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I would like to discuss two books that are particularly useful for teachers, students and parents. Gifted Education Press has recently published (2013) Harry T. Roman's **STE*A*M Education for Gifted Students! Upper Elementary Through Secondary Levels: Combining *C*ommunication and *L*anguage *A*rts with Science, Technology, Engineering and Mathematics**. He presents detailed lessons for integrating STEM Education with Communication and Language Arts. Some examples of lessons are Critical Workplace Skills, Writing Away to Companies, Technology Reporting, Invention and Communications, Writing an Operating Manual, What Makes a Good Oral Presentation?, A Technical Paper, and The Teacher as Communicator. The book also contains sections for teachers to record their *Notes, Ideas and Reflections*, and has many specific and practical lessons for teaching the gifted. Some of the Key Words and Concepts in his STEAM book are: How to Combine Communication and Language Arts with STEM Education, Presents Numerous Lessons and Examples with Special Exercises for Gifted Students, and Shows How Job Success in STEM areas is Closely Related to Good Communication and Writing Skills.

The second book is by Robert A. Schultz and James R. Delisle: **If I'm so Smart, Why Aren't the Answers Easy? Advice From Teens on Growing Up Gifted** (Prufrock Press, 2013). It is delightful and full of creative advice from gifted teenagers rather than from nagging parents and teachers. The authors say in their Introduction (p. 2) that they wanted to find out what statements or advice would be offered by gifted teens. They set up a web site beginning in 2003 that allowed teens from around the world to respond to questionnaires regarding beliefs, experiences and concerns (http://www.giftedkidspeak.com). The following chapters resulted from sifting through thousands of responses and compiling selected statements: What is Giftedness?, Friends, Peers, and Fitting in, What Do You Expect?, The Many Stories of School, Family Life, A Look Toward the Future, and Questions and Answers. . . Sort of. Here is one of my favorite quotes (in Chapter 1): "Giftedness is having exceptional abilities and being motivated enough to use those abilities to create wonderful things." (Girl, 13, Iowa, p. 6). I strongly advise parents and teachers to read this book for insights into how gifted students view their life and world.

Articles in this Issue:

- Echo H. Wu of Murray State University addresses some of the issues involved in using enrichment and acceleration to achieve best practices for educating gifted students. I should emphasize that this article in not just a review of the literature, but is instead a well-reasoned discussion of the history of these educational methods, wherein Dr. Wu shows how various elements can be effectively combined to produce the best possible differentiated programs for the gifted. I would like to welcome her as the newest member of our National Advisory Panel. Her knowledge and understanding of gifted education will help to focus ***GEPQ*** on topics related to improving this field.
- Stephen Schroeder-Davis engages in a rigorous analysis of some of the current barriers that prevent students from becoming intellectuals. He first shows how poor reasoning is fostered by enemies of the scientific method who have fixated on interjecting faith and politics into such areas as Darwin's Theory of Evolution. Stephen presents an even more compelling argument when he critiques Content Standards and the High Stakes Testing Movement as being detrimental to reasoning and problem solving skills.
- R. E. Myers provides wonderful examples of how teachers can use lessons on Success and Loyalty to stimulate gifted students' creative thinking.
- Harry T. Roman defines the major characteristics of STEM Education, shows how training in STEM areas can lead to career success, and reviews critical employee skills necessary for STEM related fields.
- Michael Walters discusses the great Russian-American writer, Vladimir Nabokov.

Maurice D. Fisher, Ph.D., Publisher

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Enrichment and Acceleration: Best Practice for the Gifted and Talented

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Providing appropriate services and programs for gifted and talented students in schools is one of the most important issues in gifted education. Without careful and specific services and program design, other efforts such as defining giftedness and identifying the gifted may turn out to be meaningless.

Special services for gifted students have been introduced to North American schools about a century ago (Kulik, 2003), and enrichment programs and acceleration opportunities are among the most effective services for this population. While acceleration may not be a common practice in the US school systems, various enrichment programs are far more generally provided to gifted students in different states.

The purpose of this paper is to review the literature regarding enrichment and acceleration programs for gifted and talented students, to consider the pros and cons of heterogeneous and homogeneous settings of learning, and to discuss the best practice in providing programs for gifted students. There are two main foci of this paper, with the first focusing on the roles and advantages of enrichment and acceleration, respectively, and the second specifically focusing on options and values of homogeneous and heterogeneous settings in providing services to the gifted and talented. It should be noted that, although the definitions of acceleration and enrichment may vary according to different researchers and resources, the author of this paper adopts the simplified notions of them, where enrichment can be seen as "horizontal" programs within same grade levels that include academic modifications on speed, depth and breadth regarding learning content, process and products, while acceleration can be referred to as "vertical" programs that include different levels of grade skipping, early entrance to school or college.

Enrichment

Enrichment "refers to richer and more varied educational experiences, a curriculum that is modified to provide greater depth and breadth than is generally provided" (Davis & Rimm, 2004, p.120). Enrichment programs may include within-class ability groups, special classes in and outside of schools, special schools, after-school activities, and Saturday as well as summer enrichment programs. Such programs are supposed to broaden classroom activities and curriculum, and to include more material and information that is not in regular classroom study (Piirto, 1999). Davis and Rimm (2004) provide a useful list of categories concerning enrichment programs as follows:

- Maximum achievement in basic skills, based on needs, not age
- Content and resources beyond the prescribed curriculum
- Exposure to a variety of fields of study
- Student-selected content, including in-depth studies
- High content complexity- theories, generalizations, applications
- Creative thinking and problem solving
- Higher-level thinking skills, critical thinking, library and research skills
- Affective development, including self-understanding and ethical development
- Development of academic motivation, self-direction, and high career aspirations
- Development of computer skills

All the above categories of issues may be addressed within enrichment programs, such as individual instruction, independent study, research, field trips, and various creative projects (Davis & Rimm, 2004). In comparing acceleration, enrichment programs are normally offered to gifted students without them skipping grade(s), and thus may bring fewer difficulties for the school administration than acceleration does. The students would either stay with their same age peers in heterogeneous settings, or study part-time with academic peers in homogeneous settings. Besides differentiated instruction and curriculum that teachers may offer to the gifted in regular classrooms, other enrichment programs, such as extra-curricular activities, can provide gifted students with more advanced learning opportunities in different ways (Olszewski-Kubilius & Lee, 2004; Schenkel, 2002). In order to challenge students and encourage the growth of giftedness and talent, appropriate enrichment program design is very important, and

additional resources, material and information are particularly critical to these gifted students learning under heterogeneous settings (Schiever & Maker, 2003).

No matter what type of enrichment programs a school can offer to the gifted, it is essential for school administrators and teachers to be aware of the needs of these students, and to be well-equipped with skills and strategies on how to implement such enrichment programs. Within regular classrooms or after school activities, these programs can certainly provide students with various opportunities to extend their learning experience. It can help foster their learning interests, nurture their giftedness and talents in one or more different areas, develop expertise in certain areas, and increase their achievements (Roberts, 2005).

Although enrichment programs are widely used as the major strategy for teaching gifted and talented students, according to research (see Johnsen, Witte, Robins, 2006), those from economically disadvantaged families and backgrounds are frequently underrepresented in gifted programs and services. Also, it seems that the extent to which an enrichment program can be valuable to gifted students relies heavily on issues such as school teachers' and administrators' understanding and concepts of giftedness. Additionally, other issues such as broad or narrow use of identification procedures, utilization of programming, and input or influence of parental and community support systems can be all important factors that have impact on the implementation of enrichment programs. Deliberate and unambiguous design of such programs is the key to meet the needs and nature of the gifted.

Acceleration

Compared to enrichment, acceleration is another good practice and option of programs for gifted and talented students. It implies moving faster through academic subjects and content, allowing students to skip grades and instructions, so as to learn at a level that best matches their academic abilities (Davis & Rimm, 2004). Many researchers in the gifted area (see Feldhusen, 2003; Gross, 2004; Shore, Cornell, Robinson & Ward, 2003; VanTassel-Baska, 2003) have addressed this issue. It is recognized that acceleration is most beneficial for exceptionally gifted and talented individuals, and the extent of it should suitably match the individual students' particular needs.

Normally, acceleration can include grade-skipping and early entrance to kindergarten, school or college, in which students' learning occurs at a higher than normal level to receive advanced instructions suitable to their ability or potential (Schiever & Maker, 2003). However, sometime only one or two years of grade-skipping is insufficient for exceptionally gifted students (Robinson, 2003). More advanced acceleration or a unique accommodation may need to be offered to individual students, e.g., early entrance to colleges, or online distance learning courses which present valuable opportunities for some gifted and talented students, especially those who live in rural areas (Davis & Rimm, 2004).

The publication of *A Nation Deceived: How Schools Hold Back America's Brightest Students* by Colangelo, Assouline and Gross (2004) drew much public attention to acceleration as intervention for the gifted, and one of the types of acceleration that is suggested in the book is subject-specific acceleration (Southern & Jones, 2004). Such subject-specific acceleration can be one of the most cost-efficient and effective ways for schools to offer to the gifted. However, teachers are normally resistant to employing this strategy with gifted students (Vialle, Ashton, Carlton, & Rankin, 2001) due to some concerns regarding issues such as potentially harmful social-emotional or adaptation effects that may be unfounded from research (Gross, 2002). Indeed the decision-making on choosing various forms of acceleration has remained one of the most controversial practices in education (Kanevsky, 2011).

It is interesting to know that, according to the study by Wells, Lohman and Marron (2009), girls are more likely to be accelerated than boys, and students on the West and East coasts of the US are more likely to be accelerated than students living in the middle of United States. An analysis of over two hundred students who skipped one grade between kindergarten and grade 7 conducted by Kuo and Lohman (2011) also reports interesting results. They find that female, white and higher socio-economic status students are more likely to skip in early years.

The advantages and disadvantages of acceleration can both be obvious. For some gifted children, acceleration may be the only way for them to meet not only their academic needs, but also social-emotional and psychological needs, and they may like school much better with adequate accommodation (Heinbokel, 2002). Gross (2004) strongly suggests that a grade-skipping acceleration program should be provided to gifted children, especially those who are profoundly gifted, since these children usually get along much better with older children who are more compatible with themselves in many aspects. Furthermore, the research by Howley (2002) has found that acceleration is a very good option for the gifted, especially in small school districts where additional services are minimal and the resources and programming are not demanding. However, one of the negative aspects of acceleration can be that, although research strongly supports the effectiveness of acceleration as program and curriculum options, parents and educators may feel

reluctant to accept the acceleration practice because of their assumption that such a program would disrupt the healthy development of children (Muratori, Colangelo, & Assouline, 2003). Some educators are concerned about school administration and scheduling issues, or the potential increase of parents' awareness and more requests for acceleration (Howley, 2002). It is also a common concern, not only for teachers and parents but also for researchers, that advanced acceleration may cause social-emotional problems. Apparently, acceleration has been one of the most researched but yet underused strategies for meeting the needs of the gifted (Colangelo et al., 2004). Teachers who are critical in recommending acceleration and getting the strategy started are usually reluctant, as they seem to have more negative attitudes regarding outcomes of acceleration than positive ones (Rambo & McCoach, 2012).

Integration of Acceleration and Enrichment

Enrichment and acceleration are crucial for advanced learning and intellectual development, which distinguish the nature and needs of gifted and talented students (VanTassel-Baska, 2010). These two types of services and programs are frequently discussed as though they are exclusive (Piirto, 1999). Some researchers (e.g., Shore et al., 1991) argue that these two different programs would best serve gifted students when integrated within each other. Feldhusen (2003) combined the two programs and argued that "acceleration may be the wrong description; the right descriptors would simply be educational services and opportunities to meet their academic needs" (p.56). Kulik & Kulik's (1992) meta-analysis of grouping programs for the gifted finds that when used in tandem with ability grouping, acceleration is more effective than enrichment programs in students' learning.

One of the most influential program models, the *Schoolwide Enrichment Model* (SEM) initiated by Renzulli (1977) and later together with Reis (see Renzulli & Reis, 1997) integrated both enrichment and acceleration programs. Renzulli and Reis (2002) described the model as follow:

> *"The Schoolwide Enrichment Model is an organizational plan for delivering enrichment and acceleration through an integrated continuum of services… …Services provided by the model range from general enrichment for both wide-ranging and targeted subgroups to highly individualized curriculum modification procedures for rapid learners and first-hand investigative opportunities for highly motivated individuals and small groups. The model also includes a broad array of specific grouping arrangements based on commonalities in abilities, interests, learning styles, and preferences for various models of expression"* (p. 19).

The authors suggest that the SEM should be viewed broadly "as an umbrella" that covers various types of enrichment and acceleration services for targeted groups and subgroups of students. One of SEM's components, the Enrichment Cluster is highly recommended by Renzulli and Reis, "in which knowledge utilization, thinking skills, and interpersonal relations took place in the real world" (Eckstein, 2009). In such Enrichment Clusters, "students are guaranteed that at least some time every school week is devoted to the kinds of learning that make schools more engaging, enjoyable places," and "educators have created a time and a place within the overall weekly schedule that focuses students' attention on authentic learning applied to real-life problems. These two characteristics – authentic learning and real-life problems – are fundamental qualities of enrichment clusters" (p.1, Renzulli, n.d.).

Feldhusen (2003) also suggested enrichment and acceleration should be used as integrated programs. He pointed out that since many precocious children have the ability and the motivation to read far beyond their age levels, schools need to provide students with, first, higher level and more challenging materials, which is an enrichment program, and second, overall grade advancement, namely, acceleration options. Swiatek & Lupkowski-Shoplik (2003) discriminate the two concepts, and advocate that while enrichment programs need to be accommodated for the main body of gifted students, acceleration programs should be provided to highly gifted students, and it is the schools' responsibility to encourage such programs.

Research has provided evidence supporting both enrichment and acceleration. However, implementing these programs with the most efficiency and effectiveness requires a careful assessment of students' academic abilities as well as their social-emotional readiness for whether they should stay with peer groups, or they should be moved up (Feldhusen, 2003). Without scrupulous consideration, either program may become a superficial approach that cannot offer authentic help to gifted students.

Heterogeneous and Homogeneous Settings

Similar to whether to choose enrichment or acceleration programs, the issue concerning the value of heterogeneous and homogeneous settings for gifted students has also been controversial for many decades. The dilemma may first stem from the conflict between equity versus excellence (Passow, Monks & Heller, 1993). It should be stressed that here the word "equity" does not mean equal education in terms of content and process of learning, but equal opportunities for students to fulfill their potential

and to achieve excellence. Therefore, just as it is essential to provide special programs for disabled children, proper treatment such as pullout programs or individual classes are certainly appropriate in meeting the academic as well as social-emotional needs of gifted and talented children (Rosemarin, 2001). The key questions might be what kinds of treatments or programs are more suitable for certain students, and whether we should provide services for the gifted within regular classrooms, namely heterogeneous settings, or we should offer them opportunities to study in special classes or schools, namely homogeneous settings.

Some researchers (see Feldhusen, 2003) argued that it is more appropriate to group gifted and talented students in homogeneous settings, providing them with uniquely designed classes, advanced curricula and a speedy instructional pace. In that way, not only can these students benefit from the academic challenges from such advanced programs, but they can also interact with others who are from the same or similar ability levels, who may well have comparable intellectual and social-emotional characteristics. Robinson (2003) strongly suggests that schools, especially those in large districts, should offer rigorous special classes to highly gifted students, whose needs can hardly be challenged within regular, heterogeneous classroom settings. With specifically designed curricula, these self-contained classes "are the easiest, least expensive, and most effective way to meet the needs of the brightest students while, at the same time, enabling them to profit from the stimulation and support of other bright students" (p.262). The *Growing Giftedness Model* proposed by Bernal (2003) even says that highly gifted students should work with one another and with adults in full-time programs rather than in part-time gifted programs, since only in such a way, can these gifted students be provided with truly differentiated instruction and guidance to develop their potential to the highest possible levels. Accordingly, homogeneous programs are highly recommended by some researchers as the preferred and the most proper programming options for developing the abilities of exceptionally gifted children.

In accordance with the popularity of homogeneous settings, the results of a study conducted by Hertzog (2003) on the impact of programs as perceived by gifted students themselves also indicate that these students enjoy learning more in homogeneous classes or schools than in heterogeneous settings. This study reveals that one of the most significant differences between regular and special classrooms is the behavior of the students and the enthusiasm and characteristics of the teachers. The gifted students in this study indicated that teachers in the special programs are more competent and enthusiastic when compared to teachers in regular classrooms. These students also articulated that they enjoy the advanced learning much more when being together with their academically compatible peers. They further explained that they preferred full-time gifted programs since they believed that part-time programs may put them in awkward situations where they are not easily accepted by their same age peers.

While homogeneous programs seem to have great value for gifted students' rapid growth in special areas, research has also indicated the positive impact of programs for the gifted in heterogeneous settings. The study by Barone & Schneider (2003) reveals that an open-ended, flexible learning and teaching environment occurring in regular classrooms can benefit the learning of gifted students, as well as other children. The researchers point out that one of the merits of such a within-class program is that gifted students can take advantage of the available heterogeneity of experience, knowledge, and skills, and get to know their own strengths, which may help enhance their further learning. Wu's (in preparation) observation also suggests that when special classes or schools are not available, which is not uncommon in many states and countries, educators' strategic planning and teaching within regular classrooms can positively facilitate and promote advanced learning outcomes of gifted students.

One of the gifted programs in heterogeneous settings is ability grouping, which seems to be especially popular for many schools in the United States. Some research studies (Kulik & Kulik, 1992; Robinson, 2003; Slavin, 1993) indicate that, within-class grouping has proven to be popular with classroom teachers, and has led to positive outcomes of student learning particularly in elementary and middle schools. Various grouping options have been found beneficial for different individuals in different ways, and the options can be varied from full-time placement in enriched or accelerated gifted programs, to part-time enriched instruction in certain subjects, or to pull-out grouping and within-class ability grouping (Rogers, 2002). All of these program options possess both strengths and weaknesses which should be respectively taken into account in designing programs for individual students.

Reflecting on the advantages and disadvantages of both settings, it is not easy to make a final decision on which one is more appropriate and more beneficial for the gifted. On the one hand, although homogeneous settings seem to be favorable to many gifted students, such programs have a distinct drawback that they may involve a substantial amount of energy, time and money. In addition, homogeneous settings could be more difficult for schools and administrators to implement, and sometimes are even purposely avoided for gifted students. In some other situations, it may be financially impossible to offer such programs to these students. On the other hand, heterogeneous settings where there are wide ranges of abilities and interests, suitable ability grouping can be of great value in challenging students at appropriate levels (Kettler & Curliss, 2003; Reed, 2004). However, to the highly or profoundly gifted students who need more deliberate accelerated programs, same grade level grouping programs may not be

adequately challenging (Rogers, 2002), as within-class and cross-class grouping appear to benefit more the slower students than the gifted students (Kulik, 2003).

Preferably, the best programs for the gifted are those that can meet the specific needs of each gifted student individually. However, whether it is good to offer homogeneous or heterogeneous settings for these students is a decision that involves many aspects. It may depend on individual students in terms of their personality or social-emotional maturity, and it can also depend on individual teachers who may or may not have the capacity to offer suitably differentiated programs within heterogeneous classroom settings. In addition, it can certainly depend on individual schools or systems where funding support may or may not be available.

Summary

As all gifted students have their unique giftedness and talent in peculiar areas, it is essential that these students be provided with individually designed programs to match their own learning needs. Research has not only made available abundant evidence of the value of different enrichment and acceleration programs for the gifted and talented, it has also offered positive outcomes and significant implications for future research and practice. As clearly expressed by students involved in gifted programs in Hertzog's (2003) study, specifically designed programs (especially those that address the diverse nature of gifted population) are much needed to better serve the young generation. In considering the options, educators need to make wise decisions on whether to choose enrichment or acceleration programs, and whether to offer these programs in heterogeneous or homogeneous settings.

Academic services and programs for gifted and talented children should not be inflexible. A specific answer to the question of whether we should change gifted children in order to fit the programs, or whether we should change the programs to fit the children is that, yes, we do need to provide flexible programs to match the various needs of gifted and talented youth (Olszewski-Kubilius, 2003). Some highly gifted students may need acceleration programs to fully develop their potential, while some moderately gifted students may best be served with enrichment programs by putting them into ability groups within or outside the regular classrooms. Renzulli (2012) mentions that "g[G]ifted education, like all other specialized areas in the arts and sciences, is constantly in search of its identity" (p.158). The choice for either enrichment or acceleration program for the gifted has also been part of such a "search of identity" as different school systems in different countries, states and counties would have their own guidelines and programs for implementing teaching and practice in gifted education. Nevertheless, no matter where it is, school administrators and teachers need to be aware of the importance as well as the differences among various options of educational programs, so that they can be better equipped to assist gifted students' learning, and to facilitate their full development of potential.

Enrichment and acceleration program models, and various groupings in and out of classes should all be carefully considered where necessary. As long as we pay attention to the different needs of gifted and talented students, our efforts in defining giftedness as well as identifying the gifted and talented will not lose their great value, and gifted education as a whole can eventually be meaningful to all the parties, including students themselves, teachers, parents, communities, and the entire society.

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Intellectualism

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My article (Schroeder-Davis, 2012) in the fall issue was entitled, "Why Don't Our High Schools Graduate More Intellectuals?" In this issue, I will extend my critique with an examination of two recent machinations that compromise the entire educational enterprise. The last installment in this three-part series will offer ways teachers and students can practice intellectualism despite the various barriers that exist in the current "data-driven" educational environment.

There are several elements that define an intellectual, which I have adapted from The Foundation for Critical Thinking's (2011), *Valuable Intellectual Traits*:

- **Intellectual Humility**: Being conscious of the limits of one's knowledge, sensitivity to bias, prejudice, and limitations of one's viewpoint.
- **Intellectual Courage**: Resisting passively and uncritically "accepting" what we have "learned." We also need the courage to be true to our own thinking, even though the penalties for nonconformity can be severe.
- **Intellectual Empathy**: The ability to reconstruct accurately the viewpoints and reasoning of others, and to reason from premises, assumptions, and ideas other than our own. This trait also correlates with the willingness to remember past occasions when we were wrong—especially when we held an intense conviction that we were right—and with the ability to imagine being similarly incorrect in the case-at-hand.
- **Intellectual Integrity**: Holding one's self to the same rigorous standards of evidence and proof to which one holds one's antagonists.
- **Intellectual Perseverance**: Being conscious of the need to use intellectual insights and truths in spite of difficulties, obstacles, and frustrations.
- **Faith in Reason**: Confidence that, in the long run, one's own higher interests, and those of humankind at large, will be best served by reason and by encouraging people to come to their own conclusions by developing their own rational faculties.

"Faith in Reason" stands in direct contrast to "faith in faith," and requires further examination.

Separating Science from Politics and Faith: Inconvenient Truths

To be clear: Faith and reason are *opposites.* Faith asks that we *accept as true* that which is unknowable, while reason requires that we use data provided by our senses to *determine what is true*, and further, that we be ready to refine or refute our conclusions if new evidence emerges contradicting previous knowledge. Instilling all of the cognitive qualities listed above is vital if we are to develop students' intellectual faculties. Yet "faith-based communities" and their representatives are having a significantly negative impact on school curricula, texts, and policies because they assert thinkers should shun reason if it appears to contradict what one wishes to believe based on faith.

For an example of religious-based faith influencing (i.e., undermining) the intellectual pursuit of truth, one need look no further than the 2012 state science standards. In 2012, the Thomas Fordham Foundation (Gross et al., 2012) completed a review of multiple aspects of U.S. state science standards and determined states averaged a "C-" overall for science curriculum and delivery, with only six states earning an "A." One of the review's authors, Paul Gross (Gross, 2012), wrote:

> There are, of course, multiple reasons for the low marks. Among these, the saddest and least justifiable is what the authors call "Undermining Evolution."
>
> . . . in many states, evolution is weakly, incompletely, even erroneously presented—unlike elements of other currently active areas such as modern physics or cell biology. Evolution is singled out in high-minded calls for "critical thinking," for "strengths and weaknesses"—as though it were less reliable, less scientific, than the others! (para. 2-3)

How are our students to develop critical thinking when legislators (and some science teachers!) conflate religious doctrine with science? The following example illustrates the confounding of religion and science teaching and is quoted from Tennessee House Bill 368 (2012):

> **(**a) The general assembly finds that:
> 1) An important purpose of science education is to inform students about scientific evidence and to help students develop critical thinking skills necessary to becoming intelligent, productive, and scientifically informed citizens;
> (2) The teaching of some scientific subjects, including, but not limited to, biological evolution, the chemical origins of life, global warming, and human cloning, can cause controversy . . . (p. 1)

This bill is ironic in the extreme in that evolution is *not* controversial in the scientific community. It is bills such as House Bill 368 that engender "controversy" because they can make the *teaching* of evolution—not the theory itself—controversial. Elevating *criticisms* of evolution (e.g., "intelligent design" and "scientific" creationism) to the level of theory, and stipulating they be taught alongside evolution to provide "balance," makes it appear as if *every* explanation is a scientific theory, which is tantamount to nothing being a scientific theory.

Recommendations and Observations

As the Fordham Foundation's critique of state science standards makes abundantly clear, many states are failing our students by suggesting that, "curriculum makers should include . . . [creationism and intelligent design] as an exercise in critical thinking, and that 'freedom of speech' or 'fairness' requires that they do so" (Gross et al., 2012, p. 12). This and similar legislative mandates, if they were authentically intended to encourage intense scrutiny of Darwinian theory against traditional religious doctrine, could promote the development of multiple valuable intellectual traits, such as those described by Critical Thinking (2011). Instead, however, such mandates are actually a thinly veiled attempt to discredit the theory of evolution by requiring educators to present students with two *equally viable* explanations for the origins of life. In effect, legislation demanding equal time for creationism implicitly asks students to become *anti*-intellectual because it implies a priori that both ideas have equivalent validity. Instead of encouraging careful, objective evaluation of bona fide evidence, state mandates encourage students and the teachers they trust to abandon the scientific process and equate their faith in *reason* with the legislators' faith in *faith*.

What would happen if teachers resisted the pressure/temptation to present the two competing "theories" as equally viable, and instead, in the interest of promoting critical thinking skills and intellectualism, and used the controversy as a means of teaching students to *think?* I can't improve on the suggestion made by Shawn Lawrence Otto (2012) in the current issue of *Understanding Our Gifted*, which was devoted to Science, Technology, Engineering and Mathematics (STEM) programs. In his article, "Teaching Gifted Students STEM in an Anti-Science Society," Otto, the cofounder and CEO of Sciencedebate.org, offers several ways to address politically motivated science "controversies" while at the same time promoting scientific reasoning. The following is the recommendation Otto (2012) most frequently proffers to teachers:

> First, pick a politically contentious science topic. By doing this as an educator you are already opening up a conversation that intersects with students' lives. Second, state a preposition about that topic; i.e., anthropogenic climate change is real. Then, announce the debate and tell students to research it. But here's the critical piece: don't tell them which side they are going to argue. They have to research both sides of the debate, and which side they argue will be determined by a coin toss on the day of the debate. In their research and in building the very best arguments they can on both sides, students begin to learn the difference between knowledge-based arguments and rhetoric. (p. 21)

Unfortunately, teaching strategies promoting students' capacity for authentic, deep, analytical evaluation, such as the one embodied in Otto's brilliant suggestion, could easily get waylaid by the continuing legislative appetite for content standards, our clumsy national attempts to make thinking quantifiable. Content standards, lists of facts educational overseers have decided all students should know, confound *thought* with the *content* of thought. The result is that we are currently pretending that having students store facts in their heads is the same thing as knowing what to do with those facts—knowing how to think. Unfortunately, just having a baseball in your hand does not mean you know how to throw the ball, having a storehouse of facts does not mean you know how to put them together to draw useful, reality-based conclusions.

Content Standards Do Harm to Students

According to the Gizmodo (2011) website, shut down your intellect for 60 seconds, and here's a sampling of what you will miss:

- 1500+ blog posts

- 98,000 new tweets
- 12,000 new ads on Craigslist
- 20,000 new posts on Tumblr
- 600 new videos (25+ hours worth) on YouTube.

This information is already dated, as it was created in 2011, but the items above illustrate the folly of focusing students on mere curriculum content: There is simply too much information generated each minute for anyone to accurately determine what specific content every student needs to become educated. Remember that schools are currently required to see that *every* student attains proficiency in *every* subject, and at the same chronological point in their lives!

Writing in *Education Week*, Marion Brady (2009) offered several suggestions for improving schools. Here are three I think would also promote students' intellectual development:

> 1. Stop fixating on the American economy. Trying to shape kids to fit the needs of business and industry rather than the other way around is immoral.
> 2. Stop massive, standardized testing. For a fraction of the cost of high-stakes subject-matter tests, every kid's strengths and weaknesses can be identified using inexpensive inventories of interests, abilities, and learning styles.
> 3. Abandon the assumption that spending the day "covering the material" in a random mix of five or six subjects educates well. Only one course of study is absolutely essential.
> Societal cohesion and effective functioning require participation in a broad conversation about values, beliefs, and patterns of action, their origins, and their probable and possible future consequences. The young need to engage in that conversation, and a single, comprehensive, systematically integrated course of study could prepare them for it. It should be the only required course. (Brady, 2009, para. 14-16)

The supreme irony of the current educational paradox in which teachers have been placed is that the demands of standardized tests and content standards virtually eliminate opportunities for students to truly investigate issues, parse perspectives, and *create* information, all of which government and business officials insist they want. In other words, the supposed rigor of standardized tests and content standards reduce opportunities for actual, deep thinking. In 2004, Cohen, Manion, and Morrison published seminal work on deep vs. superficial learning. They stated that superficial learning is merely information-reproduction and is characterized by:

- Excessive amounts of material and inert, discrete knowledge as facts
- Relatively high class-contact hours
- Lack of opportunity to pursue subjects in depth
- Lack of choice of subjects and methods of study
- Passive learning
- Repetition, word for word, of material to be learned
- Threatening and anxiety-provoking assessment systems
- Fear of failure, and, therefore, attempts to avoid failure
- Memorization as an end in itself
- Assessment that asks students to reproduce information rather than apply understanding. (Cohen et al., 2004)

The authors go on to state that superficial learning tends to be encouraged by:

- Assessment methods that create anxiety and that emphasize recall or application of trivial knowledge
- Cynical or conflicting messages about rewards
- An excessive amount of material in the curriculum
- Poor or absent feedback on progress
- Lack of independence in studying
- Lack of interest in, and background knowledge of, the subject matter. (Cohen et al., 2004)

The description is about superficial learning—particularly the threatening and anxiety-provoking assessment systems, fear of failure, memorization as an end in itself—and the conditions under which superficial learning is engendered (an excessive amount of material in the curriculum, poor or absent feedback on progress, disinterest in subject matter) aptly describe the present state of schooling for most students and teachers.

As a case in point, below is a sample of National Assessment of Educational Progress [NAEP] (2011) test questions for the 8th grade level, taken directly from their *Sample Test Questions Booklet* for 2011. Note how the questions do not demand from students real thinking or problem solving so much as the ability to locate and/or recall facts.

- After reading a poem entitled "Alligator Poem," the students are given some blank lines for writing and asked to, "Explain how 'Alligator Poem' could be seen as both a good title and a bad title for the poem. Support your answer with a reference to what happens in the poem." (p. 18)
- From the science assessment section, students are given this question with attendant answer choices: "Pat has two kinds of plant food, 'Quickgrow' and 'Supergrow.' What would be the best way for Pat to find which plant food helps a particular type of houseplant grow the most?
  a. Put some Quickgrow on a plant in the living room, put some Supergrow a plant of the same type in the bedroom, and see which one grows the most.
  b. Find out how much each kind of plant food costs, because the more expensive kind is probably better for growing plants.
  c. Put some Quickgrow on a few plants, put the same amount of Supergrow on a few other plants of the same type, put all the plants in the same place, and see which group of plants grows the most.
  d. Look at the advertisements for Quickgrow, look at the advertisements for Supergrow, and see which one says it helps plants grow the most." (p. 22)
- Following another reading selection, students are asked, "What is the speaker doing at the beginning of the poem?
  a. Watching the birds
  b. Wading in the stream
  c. Drinking the water
  d. Picking wildflowers" (p. 13)

Finally, from NAEP (2009), a sample question for 12th grade science students offers four multiple-choice solutions from which to select an answer to this question: "How hot is the surface of the sun?" (p. 19). Again, neither this question nor those above come remotely close to anything resembling rigor, as they do not require deep thought. Like the previous examples, the question includes four answer options from which to choose. I did not include the solution choices for the sun-surface question because they are irrelevant: A multiple choice question for 12th grade science students does not require deep understanding of the mechanics of stars and does not represent real world application. There is rarely only one best answer to most problems in life, and most of the time, real-life questions require thinkers to generate their own list of possible solutions rather than select one from a prefabricated list.

Examples from the following two sources may drive home the ubiquity of the weaknesses that characterize standardized tests as a means of assessing learners' ability to think (intellectualism). The following test question is from the Louisiana Department of Education's (2011-2012) *Louisiana Educational Assessment Program* (LEAP) teacher's guide and sample test questions booklet. Note that the LEAP prompt suffers the same inadequacy as the test items above in that the student is offered a prefabricated list from which to select the "correct" answer. First, from the 2011-2012 Grade 8 test for reading, after reading a selection called "Niagara Falls," students are prompted with:

"Sara's father is best described as:
a. confusing
b. generous
c. adventurous
d. knowledgeable." (p.22)

Last, from a sample of Louisiana Grade 10 EAGLE assessment in math:

> Mike needs to buy a water tank for his business. The tank must fit inside a storage box that is shaped like a cube with side lengths of 30 feet. Water tanks are available in cylinders, cones, square pyramids, and spheres. Mike wants to buy the tank that has the largest capacity. What shape of tank should Mike buy? Explain why your choice is the best option for Mike. (Louisiana Department of Education, 2012, p. 9)

As we've seen, standardized tests typically fail to promote or measure analytical or creative thinking—fail to provide meaningful information about students' developing intellectualism—because the assessment questions generally require simple recall and/or only superficial understanding of a given problem. Standardized tests, however, suffer another flaw in terms of helping students develop meaningful thinking skills. Despite the fact that students are now accustomed to immediate feedback in virtually all of their social networking, game playing, and in many of their networked classrooms, authentic feedback on standardized tests not only

lacks immediacy but is nonexistent for the student, as the tests weren't designed for the purpose of improving student *thinking*, but rather for measuring student *responses.* Simply measuring responses and providing a score is not the same as giving meaningful feedback that promotes understanding, and therefore cognitive development.

Further, the test preparation that accompanies high-stakes exams, and the overloaded curricula that burden students and teachers alike, match almost perfectly Cohen et al.'s (2004) description of environments that promote superficial thinking. Of the example test questions above from the NEAP and LEAP, only the question on Mike's water tank needs requires something resembling real world application and more than a superficial understanding of the principles involved in finding a solution.

Even so, and while the test prompt requires students provide an explanation to justify the choice made, the question is still essentially multiple choice, as four water tank shape options are offered. The question could be made more rigorous and intellectually challenging if it were phrased more like: Mike needs to buy a water tank for his business. The tank must fit inside a storage box that is shaped like a cube with side lengths of 30 feet. *Design a tank with the largest capacity that will fit within the storage box. Explain why your design best meets the requirements above and what mathematical principles informed your thinking.*

This rephrased question is similar to both the more robust assessments given in other countries and to the real world in that the problem is presented without the four predetermined answer options that were embedded in the original test question. Without the prompts, and if left to their own devices, students might offer a fifth shape, or construct a hybrid of several shapes and actually improve on the supposedly "correct" answer.

If we want students to become content producing intellectuals rather than merely content recalling vessels, we must begin phasing out massive, industrial-style standardized tests and replacing them with the more authentic assessments such as those modeled in the Program for International Assessment (PISA). According to the Organisation for Economic Co-operation and Development [OECD] (n.d.a) website:

> The Programme for International Student Assessment (PISA) is an international study which aims to evaluate education systems worldwide by testing the skills and knowledge of 15-year-old students. . . . Since the year 2000, every three years, a randomly selected group of 15-year-olds take tests in the key subjects: reading, mathematics, and science. (para. 2-3)

Suggestively, most of the questions from PISA are too complex (involving charts, graphs, and multi staged questions) to be reproduced here, so I suggest interested readers go to the *EDinformatics* web site: http://www.edinformatics.com/timss/TIMSS_PISA_test.htm and bookmark it into their browsers. This link will lead to sample PISA questions, and for comparison purposes, to sample questions from the Trends in International Math and Science Study (TIMMS), the less vibrant test typically used to "benchmark" American students.

It also might be instructive to consider the framework from which the PISA questions are derived: promoting scientific literacy. According to the OECD (n.d.b) document *Science Concepts & Science Items*, scientific literacy is defined as: "The capacity to use scientific knowledge to identify questions, and to draw *evidence-based conclusions* [emphasis added] in order to understand and help make decisions about the external world and the changes made to it through human activity" (p. 14). *Science Concepts & Science Items* (n.d.b) further states that the PISA scientific assessment is constructed with the following dimensions in mind:

- **Processes:** The mental processes involved in trying to address a question or issue.
- **Content:** Scientific knowledge or conceptual understanding that are required when using these processes.
- **Situations**: A scientific situation is defined here as a real-world phenomenon in which science can be applied. (pp. 14-15)

None of the three dimensions listed above were likely considered when constructing the NAEP 12th grade science question cited earlier: "How hot is the surface of the sun?" The apparent failure to use these constructs in the design of most standardized test questions goes a long way toward explaining why our tests do not truly assess how equipped our students are for their future.

In sum, sociopolitical pressure to confound beliefs and actual scientific theory, along with legislated testing mandates that severely constrict teachers' ability to teach students how to go about the process of real thinking, have combined to create serious impediments for those who want to help students become intellectuals. The last installment in this three-part series will offer ways teachers and students can practice intellectualism despite the various barriers that exist in the current "data-driven" educational environment.

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Challenging the Bright Ones

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As a teacher of gifted students, I have observed that they like a challenge because much of what they are asked to do in school is quite easy for them. It's comfortable for some academically gifted students to just coast along after they have caught on to what is required, having learned that coming up with the answer very quickly, or finishing the assignment before everyone else, doesn't win them many points with their peers. So they often have time to daydream – or to get into trouble.

Teachers of bright students can offer them chances to delve deeply into regular assignments and also complete additional items in exercises in the allotted time (e.g., five more problems added to the 20 given to the class in arithmetic). These are measures that teachers often take to keep their quickest students occupied. I see nothing wrong with either of these tactics. However, the ideal solution to the problem of keeping the brighter students occupied while not frustrating their classmates with tasks that are too difficult for them is to give the entire class an assignment that interests them all but also allows the best students to utilize their superior talents. In general, activities that cause young people to think both critically and creatively satisfy both criteria. Students can respond according to their abilities.

This is an example of a lesson that should cause most students to think but will also allow the brighter ones to shine.

SIGNS OF SUCCESS

We think a lot about success in this country. In some communities young people are given a great many opportunities to feel successful. They can win awards and trophies for being on athletic teams; doing well in their studies; exhibiting animals, vegetables,

artwork, and foods at fairs; attaining ranks in youth groups such as Boy Scouts and Campfire Girls; and performing in music events and plays – among a host of ways to feel successful.

In the world of adults, we also have a great many ways of indicating success. There are honors and awards for all kinds of activities. But what about the indications of success – or failure – that we are exposed to every day, such as signs? How do you interpret these common signs as indicators of success? What do these signs tell you about the success, or lack of it, of the people who put them up?

MY SON IS ON THE HONOR ROLL AT RIPON SCHOOL
50% REDUCTION ON ALL MERCHANDISE
NO TRESPASSING – VIOLATORS WILL BE PROSECUTED
(on a desk) THE BUCK STOPS HERE
ALL-AMERICAN CITY
PRIVATE DRIVE – MEMBERS ONLY
NOW HIRING – FULL BENEFITS – INQUIRE WITHIN

Of course, teachers can substitute other signs for the seven given, choosing those that are more appropriate or are more commonly seen by their students.

In this activity, the bright students can go more deeply when responding to the prompts, and their classmates should all be able to respond satisfactorily, according to their abilities. For example, a student who is not intellectually gifted might respond to the prompt "PRIVATE DRIVE – MEMBERS ONLY" with comments indicating a doubt as to whether success has anything to do with denying non-members of an organization access to a place of private property, and let it go at that. On the other hand, an academically gifted student could call into question the *criteria* by which an exclusive organization decides to bestow its membership, and then she or he could enumerate the pros and cons for justifying club membership as an indicator of success.

The reason that this lesson will accommodate most ability levels is that the less academically talented students will interpret signs such as "NO TRESPASSING" as being irrelevant to success. They are probably correct in most cases – unsuccessful property owners have been known to post such a sign, as well as wealthy paranoid people – but highly talented students will react to it in imaginative ways, concocting stories to illustrate their ideas. Of course, in taking any approach students will have to define success. Just what is it? The more thoughtful students will see that you can define success in a great many ways, as the introduction of the lesson indicates. One definition is that success is reaching a goal that a person makes – or perhaps that society makes. Complete and enduring success is what many people strive for. By delving into this topic, students can learn a lot about themselves and our society.

When a classroom contains several very bright youngsters, a teacher can challenge them along with the others by asking questions that can be answered according to each student's ability to reason and reflect. Such questions can be personal without violating the privacy of the individual.

The following is a set of questions that might be asked concerning loyalty, something young people contend with regularly and feel deeply about.

LOYALTY

There are many opportunities to demonstrate your loyalty to someone or something, or to refuse to betray someone or a principle that is dear to you. The way in which you react in these situations says a lot about your character.

At what times is it important to be loyal in the following situations? Underline them, and then explain why it is important or not.

When:

- choosing a TV program to watch?
- a friend needs your support in a dispute?
- selecting a candy bar?
- rooting for teams at a game?
- finding someone to share a treat with?
- selecting a new member to a club?
- buying a pair of athletic shoes?

- voting for a class officer?
- someone puts down your friend?
- someone tempts you to do something you know is wrong? (What has this to do with loyalty?)
- there are nasty rumors going around about a friend?
- your family needs your presence in an emergency?

Now go back and underline the three most important times to be loyal once more. Explain why those are the three most important times.

The questions above should be challenging for the entire range of abilities in any classroom. Importantly, they do not discriminate against students of superior intellectual gifts nor those who have them in lesser degree. Such questions can be asked by teachers of heterogeneous classes in which superior students often become a problem when bored.

A few of the prompts call for some serious thinking – perhaps some soul-searching as well. Selecting a new member to a club may not be as vexing as some of the others, but it probably will elicit quite a variety of responses in a class of students with widely divergent abilities. For instance, a student of average reasoning skills might simply respond that the club should be available to everyone. That is, there should be no discrimination – it's not a matter of loyalty at all! The situation may not be that simple to the intellectually gifted student. Clubs typically have criteria, standards, or some kind of policy for admitting members, if only one of popularity. When loyalty enters the picture is when one's friend either is eligible for membership or indicates that she or he would like to become a member of a club. If a member has such a friend and doesn't honestly believe that the friend is suitable for membership, he or she has a dilemma: back the friend even though the friend wouldn't be right for the club, keep silent about the friend's desire to join, or be honest when the friend's name comes up and indicate that asking her or him wouldn't be a good idea. The bright students will most likely understand the dilemma and explore it.

The two exercises given above are merely examples of activities designed to get students to think. They deal with the concepts of success and loyalty, which are among a host of basic concepts that are significant in young people's lives. The concepts are meaningful to all students, but they are also presented in such a way as to challenge the intellectually gifted students to do more than provide obvious and/or "correct" answers.

STEM — The Perfect Transition from School to Work for Gifted Students

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What STEM is About

- STEM is an educational paradigm that integrates the curriculum – both process and content oriented, and standards-based.
- It exemplifies open-ended problem solving in the workplace representing life-on-the-job after graduation from either high school or college through team-based, head and hands learning.
- It uses the scientific inquiry process (asking questions), the invention process (creativity), and the engineering design process (designing with constraints).
- STEM's fundamental premise is that the world is interconnected, and solving problems is an inter-disciplinary and multi-dimensional endeavor……involving active learning, teamwork, collaboration, and student empowerment.
- It challenges students to become comfortable with open-ended, context based problem-solving…..defining the problem first – then asking high quality questions so robust and high quality solutions can be evaluated. The questions asked determine the quality of the solution(s).
- Problem solution is necessarily an iterative process. There is no answer in the back-of-the book, or a discrete solution that is "right." It is about asking questions and exploring the problem, and then designing a solution that answers the questions. (Non-linear, insightful thinking, lateral thinking, and experiential insights can play a powerful role here.)
- STEM shines best when students see how math can be used for practical applications, and gain an appreciation of the problem's magnitude and significance.
- Designing with constraints often uses a matrix-style of solution identification, assessment and selection. High quality solutions blend together the technical and non-technical concerns in potential solutions.

•Teachers should conduct the classroom in a Socratic style, encouraging students to try new things, and document their work in order to learn from failure and be ready to try again. Teachers tie the students to the problem, leading them to pursue solutions through their students' own natural exuberance and creativity.
•The arts, humanities, and language skills are very important. In its most concentrated state, STEM is a complete integration of the entire academic curriculum.
•Good written and oral communications are an absolute must for STEM students. In the workplace, great ideas poorly presented will not be implemented.

STEM Pays

At a time when STEM is such a big topic in the educational vista, it is good to show the raw power of a STEM-based education – to drive the point home that a science, technology, engineering, and mathematics based education has great earning power. Here below are some sample salaries for those who work in a STEM related career. Notice the high starting salaries and the median value for that job in mid-career (generally folks with 20-25 years of seniority in their field).

Career	Starting Salary	Mid-Career
Petroleum Engineering	$97,900	$155,000
Chemical Engineering	64,500	109,000
Electrical Engineering	61,300	103,000
Physics	49,800	101,000
Applied Math	52,600	98,600
Computer Science	55,600	97,900
Biomedical Engineering	53,800	97,800
Mechanical Engineering	58,400	94,500

What should be obvious here is that a good grounding in a multi-dimensional, multi-disciplinary problem solving environment is something business and industry value, and are willing to pay for in the form of high salaries. This can be interpreted as meaning that such an educational background has serious potential for improving a company's standing and help it compete in the global economy. Salaries reflect a company's willingness to invest in employees with great skill sets that can be applied on behalf of a company and its shareholders. STEM pays!

Critical Employee Skills – Leveraging STEM

The business world is a multi-dimensional environment that expects its workers to solve problems cooperatively, through inter-disciplinary, team-based project activities while assessing, evaluating, and making tradeoffs as necessary. Rigorous adherence to a STEM problem solving regimen is a superb training ground for the mastery of critical employee skills. Here are the critical skills globally competitive employers will look for. Please notice also how all these skills depend very much on a solid bedrock foundation of good communication skills.

1) Analyze Information. In an information-rich company, people with good planning, organization and analysis skills will be in key positions to manage, process and interpret the huge flow of internal and external data and information. With solid logical and analytical skills, employees should be able to understand the significance of the information and recommend action.
2) Convert Information Into Knowledge. All innovative companies strive to convert raw data and corporate-gathered information into saleable products and services. Executives use this knowledge to help them gain competitive and strategic advantage over other

companies. Significant value is placed on individuals who can convert data and information into knowledge, and do it quickly, efficiently and consistently.

3) Sell New Ideas to Management. The ability to implement new ideas and concepts is the real measure of success. To bring ideas to fruition, one must be proficient in selling ideas to the executive who can grant access to the necessary corporate resources. Remember — no one will give poorly packaged and presented ideas the time of day, regardless of how promising they may appear. Employees must skillfully present:***** Market analyses for proposed ideas; ***** Pricing and marketing information; and ***** Timing related to return on investment.

4) Communicate Concepts Clearly and Succinctly. This skill is a "biggie." Careers have been – and continue to be – severely jeopardized because of poor communication skills. In fact, without them, one's career could be permanently stunted. Employees *must* be articulate. Today's managers often judge employees by how well they express themselves, both orally and in writing. Managers need condensed kernels of information around which to base their decisions. They don't have time to wade through endless pages of reports or be intrigued with dazzling, yet long-winded analyses. Succinct analysis wins the day. Employees are ambassadors of their companies, whether meeting with clients, giving a paper at a conference, or talking and interacting with members of the public or regulatory agencies. Communication skills are the absolute foundation for all the others.

5) Plan for Timely Commercialization. Getting new products to market is the way companies sustain their cash flow and generate new sources of it. Timely implementation begins with people who know how to plan, organize and execute the commercialization process. Knowing how to plan well allows an employee to handle a variety of different projects. It is also a skill that senior managers value. It sends a clear signal that one knows how to use precious corporate resources efficiently and effectively.

6) Be a Team Player. Teamwork and collaboration among corporate departments has become a mainstay of industry problem solving. Team members must possess excellent communication skills, present new ideas effectively, and resolve to act together to address corporate problems and needs. Articulate leaders connect their team members and their assigned tasks to the big corporate picture. Selecting the right mix of team members is as important as formulating the problems the team must address.

7) Do Multi-Dimensional, Integrated Problem Solving. Making sound business decisions require more than just the technical and economic aspects of a problem. The environmental, safety, social, political, and regulatory considerations of a new product are also important. Employees need a balanced education so they can make tough choices from a multi-dimensional selection of options. Employees who can think and reason about problems on multiple levels simultaneously are essential in today's complex decision-making environments. Are today's students well rounded and capable of multi-dimensional, integrated problem solving? Can they see the parts of a problem and the whole problem at the same time? Do they know how to ask the tough questions that will define and bound the problem for analysis?

8) Seek Learning Opportunities. Learning must be constant. Continually improving or rejuvenating one's skills to meet new corporate challenges is absolutely essential. Employees must develop and maintain a life-long discipline of learning, honing skills, building new knowledge, and setting new goals. The global economy is a very unforgiving place**.**

The challenge to teachers and school systems will be to emphasize and practice these skills during the normal educational process in the classroom. How can these skills and their practice be embedded in the various subjects, classroom projects, design challenges, and team activities that gifted students normally do? Perhaps some engineers from local companies can be invited in to talk to students, and also interact with teachers to help jointly develop activities that will build such practice into the normal school day.

Epilogue

These videos referenced below from the North Carolina STEM Learning Network lend powerful credence to the discussions above. STEM is directly relevant for the 21st century workplace, and success in a globally competitive economy.

http://www.youtube.com/watch?v=zWbD2yUFbXU

http://www.youtube.com/watch?v=T8kb68ZfGxg

http://www.youtube.com/watch?v=wS-IESwjCwE

http://www.youtube.com/watch?v=xT1MmTj5hPM

The Metamorphosis of Vladimir Nabokov and the Gifted Sensibility

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Center for the Study of the Humanities in the Schools

". . . . This re-Englishing of a Russian re-version of what had been an English re-telling of Russian memories in the first place, proved to be a diabolical task, but some consolation was given me by the thought that such multiple metamorphosis, familiar to butterflies, had not been tried by any human before." ***Speak, Memory*** (1967). Foreword, pp. 12-13.

The life and writings of Vladimir Nabokov (1899-1977) have many insights for understanding gifted education. The operative word in the above quotation is metamorphosis. Gifted education is based upon the creation and stimulation of psychological and intellectual metamorphosis.

First, there is the metamorphosis of language. Nabokov was able to think and write in many different languages. It wasn't just a matter of mastering languages within the same family such as French, Italian and Spanish. Instead he mastered such diverse languages as English, Russian and French. This ability demanded pronunciation, reading decoding and composition skills that were not similar. The term metamorphosis aptly describes the ability to achieve these linguistic transformations. The gifted education curriculum needs to include courses that train the mind in different formats. For example, translation needs to be an integral part of the differentiated curriculum since it is a higher taxonomic ability than is presently understood. As shown by Nabokov, his skills in translating from Russian to English and vice versa were astounding.

Another metamorphosis was applying his scientific experiences to his literary creations. He was a world-renowned collector of butterflies who traveled extensively to gather myriad forms of these insects. In addition, he discovered a unique species which is included in his collection at Harvard University's Museum of Natural History. The study of science and humanities were part of his holistic creative pattern. Gifted education needs to create a curriculum that is holistic in a similar manner.

Nabokov's writing style was also a form of metamorphosis. His sentences transformed readers as they experienced them. In the same sentence he included references to varied sensory responses – auditory, visual, taste and tactile. Gifted education should help students blend this sensory information into a meaningful and creative force.

His book, ***Speak, Memory*** (1967), was both a memoir and poetic verse. Nabokov wasn't intimidated by his memory. He sought to change it into an art form. Gifted education must enable students to function in a similar manner. When reading ***Speak, Memory*** one cannot help but comprehend the gifted sensibility of intellectual geniuses such as Aristotle, Dante, Shakespeare, Goethe and Darwin. The key lesson is the role of metamorphosis in the gifted student's life. ♦♦♦

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(All of them can be ordered through Amazon.com.) **Click the Link: Now Order Selected Versions in PDF Format by Using PayPal**

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2. ***STEM Robotics in the Gifted Classroom: Meet ROBO-MAN! Upper Elementary through Secondary Levels*** **(ISBN 0-910609-61-6) by Harry T. Roman. COST: $22.00 Including P&H. http://bit.ly/GSwhit**
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