



The Gordon Commission
on the Future of Assessment in Education

Changing Paradigms for Education:

From Filling Buckets to Lighting Fires

To Cultivation of Intellectual Competence

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Introduction – “Lighting Fires”

Perhaps one of the greatest difficulties our schools face today is the challenge of “lighting fires” or engaging students and creating excitement about learning. Traditionally, our educational endeavor has been pre-occupied with “filling buckets,” or teaching students to recall specific content given to them through lecture. Exciting students about learning and education is an integral part of preparing them for future success as students and as members of society. In order to light fires, attention must be paid by educators to the capacities, interests, and habits of students (Egan, 2008). In essence, effective engagement of students requires engaging the imagination and lighting the fire of creativity.

“All knowledge is human knowledge and all knowledge is a product of human hopes, fears, and passions. To bring knowledge to life in students’ minds we must introduce it to students in the context of the human hopes, fears, and passions in which it finds its fullest meaning. The best tool for doing this is the imagination.” (Egan, 2005, p. 12)

Along with lighting fires, it is important that education pay attention to various strategies that increase the effectiveness of assessments. Engaging the imaginations of students is often a difficult task given the current state of assessment, teaching and learning. Contemporary assessment lacks measures that test many of the educational outcomes associated with the kind of thinking that Egan advances. Modification of assessment to include recognition of the contexts in which test takers live and operate is one way to inspire achievement. Integrating teaching and learning into the process of assessment, educating for complex, high order thinking, and assessing with increasingly diverse content, are all strategies that contribute to assessment’s effectiveness. As it stands today, assessment in its quest to create and attach value to student achievement stifles some of the very mechanisms that inspire such achievement. It is with this paradox in mind that we turn our attention to the future of assessment and the changing paradigms that will shape it.

The persistent dominant role played by families in the education and socialization of children (Bailyn, 1960; Coleman, 1966; Cremin, 1970, 1980, 1990) has, perhaps, contributed to the emergence of schooling relatively late in the history of education. Competition from religious

institutions, print and now digital media could overshadow both families and schools as the principal sources of education (experiences and materials) in the 21st century. With new digital mediums, traditional methods of teaching will become increasingly outdated. People that have the ability to inquire, think, produce knowledge and continually learn will gradually make traditional teachers obsolete. Autonomous learners will be less dependent on the human teachers to assist them in the learning endeavor. The content and process of study will, more and more, come under the control of learner choice and engagement. What will be learned and how it will be learned are more difficult to predict, since the theories that inform education continue to change, and learner choice and engagement depend so heavily on the epistemological and political contexts that shape those education-molding philosophies. The gradual move toward autonomous learners will bring us closer to what John Dewey once envisioned,

“Since there is no single set of abilities running throughout human nature, there is no single curriculum which all should undergo. Rather, the schools should teach everything that anyone is interested in learning.” – John Dewey (1859-1952)

One of the three stated missions of The Gordon Commission on the Future of Assessment is to consider our best estimates of what education will become in the 21st century and what will be required of the educational assessment enterprise by the middle of this century. In the pursuit of addressing that component of our mission, Commissioners and Consultants to the Commission are exploring emerging and anticipated changes in the paradigms that will in turn change the goals and processes of education. Among these emerging paradigms are the following:

Learners as knowledge managers and knowledge producers:

We are beginning to see a shift from thinking about education as concerned with "filling buckets to lighting fires. Increasingly, the goals of education reflect the growing concern with encouraging and enabling students to learn how to learn, and to continue learning over their entire lifetimes; to become enquiring persons who not only use knowledge, but persons who also produce and interpret knowledge. The pedagogical challenge will be less concerned with

imparting factual knowledge and more concerned with turning learners on to learning and using their mental abilities to solve ordinary and novel problems.

The three R's, meet the 5 C's:

Reading, wRiting and aRithmetic will continue to be essential skills but thought leaders in education, Sir Kenneth Robinson among them, increasingly point to varying combinations of five Cs as essential processes in education;: Creativity, Conceptualization, Collaboration, Communication, and Computation. The Cs are joining the Rs as the modern ends toward which education is directed. Learning to think critically and creatively, reason logically, interpret relationally, and access and create knowledge, will become more and more privileged in the 21st century. The new century workplace values basic communication skills such as reading and speaking, but also finds increasing value in listening and collaborating skills, and facility in processing information from multiple perspectives. The capacity to recognize and even create relationships between novel and disparate inputs of information will be rewarded in this new century. For 21st Century societies, the illiterate will include not just those who cannot or will not read, but also those who cannot navigate the world of digital technology. Computer literacy will be a requirement of economic, educational and social intercourse, but literacy will also mean far more than the ability to do word processing, social networking and play electronic games. Digitalization will change the demands and opportunities of modern societies even more rapidly and radically than did industrialization, and as a result the processes of education and the needs of assessment will change quickly.

Re-integrating knowledge:

In the 18th, 19th and 20th centuries, we privileged de-contextualization in the pursuit of precision in measurement and control in experimentation. When we turned to multivariate analysis to study complex (dynamic, multi-level) phenomena, it was with a view to the sequential teasing out of the contribution made by each of several component variables, even while we were beginning to understand the notion of dynamic and dialectical interaction. The isolation of variables or components for the purpose of study may continue while the intent of such study is to know facts. However, as our purpose turns to *understanding* of the phenomena of the world and the relationships between these phenomena, experimenting, observing and measuring things

outside of the contexts in which they have developed and function will become more and more dysfunctional. Education and its assessment will have to become capable of capturing aspects of context, perspective and the attributions, which come to be assigned to these conditional phenomena. The exactness and precision gained by de-contextualization in the past will be challenged by the situative and existential sensitivities that are necessary when contextualism and perspectivism are required for understanding, as well as knowing. It is worthy of recall that the reason qualitative methods became so prominent at the end of the 20th century was because we finally understood how inadequately we coped with contexts and multicausality.

Reviving the subjective:

In the interest of scientific validity, traditionally we have privileged “objective” knowledge over “subjective” information. We have been taught to try to control for or contain variance that is associated with affect and social/psychological situation. We have tended to examine cognitive functions independent of their contamination or influence by human biases and feelings. Yet, modern social, psychological, and biological sciences are pressing us to examine or assess human performance with greater respect for the influence of these affective, emotional, situative and social processes. Evidence mounts in support of the fact that these processes influence the character and the quality of human performance, yet instances of objectively documented human performance (assumed to be unaffected by affective, emotional, situative and social practices) are the source of the data of traditional assessments in education. Comprehensive and valid assessment in education will, in the future, have to be more sensitive to subjective phenomena, i.e., to affect, attribution, existential state, emotion, identity, situation, etc., as will also the teaching and learning transactions in which learners are engaged.

Re-balancing assessments:

Assessment of the outcomes of learning in the interest of accountability will be with us for a while, but the future is likely to bring increased concern in assessment for the purpose of informing and improving learning and the teaching processes that enable learning. Political pressure and some simplistic reasoning continues to support the possibly inappropriate use of educational assessment data for accountability purposes, even though such practices are not supported by the empirical evidence, not supported by many leading psychometricians, and some

educators feel that such practices are actually counter-productive for the intended purposes. Pressure mounts, from the profession and the practicalities of educational praxis, for better information to inform intervention prior to the search for better information by which to determine how well we are doing. We have known for more than a century that what we do in education is imprecise; that one model does not fit all; and that much of our intervention is under-analyzed trial and error. We believe that assessment in education can and should inform and improve teaching and learning processes and outcomes, without ignoring the importance of accountability. Whether the two purposes can be served concurrently, and by the same assessment instruments and systems, is one of the most important contemporary questions to be answered.

The “new” functions of learning:

Humans will very likely continue to create technologies that make their work easier and that amplify and expand human abilities. Some of these new technologies, as with artificial intelligence inventiveness, could change the importance of some of the competencies for which we currently educate. Or, more likely, they will exacerbate the need for other functions that we currently know less about enabling, i.e., agency, disposition, and relational adjudication (reconciling contradictory relationships). The human ability-amplifying digital electronic technologies may make some of our educational tasks easier, but they also may create monumental challenges and opportunities for the people who are responsible for assessing, teaching and learning, particularly since the future employment of youth will be in as much flux as the schools designed to prepare our youth for work.

Learning as a social process:

Just as human intellect is increasingly recognized to be a social phenomenon, both experienced as, and produced by social interaction and consensus, so also are teaching and learning. Even the learning we do “alone” benefits from the social transactions that have preceded it. Electronic games and distance teaching and learning are some examples of the teaching and learning that occur in relative social isolation, but that depend on the collective actions of others. Pedagogy of the future will need to reconcile the individual/social paradox of teaching and learning and the implications of this paradox for assessment. For assessment, such issues arise as:

- Isolated and collaborative performance as targets of assessment;
- Knowledge and skill retained in one's mind, and knowledge and technique accessed or generated in social transaction;
- Contextualist and perspectivist validation and the limits of empiricism; and
- Systematized documentation of relationships among attributions, contexts, identities, and performances.

The field of education is constantly shifting in accordance with changing economic conditions, demographic data, technological advances, and political debates. These drivers change the ways in which politicians and test makers must conceptualize and ultimately construct curriculum and assessment. As a result, an inventory of the ways in which education is shifting and inquiry into the mechanisms that causes these shifts is central to conceptualizing the future of assessment and education. Current education practices need to consider the possible ways that future educational systems can meet, address, and re-envision the concept of education into the next 50 years. This paper attempts to outline the changes in the ways we need to think about education, highlights the possible future conditions that these new ways of thinking create, and conceptualizes a future for education and testing that reconciles new realities with assessment practices.

Why Do We Educate?

The educational endeavor is shaped and informed by the goals that we set for our youth. The manner in which we choose our goals, and the goals that we select have a substantial influence on the outcomes of our educational system. As such, it is important that we clearly detail what it is that we expect our youth to attain through education, as they become adults. There has been some agreement among stakeholders of the educational system about the purpose of education for youth. Rothstein, Jacobsen, and Wilder (2008) conducted a survey of American educators and parents, which found that both groups had very similar conceptions of what it wanted from the American school system. They valued basic skills foremost followed quite closely by critical thinking. Then, almost equally tied for third place, were the following: developing social skills, developing a work ethic in youth, developing personal responsibility, developing an ability to get along well with others (especially others from different backgrounds), providing vocational, career, and technical education that could qualify youth for skilled employment (that does not require a college degree), providing a foundation for lifelong physical health (including good habits of exercise and nutrition), developing a love of literature and the capacity to participate in and appreciate the musical, visual, and performing arts and finally developing self-confidence, respect for others, and the ability to resist peer pressure to engage in irresponsible personal behavior. Schools are asked to do a lot, and some schools actually attempt to meet all of the demands placed on them. It is clear, however, that schools cannot reliably and validly assess many of the activities in which they engage. They end up assessing only the tip of the iceberg, and consequently there are many parts of schooling that are not visible and not assessed.

Broader conceptions of the goals of education can help schools to overcome the overextension of programming that naturally occurs when there are numerous goals and limited resources. Many of the specific demands of parents and educators identified by the Rothstein, Jacobson, and Wilder survey can be combined into broader categories. Gordon (1999) proposes that there should be five broad ends of educational outcomes:

- 1) The individual's ability to know, understand and appreciate oneself and multiple perspectives concerning the world;

- 2) The attainment of multiple literacies and oralities, like reading, speaking and writing, and quantitative, scientific, and technological literacy;
- 3) The mastery of bodies of knowledge and the capacity to create new knowledge and techniques;
- 4) The ability and disposition to access and manage information in its complexity and its application to solving novel as well as ordinary problems; and
- 5) The ability and disposition to use knowledge, values, and thought to recognize and adjudicate relationships among the phenomena of one's experience.

Education in its current form cannot account for the majority of Gordon's (1999) broad ends or the many purposes outlined by Rothstein, Jacobsen, and Wilder. Curriculum, especially as it has been reactively configured in the wake of No Child Left Behind¹, has not been able to provide students with these outcomes. Consider the following quote from David Berliner (2010):

"... In this era of high-stakes testing students cannot be allowed time in school to follow their interests. The standards define what students should know at different grade levels, and deviation from that plan is considered dangerous because it might result in missing some items on the states high-stakes accountability test. Of course schools never allowed much time for individualized work, but now even the teachers that made some use of problem-based or project-based learning, forms of instruction that could ignite students' interests through a curriculum more personally tailored for an individual, are not allowed to do so. One size of the curriculum is supposed to fit all students. Yet we are reasonably sure that the 21st century economy will require from our work force a broad set of skills, not a narrow one. Thus diversity in the outcomes of the educational system ought to be a goal of American education, not sameness. Education for a Volatile, Uncertain, Complex, and Ambiguous future world, a VUCA world², would seem to demand breadth of talent in society so at least some of the talents that exist in society would be appropriate to whatever the world brings our way. It is like evolution. If characteristics of the niche that one inhabits change, only organisms that are adaptive will survive. This means that in changeable times variation in talents, like variation in genes, is needed. Identical skills, like identical genes may prove of no value for survival. The emerging VUCA world of the 21st century, more than ever before in our history as a nation, requires breadth of talent so that we might

¹ The No Child Left Behind Act of 2001 was signed into law by President Bush in 2002 and requires states to develop assessments of basic skills (*No Child Left Behind Act of 2001*, 2002). The full text of the law can be found at the U.S. Government Printing Office at <http://www.gpo.gov/fdsys/pkg/PLAW-107publ110/content-detail.html>.

² Derived from military vocabulary to describe the uncertainty of the future (Stiehm & Townsend, 2002).

posses an adaptable work force. The behaviors associated with high-stakes testing work against that goal.” (Berliner, 2010)

It also is important to consider the purposes of socialization and citizenship when discussing the goals of education. Creating informed and thoughtful citizens that are able to contribute to society is a primary function of the education system. As Franklin D. Roosevelt famously declared:

“Democracy cannot succeed unless those who express their choice are prepared to choose wisely. The real safeguard of democracy, therefore, is education.” – Franklin D. Roosevelt (1938)

Democratic structures necessitate that participants in the democracy are informed or have the ability to be informed on a wide range of topics. Education’s ability to provide this function is telling of how well the system will work and how well the needs of citizens will be met. This goal combined with the purposes and concerns outlined by Gordon, Berliner, Rothstein, Jacobsen, and Wilder allow us to answer our question, “Why do we educate?” To respond to the question we use a definition that is slightly modified from one that Debbie Meier provides (Meier, 1994):

“An educated person has the ability and inclination to use knowledge, technique, judgment and imagination in solving the problems that confront them at work and at home, and to participate in the maintenance and further development of our democracy.”

Reprise of Major Trends

The trajectory of education has shifted alongside historical contexts throughout history. Movements have contested the hegemonic conceptions of education and dared to conceptualize new and improved forms of education and assessment. The trends that follow promise to transformation what is desired from teaching and learning, and reflected in educational assessment.

Demographic and economic trends force changes in the ways that we teach, learn, and assess. Poverty and inequality seriously inhibit the ability and potential of learners to become

successful in educational spaces. Research shows that poverty affects students in multiple ways. Students living in poverty³ experience difficulty learning, lower levels of overall health, and develop mental health problems (J. L. Aber, Bennett, Conley, and Li, 1997; Duncan, Brooks-Gunn, and Klebanov, 1994; Pollitt, 1994). According to an OECD⁴ report, the United States has the highest inequality level and poverty rate across all OECD countries with the exception of Mexico and Turkey (2008). In 2011, about 46.2 million people were living in poverty in the United States, amounting to 15 percent of the more than 306 million people in the country. In 2011, the rate of poverty for children under 18 was 21.9 percent, or about 16 million youth (L. Aber, Morris, and Raver, 2012). Of these, approximately 5.8 million (24.5 percent) were children under the age of six living in poverty (Smith, Proctor, & DeNavas-Walt, 2012). Meanwhile, the income of the top earners in the country was rising, with the second highest increase in income inequality on record since 1913 occurring in 2007. The top one percent of earners increased their income share from 22.8 percent to 23.5 percent in 2007. That year was also emblematic of the larger shift in incomes that occurred from 2002 to 2007 and beyond, when the top one percent of earners received two thirds of the entire income growth in the United States (Saez, 2010). Even in the tough economic climate following the Great Recession, declines in incomes were unevenly distributed. Between 1999 and 2011, the top 10 percent of earners experienced a 1.3 percent decline in income while earners at middle income levels experienced an 8.9 percent decline and earners in the bottom 10 percent a 14.1 percent decline (Smith et al., 2012).

These statistics show the extreme situation of poverty and income inequality that exists currently in the United States and is likely to persist. The deepening of economic divides and poverty suggest considerable changes for many students' family incomes in the future. If family income can be used as a predictor of future educational success, then the future prospects for the educational achievement of students from lower income families are shrinking, while the future prospects of students from upper income families are rising (Reardon, 2011). The Congressional Budget Office (CBO) projects that, "the economy of the United States will continue to struggle with sluggish growth and high unemployment for several more years." If CBO projections come to fruition, then the economy will have permanently lost jobs, and unemployment will remain above the historical level of 5.3 percent until 2016 (Congressional Budget Office, 2011). And,

³ The federal poverty level was \$22,350 for families of four, \$18,530 for families of three, and \$14,710 for families of two in 2011 (Addy & Wight, 2012).

⁴ Organization for Economic Co-operation and Development

growing income inequality is associated with growing inequality in educational and other developmental outcomes among children (Putnam, Frederick, and Snellman, 2012; Reardon, 2011).

Ethnicity, race, and language diversity are other critically important factors to consider when thinking about the present and future trends in education. Diversity has increased in the United States over the last decade as minority population numbers have significantly outpaced growth in majority populations. From 2000 to 2010, the total population of the United States increased by 27.3 million persons. Hispanic Americans accounted for more than half of this increase, amounting to 43 percent growth. By comparison, non-Hispanic American white populations grew by only one percent during the same period (United States Census 2010, 2011). The enrollment of minorities in four-year colleges, community colleges and trade schools has increased drastically. Between the fall of 2007 and the fall of 2008 the number of minorities entering these institutions increased by six percent, the largest percent growth in 40 years (Fry, 2010). This growth has not, however, resulted in corresponding economic growth for minority groups. In 2011, 26.1 percent of African American families and 24.3 percent of Hispanic families had incomes at or below the poverty line (Smith et al., 2012). Children of minority families are at particular risk. In 2010, African American, Hispanic American, and American Indian children account for 54 percent of all low-income⁵ children in the United States. Sixty-four percent (6.5 million) of African American, 64 percent (10.7 million) of Hispanic American children, and 63 percent (0.4 million) of American Indian children lived in low-income families (Addy and Wight, 2012). In addition, immigration into the United States increased from eight percent in 1990 to 12 percent in 2005 (National Center for Education Statistics, 2007). These populations add a sizable number of students into the educational system while at the same time increasing the racial and ethnic diversity of the school system. First generation immigrant students are more likely to be from lower socioeconomic backgrounds and live in poverty than their American peers, causing the school system to increasingly serve students from impoverished backgrounds (Glick, 2004).

Funding for public education is an important indicator of society's priorities and an obvious indicator of future education trends. The differences in spending on education between

⁵ Low-income is used to describe the minimum amount that allows families to meet their most basic needs on average based on geographical location. Low-income families live on less than twice the poverty level. \$44,700 for families of four, \$37,060 for families of three, and \$29,420 for families of two (Addy & Wight, 2012).

federal, state and local governments are also indicative of educational trends. State spending is particularly interesting because of its implications for the success of students. NAEP⁶ found that states with higher per student spending were more likely to have students that could outperform their peers in states with lower per student spending (New America Foundation Federal Education Budget Project, 2012). From 1991 to 2005, federal funding for K-12 schools increased from 5.7 percent to 8.3 percent of total educational spending, respectively (U.S. Department of Education, 2005). Total public spending on elementary and secondary schools increased to \$520.6 billion in 2006 (Zhou and Johnson, 2008). Increases in federal funding came attached to a huge push for accountability measures, aimed at holding teachers responsible for the growth of students and the efficient use of federal funds.

Education in the United States has undergone a serious shift in the ways in which students pay for post-secondary education. The primary mode of funding has shifted from need-based grants to personal loans. The result is that students have more debt than at any previous time in history. Students with federal loans jumped from 45 percent in 1981, to 58 percent in 2000, an increase of 13 percent (The National Center for Public Policy and Higher Education, 2002). Students at the lowest levels of income are hit the hardest by the increase in student loans because of the difficulty that they face in securing funds to repay the loans. Complicating matters is the fact that college tuition increases have historically occurred during periods of economic hardship (The National Center for Public Policy and Higher Education, 2002). Loan burdens have escalated as tuitions have increased and graduate programs become compulsory. High dropout rates at higher education institutions have led to many lower income students incurring huge debts without securing a degree or job.

Teacher turnover can affect future education trends by increasing costs for schools, and creating an immediate need for qualified teachers. Turnover is an indicator of a number of important variables, including stress level and compensation. It is indicative of working conditions and the amount of support teachers perceive they are receiving. Annual teacher turnover rates increased from eight percent to 15 percent between 1992 and 2005. Within this timespan 29 percent of public school teachers left teaching, switched their teaching subjects, or changed schools (Boe, Cook, and Sunderland, 2007). Underperforming schools are especially

⁶ National Assessment of Educational Progress

sensitive to the rise in teacher turnover. A study by the NCTAF⁷ found that at-risk schools lose already scarce resources to teacher turnover, and greater investment in teacher retention could potentially save cash strapped at-risk schools from the significant economic loss associated with teacher turnover (Barnes, Crowe, and Schaefer, 2007). The increased impact of teacher turnover on underperforming schools only deepens disparities in education. Evidence exists that a higher than average rate of teacher turnover in low performing schools reduces the test scores of the students at that school (Ronfeldt, Lankford, Loeb, and Wyckoff, 2011).

Changes in the political economy of education also promise to shape the future of education. Education policies designed to increase accountability and introduce markets into the education system have created drastic changes (Hursh, 2003; Hursh and Martina, 2003). Education has shifted from a primarily localized effort, where teachers had to adhere to local, cultural and administrative rules, to a more nation-wide effort where high-stakes tests control and evaluate teachers (Hursh, 2004). David Hursh, in the following passage, summarizes the connection between the changes in the political economy of education and the demographic changes previously discussed.

“In the USA, many of the recent education reforms have been implemented in response to calls from neo-liberal and conservative policy makers to improve education efficiency and reduce public expenditures within an increasingly globalized economy. Consequently, local, state, and federal education policies increasingly employ curricular standards and high-stakes testing as a means of introducing competition and markets into education. Moreover, for some policy makers such reforms are the first step towards privatizing education through charter schools and voucher programs... In particular, the reforms have shifted the control over education from the local to the state and federal levels. Further, the reforms have increased inequality between the advantaged middle-class and white students and the disadvantaged working-class students and students of color.” (Hursh, 2004, p. 607)

In sum, these and other unanticipated demographic and economic changes in the United States will have drastic effects on education into the future. Developing methods of teaching, learning, and assessment that account for and anticipate these changes is important if education is to provide an egalitarian tool of social mobility for all segments of the population. It is also

⁷ National Commission on Teaching and America’s Future

important to consider, however, the emerging concerns of teaching, learning and assessment in the 21st century. These concerns, while informed by the surrounding demographic and economic conditions, are driving conceptions of what it means to educate in the future.

Inventory of Emerging and Anticipated 21st Century Concerns

The education enterprise and its processes are very likely to continue to change in the 21st century in response to and in incorporation with several concerns, including:

- The many major developments in measurement theory and technology over the past century;
- Emerging technologies for the amplification of human senses and the capacities of the human mind and body;
- The declining centrality of long-term memory and recall in an age of electronic access to and processing of information (short-term, “working” memory remains critical);
- Changing conceptions of the transactions by which teaching and learning proceed;
- Growing recognition of the importance of attributional, existential and transformational processes (see below) to human behavior, consciousness and intentional performances;
- Recognition that all life experiences are educative and productive and should be assessed;
- The continuum of knowing, understanding, adjudicating relationships, reconciling contradiction, judging, and acting wisely;
- Growing awareness of the roles of context, situation, empathy, compassion and perspective in human learning, thought and performance;
- Recognizing the tension between using assessments for accountability and using assessments in developing teaching and learning strategies, and emphasizing these latter purposes more;

- The growing use of assessments in summative evaluations and their decreasing role in providing information for the improvement of teaching and learning, and formative evaluation.

Emerging technologies for the amplification of human senses and the capacities of the human mind and body also promise to shape the future of education. It is not mere science fiction to think about computer chips implanted into the human body making traditional instruction centered on fact memorization obsolete by automating the learning process. This technology also could help students with the recall of learned information. Researchers are convinced that cognitive functions can be restored or even enhanced with the use of neural prostheses (Berger, et al., 2011). Chemical induced electrical and magnetic brain stimulus techniques are purported to increase math and writing skills (Naish, 2011). Some predict computer emulation or mind uploading, a process that replicates the exact system of human brain function through the use of a system of computers, can theoretically allow students the ability to recapture authentic thought from the great posthumous thinkers in history. Using a physically preserved human brain, the system can employ technology to reanimate the brain and return it to function without the need for a human body. The process can also seamlessly integrate human brain function with computers and the Internet, rendering personal devices obsolete (Kurzweil, 2005). Computer chips that are structured like the human brain mimic the potential of mind uploading. This technology by itself, without the uploading of human consciousness, can teach us how humans learn through emulation (Takahashi, 2011). In addition, 3D object transport has the potential to provide schools with the ability to “print” physical three-dimensional school supplies like tables, chairs, rules, pens and models allowing teachers to focus on teaching and the educational endeavor (Fleming, 2011).

Twenty years ago it was not often predicted that we would all have easy access to the Internet from smart phones, tablets, laptops, and netbooks, all of which have changed the way we think about effective methods of instruction, and these technologies promise to change the ways that we educate. The smart phone, as just one example, gives access to the wiki, making fact retention not obsolete, but certainly less important than ever. Take for example the following passage:

“Dickens’ Mr. Gradgrind was always a silly person, yet he was close enough to some of the teachers we all encountered to be a recognizable caricature. But in this age of augmented memory and augmented intelligence, the Gradgrinds have to go! Here is Mr. Gradgrind speaking “Now, what I want is, Facts. Teach these boys and girls nothing but Facts. Facts alone are wanted in life. Plant nothing else, and root out everything else. You can only form the minds of reasoning animals upon Facts: nothing else will ever be of any service to them. This is the principle on which I bring up my own children, and this is the principle on which I bring up these children. Stick to Facts, sir!” (Berliner, 2010)

Today Mr. Gradgrind’s insistence on facts and memorization is hardly necessary. Students can access facts at any time through Google or any number of search engines. In a world of constant Internet connection, facts are always a click or two away. The issue, however, is that quick and semi-permanent access to needed facts has the power to lessen the ability of students to recall information. In fact, studies show that frequent users of search engines like Google have lower rates of recall of desired information yet higher rates of recall of where the information was found (Carr, 2010; Sparrow, Liu, and Wegner, 2011).

Changing conceptions of the transactions by which teaching and learning proceed alter the way that students interact with education materials. Teaching, at least in some places, and often in those schools serving children of the wealthy, has moved away from the use of the didactic teaching method⁸ to more “facilitatory” (constructivist) methods (Banning, 2005). Traditional lecture is being phased out as the dominant form of teaching in some schools, and techniques like the Socratic dialogue⁹, the experiential teaching method¹⁰, and collaborative teaching¹¹ have become more common. These methods challenge students to think and facilitate

⁸ The didactic method is characterized by direct instruction where students passively receive knowledge (Smerdon, Burkham, & Lee, 1999).

⁹ The Socratic dialogue involves an open debate where participants are invited to ask, respond to and interrogate questions. By exchanging questions between all parties involved, new knowledge is created and perspectives are exchanged. In essence, this method uses dialogue in order for participants to gain meaningful insight into the topics that are discussed (Srnar & Neisser, 2004). The Socratic dialogue is, in a sense, a rejection of the foundation of the didactic method and a move to dismiss the logic of the teacher as the “impartor of knowledge” (Banning, 2005).

¹⁰ John Dewey explains the experiential teaching method in the following passage, “Experiential learning takes place when a person is involved in an activity, then looks back and evaluates it, determines what was useful or important to remember and uses this information to perform another activity” (Dewey, 1938). Experiential learning is thought to be particularly effective at nurturing critical thinking and problem solving skills.

¹¹ Collaborative teaching methods use groups in order to facilitate learning. The interaction between students allows an interchange of information that replicates the act of learning in daily life (Gerlach, 1994).

the learning process rather than engaging students in direct instruction. There is still debate, however, on the effectiveness of constructivist views of teaching. Richard Clark, for example, writes that,

“Cognitive architecture places severe restrictions on working-memory capacity and so forced guidance allows students to allocate limited cognitive capacity to learning a successful performance routine without limiting transfer. [Researchers] present consistent evidence from the past half-century where guidance results in significantly more learning than constructing solutions to problems and tasks (Clark, 2009, p. 174).”

The paradoxical nature of motivation as a characteristic of the learning person, of the teaching person or process, of the community, and of the phenomena that are to be learned, have implications for teaching practices. Differences in achievement level between populations cannot be accounted for by a fundamental construct of motivation (Banks, 1988; Katz, 1967). The context in which a student is learning and the history of the student as a learner, dictate the student’s interaction with the material and his or her ability to achieve. A student’s learned method of responding to different assignments and circumstances drives their ability to achieve (Banks, 1988). Additionally, the fact is that we hardly ever foster, under school auspices, the learning in which that our children and youth are really interested in. As a result, students lack stimulation and excitement about the educational endeavor. John Deke and Joshua Haimson (2006a) in their report, “Valuing Student Competencies: Which Ones Predict Postsecondary Educational Attainment and Earnings, and for Whom?” found that taking into account the individual strengths and weaknesses of students was the most effective way of deciding which core competencies to improve that would yield the most future success for students. Logically, they concluded that individualized approaches to learning are perhaps the most effective way of ensuring a student’s future success. In addition, they concluded that added focus on skills captured by standardized tests might cause teachers to ignore nonacademic capacities that are as important to success as skills captured by tests. A second report by Deke and Haimson (2006b) followed 9,977 students from 1988 throughout their academic careers. They observed the skills that were best at predicting achievement in post-secondary institutions. Deke and Haimson found

that improvement in nonacademic competencies¹² had the greatest effect on future achievement (Berliner, 2010; Deke and Haimson, 2006b). In essence, what Deke and Haimson unearthed was that national policies aimed at improving the official curriculum areas appeared to not be as effective as local school policies to develop student skills in areas they are already proficient in. Allowing students the chance to develop expertise in whatever areas that they are interested in, and having teachers teach in their areas of expertise, is probably as good as any push to have the official school curriculum running full time (Berliner, 2010).

The work of Deke and Haimson speaks directly to the work of Tiedeman and O'Hara (1963) who assert that the difference in the concerns of young people are evident when exploring the data that they worry about, as opposed to the data that schools worry about. The differentiation between "other people's data and one's personal data," illustrates a conflict between content mastery and activities like social interactions with peers, dating, pursuit of reputation, athletic and social competition, and the adjudication of the relationships in family as well as community politics (Tiedeman and O'Hara, 1963). In the daily life of students each individual must delicately balance his or her own content mastery with his or her own social endeavors. Engagement of students by using ideas and topics that excite them and engagement of the competencies that are particularly strong in each individual, inside and outside of the mastery of core content, should be the focus of schooling in order to better prepare students for future achievement.

The growing recognition of the importance of attributional¹³, existential and transformational processes to human behavior, consciousness and intentional performances promises to change the way that we educate. The answer to these "why" questions are framed by self-perceptions that, when recognized, can serve as learning experiences for students (Weiner, 2010). Existentialism's increased prominence in education debates is in large part due to the recent development of situated knowledge and qualitative data. The following quote by Steven Earnshaw (2007) details the connection of existentialism to the changing concerns of education:

"Existentialism is a philosophy that takes as its starting point the individual's existence. Everything that it has to say, and everything that it believes can be said of significance- about the

¹² e.g. work habits, sports skills, leadership skills, pro-social behavior, and locus of control.

¹³ Attributional theory explores the cognitive processes that people undertake to explain why things happen to them.

world we inhabit, our feelings, thoughts, knowledge, ethics- stems from this central, founding idea.” (Earnshaw, 2007, p. 1)

Per Earnshaw’s definition, if all knowledge stems from an individual’s existence then the act of education is a practice grounded in localized knowledge. This idea has important implications for the future of education. Transformative theory is loosely associated with the idea of the person as a knowledge creator. The theory deems the self-interpretation of the senses of learners as significant, and the act of interpretation as educational (Mezirow, 1994; Newman, 1994). If knowledge and the understanding of it are dynamic and the learning person is her/himself transformed by the experience of learning, the teaching and learning of static concepts and stable procedures can be problematic.

The push for comprehensive education supported by communities and parents is both an old idea¹⁴, as well as an emerging concern for thinking about education in the 21st century. Thinking comprehensively and relationally about education renders all life experience as educative and productive of what is learned and measured (Gordon, Bridglall, and Meroe, 2005). Schooling can be a productive site of learning through engagement with the right methods, but schooling is unable to provide a full educational experience. Therefore, it is important that we do not tie education exclusively to schooling. We need to acknowledge the role of grandmothers, aunts and uncles; churches, mosques, and synagogues; after school programs and youth clubs; peer groups and popular cultures, etc. When communities and parents are engaged, students learn inside and outside of the classroom thereby accelerating their development and making them better prepared students.

A Vision of Pedagogy for the 21st Century and its Assessment

The bi-directional integration of assessment, teaching and learning as symbiotic pedagogical processes is a necessary paradigm for the future. Assessment has the ability to

¹⁴ Part of the progressive ideas at the end of the 19th century, and also a part of the immigrant schooling movement of the early 20th century,

inform the curriculum for teachers and to reveal what students know or do not know¹⁵ (Pellegrino, 2012; Pellegrino, Chudowsky, and Glaser, 2001). The mastering of specific skills, the discovery of the contexts in which a student can perform these skills, and the definition of the status of a student are the overall goals of assessment. As such, the aim of assessment should be to inform teaching and learning, where the concepts that we assess are developed. Else Hausserman (1958) wrote about the assessment of developmental potential in preschool children with neurological insults. Hausserman used descriptive analyses to judge childrens' performance to determine if educational intervention was needed. For Hausserman the goal of assessment was to determine the degree of difficulty individual children had accomplishing tasks. With this information she could intervene and help them to reach a set objective. Her bi-directional integration of assessment and teaching also proved that descriptive analyses could be used to infer assessment information. Hauserman's research illuminates the importance of alternatives in the nature and modes of assessment (Hausserman, 1958). Herbert Birch (1958) summarizes the situation well, in the following quote, if you place his comments in the context of education.

“The use of a method for intellectual evaluation as an instrument that has positive value for the promotion of training and education is an essential feature of rehabilitation. In this area of work one is far less concerned with predicting whether one given child will achieve success in competition with a group of age-mates drawn from the general population, than with the problem determining the kinds of training and experience that will best promote his own adaptive functional abilities. From this point of view one becomes concerned with the laws of perceptual-motor functioning in a certain seven year old child rather than with the question of whether or not he can copy a geometric figure from a model as well as can other children of the same age. In short, the objective of the examination is to provide information about the special circumstances which are needed to create appropriate conditions for learning in the handicapped child. Such an approach, as Miss Haeussermann so aptly puts it, shifts ‘the burden of proof from the child who is being examined, to the items which test the level of his comprehension.’” (Birch, 1958, p. i)

Dynamic pedagogies, such as the concept explored by Edmund W. Gordon and Eleanor Armour-Thomas (2006), use diagnostic test data to create assessments that can identify the cognitive strengths and needs of students. Teaching, learning and assessment are integrated

¹⁵ See Pellegrino's triangle of curriculum, instruction, and assessment (Pellegrino, 2012; Pellegrino, Chudowsky, & Glaser, 2001).

through the use of curriculum, which guides a teacher's interaction with students. The result is that students are constantly assessed and their assessment leads to personalization of the teaching and learning transactions between themselves and their teachers (Gordon and Armour-Thomas, 2006).

Intellective competence/character is a capacity and disposition to adapt to, appreciate, know and understand the phenomena of human experience to make sense of the world. We also have also come to use the construct to refer to the quality with which affective and cognitive processes come to be applied to one's engagement with quotidian, novel and specialized problems. Intellective competence/character not only reflects one's habits of mind, but it also reflects the quality or goodness of the products of mental functioning. Like social competence it reflects the effectiveness of the application of one's affective, cognitive and situative processes to the making sense of and addressing the problems of the world. The integration of the core functions of education must develop the intellective capacity of students. The goals of education necessitate pedagogy that instills the appreciations and dispositions needed for the adjudication of values in the service of prosocial needs. The development of these appreciations and dispositions requires good schooling inside and outside of the classroom (Gordon et al., 2005).

Human agency is also an important facet of 21st century education. We define human agency as the ability to act in one's own self-interest and the interest of others without being involved in exploitation. Richard deCharms (1977) differentiates between "pawns" and "origins." Pawns, according to deCharms, identify motivation as external and manipulative. Origins identify motivation as internal and integral. Students must be taught to be origins and not pawns or they will refuse instruction and struggle to achieve (deCharms, 1977). Albert Bandura (2001) intimates that human agency consists of intentionality, forethought, self-reactiveness, and self-reflectiveness. Accordingly, to be an agent is to intentionally make things happen by one's deliberate actions. But to be able to make things happen one needs to both know and understand what is the relevant knowledge and what the facts mean – to whom and under what conditions. Our notion of intellective competence is instrumental in this regard (Gordon, 2010b).

Improving mental processes like accessing information; problem/situation perception; analysis and synthesis; logical reasoning; relational adjudication; selective comparison; meta-cognition and meta-compositional management; valuing and deciding; human agency should be

goals of the educational endeavor. Expertise in a subject or on a topic requires a deep base of knowledge. Fact bases are not enough. The following quote from Beatrice Bridglall (2001) details the creation of experts.

“Research comparing the performance of novices and experts in addition to research on learning and transfer, demonstrates that experts are “smart people” who also draw on a richly structured information base. But accessing factual information is not enough. The key to expertise is the mastery of concepts that allows for specialized learning and enables the transformation of a set of facts into usable knowledge. Experts use a conceptual framework to organize information into meaningful patterns that facilitates eventual retrieval for problem solving. And unlike the simple acquisition of factual knowledge, thoroughly understanding concepts facilitates the transfer of learning to new problems. This finding suggests that in-depth coverage of fewer topics that enables learning of key concepts is preferable to the breadth of coverage of subject-related topics. Teachers, consequently, need a substantial knowledge base in a variety of subjects, familiarity with the process of inquiry, an understanding of the relationship between information and the concepts that help organize it in a discipline, and a grasp of the processes in students' conceptual development (Bridglall, 2001).”

Students that are able to develop their own conceptual frameworks and have the ability to distinguish which situations work best for any given framework are on the road to expertise. Unfortunately, if students are not exposed to this mode of thinking they are less able to make critical choices and to think critically (Gordon, 2010b). Students must be engaged in a way that excites them and creates incentive for remembering the constructs that they are taught. Again Bridglall (2001) adds:

“If students' initial understanding is not engaged, they may fail to grasp new concepts and information presented in the classroom, or they may learn the material for purposes of test taking but revert to their preconceptions outside the classroom. Prior understanding in students at any level can impede their ability to learn contradictory ideas unless they are given the chance to explore the errors in their initial beliefs. These facts about learning require that teachers: (1) draw out their students' existing knowledge through creation of classroom tasks and conditions that reveal students' thinking; (2) use it as the foundation for students to further understand the subject matter; and (3) use frequent formative assessments to make students' understandings apparent to themselves, their peers, and their teachers. These assessments are more useful in promoting learning with understanding than are tests measuring students' ability to repeat facts or

demonstrate isolated skills. Schools of education can promote teachers' ability to work with students' preconceptions by helping teachers to: (1) identify predictable preconceptions that make mastery of subject matter challenging, (2) recognize unpredictable preconceptions, and (3) help students to build on their pre-conceptions by challenging them and replacing them when appropriate." (Bridglall, 2001).

Perhaps the most important competence for students is the capacity to use analytical and logical reasoning. As a result, curriculum that develops the capacity to analyze the world, both quantitatively and qualitatively, and to apply logical reasoning to the connections, patterns, and processes in a student's life, is very much in need. Social encounters between people may account for much of the learning in these two areas, but since the logic of the education may be more conducive to academic experience, the analytics and logic of education may need to be taught to students who have not explored socially (Gordon, 2010b).

The problem for assessment is to identify and measure performance indicators that are appropriate to these phenomena. One set of ways to assess the learner's knowledge and skills is to:

- 1) probe their prior knowledge, skills, and readiness for new learning
- 2) check their emerging understanding of new concepts and procedures as well as misconceptions
- 3) check whether they have acquired the new knowledge and skills
- 4) check how well they are able to demonstrate their knowledge and skills with automaticity
- 5) check how well they have consolidated their new learning, and
- 6) probe how well they are able to transfer new learning to other contexts.

Teachers can engage in dynamic assessment¹⁶ in which they assess to design instruction that is sensitive to changes in student learning and performance. As such, the primary goal is to provide diagnostic information about students' strengths and weaknesses in relation to the attainment of

¹⁶ Use diagnostic test data to create assessments that can identify the cognitive strengths and needs of students.

explicit instructional objectives (Gordon and Armour-Thomas, 2006). In addition, it is thought that assessment should,

- 1) allow for appraisal of discipline-based knowledge of content and procedures, discipline and situation – based tacit knowledge and metacognitive knowledge, understanding and skill;
- 2) be representative of the actual learning experiences and the meta-products of those experiences;
- 3) probe for progress toward the attainment of discipline-based content knowledge, metacognitive thinking and learning skills;
- 4) provide information that informs instruction and learning;
- 5) use multiple methods, modalities, and formats to appraise learning; and
- 6) be embedded in the curriculum, teaching, and learning experiences.

Teaching, learning, and assessment are dialectical and transactive components of the pedagogical process. They interact symbiotically. Each component is at once separate and part of a whole, where parts are differentially emphasized at various times for different purposes. The authors argue that once appropriate indicators of developed abilities are identified (and these should not be as suffused with mimetic components as in the past) the processes of assessment, teaching and learning¹⁷ should be integrated and function dialectically to reciprocally influence and inform intervention. We favor arrangements whereby assessment probes are embedded in the teaching and learning transactions, and are controlled by the learning and teaching persons. Those of us who are responsible for using assessment data for purposes of accountability, could well be directed to distill from rich records of the assessment-teaching-learning transactions, such measurement data as may be needed for that purpose.

¹⁷ Our conception of changing paradigms does not address the critical problem of system level accountability but is directed at understanding and improving the process of teaching and learning.

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