is richer and more dynamic than we have been led to believe by formal academic education (p. 9).

Given the current concerns over budget deficits, one's thoughts easily turn to how school districts are confronting the challenge of reducing, balancing, or cutting people, programs, and resources. Invariably, programs such as the arts and extracurricular activities fall prey to sharpened pencils of financial resources personnel. Yet, little thought is given to the contribution the arts provide to students, not to mention the degree to which we now know the arts contribute to student learning and creativity.

In 2004, the Dana Arts and Cognition Consortium (2008) brought together neuroscientists from across the United States to study the relationship between the arts and high academic performance, and why people believe there to be a relationship in the first place. The question that formed the basis of their discussions and deliberations was: "Is it simply that smart people are drawn to 'do' art—to study and perform music, dance, drama—or does early arts training cause changes in the brain that enhance other important aspects of cognition?" (p. v). The following is a summary of some of the main points the group learned:

- An interest in a performing art leads to a high state of motivation that produces the sustained attention necessary to improve performance and the training of attention that leads to improvement in other domains of cognition.
- Genetic studies have begun to yield candidate genes that may help explain individual differences in interest in the arts.
- Specific links exist between high levels of music training and the ability to manipulate information in both working and long-term memory; these links extend beyond the domain of music training.
- In children, there appear to be specific links between the practice of music and skills in geometrical representation, though not in other forms of numerical representation.
- Correlations exist between music training and both reading acquisition and sequence learning. One of the central predictors of early literacy, phonological awareness, is

correlated with both music training and the development of a specific brain pathway.

- Training in acting appears to lead to memory improvement through the learning of general skills for manipulating semantic information.
- Adult self-reported interest in aesthetics is related to a temperamental factor of openness, which in turn is influenced by dopamine-related genes.
- Learning to dance by effective observation is closely related to learning by physical practice, both in the level of achievement and also the neural substrates that support the organization of complex actions. Effective observational learning may transfer to other cognitive skills." (pgs. v-vii)

While one may wish to debate causation versus correlation issues that such research might raise, there is agreement that the relationship between the arts and cognition are clearly evident, particularly in terms of how the arts affect brain function and contribute to the development of different brain areas. This is an important finding and has specific application to the work in education. The current preoccupation in most Western schools is to create graduates schooled in mathematics and the sciences, almost exclusively ignoring the development of the affective domain of the learner through the teaching of the arts and related subjects. The arts constitute a discipline as much as do the humanities, sciences, and other subject areas in a school curriculum.

As Thomas Friedman (2008), author of *The World is Flat*, said in an interview with Daniel Pink, the noted author of *A Whole New Mind* and more recently *Drive:*

> The greatest economic competition going forward is going to be between you and your own imagination. Your ability to act on your imagination is going to be so decisive in driving your future and the standard of living in your country. So the school, the state, the country that empowers, nurtures, enables imagination among its students and citizens, that's who's going to be the winner (p. 3).

That is not to say that the only means to develop the imagination or creativity in students is through teaching of the arts. Rather, given the contribution that the arts make to all areas of study it is more likely that creativity, imagination, and intuition are cultivated by exposing students to "right brain thinking." It is imperative that there be a renewed conviction to include the arts prominently in the school curriculum for all students (Gazzaniga, 2008).

What does it say about the school system when arguably two of the greatest current innovators, Steve Jobs and Bill Gates, are college dropouts and both have now been granted honorary graduate degrees from prestigious universities? In his speech to the graduates at Stanford University Steve Jobs, Apple CEO, said:

> You know, I dropped out of Reed College and had nothing to do so I took a course in calligraphy. And it all went into the Mac keyboard! That was not an algorithm. That was a question of style and it helped define Apple's niche. Now, that's not to put down algorithms. Apple needed those algorithms to enable it all to happen. It's just you've got to have both. It's about integrating the two (Friedman, 2008, p. 4).

To conclude, Sir Ken Robinson urges educators to expand their thinking about a balanced curriculum. He provides the wisdom of his thinking when he says:

> In many school systems throughout the world, there is an imbalance in the curriculum. The emphasis is on science, technology, mathematics and language teaching at the expense of the arts, humanities and physical education. It is essential that there is an equal balance between these areas of the curriculum. This is necessary because each of these broad groupings of disciplines reflect major areas of cultural knowledge and experience to which all young people should have equal access. Second, each addresses a different mode of intelligence and creative development. The strengths of any individual may be in one or more of them. A narrow, unbalanced curriculum will lead to a narrow, unbalanced education for some if not all young people (p. 196).

Multidisciplinary Emphasis

Heidi Hayes Jacobs (2010), one of America's leading experts in curriculum design, advocates content upgrading without regard for the rigid subject area structures: "Content is a central element in curriculum design and can be organized within disciplines or through interdisciplinary design. The decision of what knowledge to present and share with learners is most often predetermined by professional educators, but in some schools and settings, content is selected and constructed by the student" (p. 30). A greater multidisciplinary emphasis will not only prepare students better by exposing them to an educational scenario that mirrors reality more closely, but will also help in developing thinking patterns that are more geared to the intrinsic complexity of the 21st century.

An increased focus on the development of projects that encompass various disciplines, incorporating hands-on work that replicates the real life environment incorporates a higher level of engagement as well as ensures deeper understandings. Other multidisciplinary embodiments of curricular work, like the analysis of case studies or the solving of real-life open-ended problems, also target some of the most relevant 21st century skills that involve higher-order thinking. Students are forced to break away from the artificial environment of isolated disciplinary problems and learn to weave complex relationships, discern patterns within real data sets and come up with various answers or possible courses of action that need to be evaluated in terms of non-linear outcomes that resemble more the kinds of problems that they will face in reality.

In her book *Powerful Learning*, Linda Darling-Hammond (2008) shares examples of multidisciplinary projects based on the Expeditionary Learning Schools Outward Bound Model. One of the schools on which Darling-Hammond concentrates is King Middle School, in Portland, Maine. This school has implemented the expeditionary learning process with great, documented success. Their goal is to undertake four- to twelve-week multidisciplinary projects. Art, science, and language arts, supported by computer technology, are used to frame the projects they will spend time developing.

The goal is for students to create an original play or presentation. For younger students the creation of a geology kit or production of a CD-ROM or a book or video is often chosen as the means to display and share their results with a wider audience, which often includes parents and members of the community. For one project members of the local Audubon Society were used to judge the final product and process that the students had to present publically. There have been a variety of projects, including an aquarium design; a CD narrative of Whitman's "O Captain! My Captain!" by students learning English; *Voices of U.S.*, a book of immigrant stories; a guide to shore life of Casco Bay; original music compositions and productions; documentaries on learning with laptops; a claymation video explaining Newton's Laws; and a Web site on

pollution. In most cases these projects were judged by local businessmen or community partners, some of whom may have consulted with the students while the students were developing their individual, team-based projects.

Research, presentation, and planning skills are integral to the design and development of each project from start to completion. Group work, community involvement, cooperative planning, and learning are part of the expectation of each assignment, as well. So too are the attributes of critical thinking and problem solving the virtual cornerstone of almost every state standard (Pickering, 2010). Also implicit in all these multidisciplinary examples is the extent to which teachers try to incorporate collaborative structures that are pivotal to the success of the instruction.

Collaboration

Advances in telecommunications that have eliminated distances, have enabled collaboration with unprecedented ease, and have dramatically turned over an individually based concept of productivity into one in which teamwork is the default setting for any level of activity. The real-world working environment has seen a dramatic transformation. Workplace demands that were traditionally focused on individual capacities are now shifting toward the ability of the individual to function as an effective member of a team.

Within an analysis of the workplace of the future, Anthony M. Townsend, Samuel M. DeMarie, and Anthony R. Hendrickson (1998) say:

> Just as the personal computer revolutionized the workplace throughout the 1980s and the 1990s, recent developments in information and communication technology are on the verge of creating a new revolution in the coming decade. A group of technologies, including desktop video conferencing, collaborative software, and Internet/Intranet systems, converge to forge the foundation of a new workplace. This new workplace will be unrestrained by geography, time and organizational boundaries: it will be a virtual workplace, where productivity, flexibility and collaboration will reach unprecedented new levels (p. 1).

A direct consequence of the new paradigm and the increased opportunities for people all over the world to break down barriers and to work together effectively is that learning how to collaborate becomes an essential core skill within the 21st century scenario. Even though there is extensive research and a whole pedagogy on effective group work, working cooperatively is still the exception and should be the norm in an evolving 21st century learning landscape. In a report by Education Services (2009) in Australia titled *Collaboration in Teaching and Learning*, it is aptly noted that:

> Many technology tools are used to support collaborative learning in all sectors of education. These include tools such as wikis, microblogs, social networking services, virtual worlds, and online games. Skills developed from participating in collaborative learning through formal education and informal learning have direct relevance to the 21st century workplace where collaborative tools are used for professional purposes (p. 24).

School systems are predominantly designed with individual accountability in mind. Schools demand the mastery of clearly predetermined outcomes in terms of contents and skills from each individual. Standardized assessments and the prevalent pedagogies that are in place to support

individual performance on these assessments emphasize individual learning. Whenever teachers engage in collaborative work, the main concern is related to individual accountability. Heavy emphasis is placed on designing assessment rubrics that make sure that students are properly evaluated and that they do not hide within the group production.

There is a way to emphasize individual learning while at the same time teaching students to function effectively within a collaborative group. Some of the collaborative software tools that are now being commonly used in the workplace can provide the needed tracking mechanisms that gauge and document the contribution of each of the team members to the final product. Many of these online, freely available applications allow for a detailed follow-up of how each individual has contributed to the development of the project, even supplying detailed time frames and logs that monitor the progress of the work in question.

Collaboration is a viable model for learning. Any experienced educator will attest to the advantages of student collaboration as a means for engaging students. Learners become more animated when presented with group work. Beyond the obvious fact that working on a collaborative project frees learners from a passive role into one in which they are sharing an activity with their peers, there are many pedagogical advantages in light of the 21st century model.

Collaboration is a direct link to the real-life working scenario. The default model for creation in a globalized world that includes increased outsourcing possibilities is collaboration, so it makes sense to try to include as many of these instances as possible within the school curriculum, and to foster the skill of effectively interacting with peers from a very early age. A growing volume of research also advocates learning from peers as a valuable strategy. In "Cognitive Perspectives on Peer Learning," O'Donnell and King (1999) write:

> A reason for the current popularity of peer learning derives from the fundamental task that schools face in preparing students for life after school and in communities. Classroom-based peer learning activities are considered an important aspect for preparation for life after formal schooling ends (p. 4).

Taking into account one of the fundamental premises of 21st century education—that learning should be customized to each and every student's individual abilities and learning style—collaborative work also gives teachers the chance to set tasks that the learners can accomplish and that also allow them to benefit from an augmented pool of talent, thus accomplishing the goal of learning from and with their peers. Another tenet of 21st century education is also accounted for in this collaborative model—the teacher has to step away from a central role of administering knowledge and act as a facilitator, coach, and mentor to guide the work being done by the groups.

Transforming Assessment for the 21st Century

In effective 21st century schools, strong instructional strategies are aligned with an array of rich assessment practices. Assessment *of, for,* and *as* learning should inspire and support the learning of everyone in the system: from students and teachers to school organizations and governmental agencies. The Ohio Leadership Advisory Council supports the use of the data collected through a variety of assessments in *Area 1: Data and the Decision-Making Process* of the *Leadership Development Framework*. Area 1 emphasizes the importance of:

- Indentifying, collecting, analyzing and effectively using relevant data to identify the greatest problems to be addressed, and to create the kind of culture and expectation that supports effective data-based decision making at all levels of the system.
- Developing shared accountability by broadening the concept of accountability to include "internal" measures that hold all adults accountable for improved student performance, rather than only external accountability imposed from outside.
- Using data to continuously monitor student progress against performance targets and district-established goals.
- Addressing achievement and growth, and in getting past opinion through the use of research-based practices. (p. 12)

In the 21st century, as well as in the 20th century, collecting and analyzing assessment data systemwide to inform decisions about teaching, leading, and learning is crucial. It is important for both students and educators to know if students have mastered desired concepts and skills. It is equally important for educators to know if their teaching and leadership practices are leading to the desired results in student learning (Hattie, 2009; Reeves, 2008; Marzano, Waters & McNulty, 2005). However, just answering the questions "What do students know?" and "What are students able to do?" is not robust enough for 21st century demands. Assessment practices need to be expanded. Unlike 20th century assessments that are standardized, secret, and focus on individual results, 21st century assessments need to be multifaceted and openly available for study, consideration, and collaboration. Students themselves contribute to the creation of the assessments (Reeves, 2010).

In *21st Century Skills: Rethinking How Students Learn,* Doug Reeves (2010) authored a chapter titled "A New Framework for Assessing 21st Century Skills" in which he proposes that 21st century assessments need to challenge students to understand, explore, create, and share. In addition to the questions that indicate the mastery of content and skills, Reeves suggests that assessments in this knowledge era also need to lead students to answer the following questions:

- **Understand:** What is the evidence that you can apply learning in one domain to another?
- **Explore:** What did you learn beyond the limits of the lesson? What mistakes did you make and how did you learn from them?
- **Create:** What new ideas, knowledge, or understandings can you offer?
- **Share:** How did you use what you have learned to help a person, the class, your community, or the planet? (p. 313)

As indicated in Area 3 of the *Leadership Development Framework*, in order to be prepared for the 21st century, students need to develop:

> …critical thinking and problem solving, creativity and innovation, communication, and collaboration skills; information and communication technology literacy; life skills (leadership, ethics, personal productivity, self-directed learning); and 21st century content (global awareness and business fundamentals and economic literacy). (p. 22)

If these skills are critical for learners in this new era, then, expanded assessment protocols must ensue. If teachers are being asked to transform their instructional practices to equip students with the necessary skills to be successful in a global community with a web-enabled playing

field, then assessment practices must facilitate this extended learning dynamic. To further illuminate this discussion, it is helpful to refer to Reeves' elaboration on each of his five elements for 21st century assessment:

> **Learning:** This is the first step. Students do need content knowledge. Twenty-first century students will continue "to learn vocabulary, be able to perform calculations without electronic assistance, speak in complete sentences, and support their assertions with evidence" (p. 318).
>
> **Understanding:** This element includes the opportunity for students to demonstrate their deeper awareness of the content being learned by explaining their learning to others in a collaborative setting. In addition, students need to be informed about the tasks in which they will engage well ahead of the actual assessment. Reeves points out that it is important for students to actually help to create the assessments through which their understanding will be determined.
>
> **Exploration:** Reeves writes, "We venture from learning and understanding to exploration when we ask more challenging questions" (p. 319). Reeves sites questions like "When was Pythagoras wrong? Why was he wrong? What does my understanding of correct spelling on last week's word list tell us about language development and political conquest?"(p. 319). The purpose of assessment is to engage students in learning. By asking stimulating questions on which students can collaborate, learning is elevated to deeper inquiry and does not languish in the regurgitation of memorized facts.
>
> **Creativity:** Assessments that truly stimulate learning call on students to apply their knowledge in fresh and insightful ways. Reeves states that "assessments must support rather than punish errors" (p. 323). Errors can provide additional opportunities for learning and may indicate that the students are taking risks and engaging difficult material in a creative manner. As in *understanding* and *exploration*, opportunities to collaborate are also critical to creativity as students provide one another with reflective feedback.
>
> **Sharing:** Reeves points out that "sharing requires a shift in student perspective." He suggests that students' success should not just be measured by the tests passed, but instead "by the ways in which they apply their learning to help others" (p. 323).

In summary, rich 21st century assessments involve learners in pragmatic social action that has value and requires judgment expected of involved and reflective citizens. In addition, 21st century assessments require identification, analysis, and resolution and demand a high degree of rigor. They stimulate engagement and exploration, draw from academic scholarship, and are often multidisciplinary. In short, 21st century assessments are designed to continuously stimulate inspired teaching and profound learning.

Conclusion

This 21st century knowledge era, with its essential premise of lifelong learning, is much more about learning than teaching, so educators need to abandon the role of sage on stage and embrace one of facilitator, guide, mentor, and coach in an effort to uncover their students' talents and tailor to individual learning styles and abilities. This required change is not just an alteration of the job description, but rather a call to rethink the prevailing mindset in teaching, which implicitly but consistently centers education around teaching as the quintessential defining process. Sir Ken Robinson, in his book *The Element*, analyzes with groundbreaking clarity the profound implications of teaching to each child's unique abilities, highlighting the individual talents of children: "Education is the system that's supposed to develop our natural abilities and enable us to make our way in the world. Instead, it is stifling the individual talents and abilities of too many students and killing their motivation to learn" (p. 16).

As Ohio's District Leadership Teams, Building Leadership Teams, and Teacher-Based Teams grapple with Instruction and the Learning Process, Area 3, of the Ohio Leadership Advisory Council's Leadership Development Framework, they will want to collectively address the instructional needs of 21st century learners. In addition, as Ohio's educators are applying Area 1: Data and the Decision-Making Process of the Leadership Development Framework, they will want to make certain that they are implementing an array of rich assessment approaches that are aligned with the expanded instructional opportunities that students are being offered in effective 21st century programs. Ultimately, all educators are wise to remember Ted Sizer's words in one of the nine *Common Principles of the Coalition of Essential Schools*: the goal of education is for students to "learn to use their minds well" and to be able to apply what they know in the world beyond school (Muncey & McQuillan, 1996).

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