Neglecting Creativity

A Quiet Crisis Clouding The Future of R&D

By Joseph Renzulli

Those who own the rights to inventions own the world.

—From the political platform of the Japanese Democratic Party, June 6, 2000

“Why,” I asked the three visitors from the Japanese Ministry of Education, “are you interested in the work we are doing?” They had come to our research center to learn about our efforts to promote the development of creative productivity in American schools. I told them that our education leaders regularly remind us to look to the East. “You have the highest scores in the world on international achievement comparisons,” I said.

I’ll never forget their reply: “Very simple, Professor. We have no Noble Prize winners. Your schools have produced a continuous flow of inventors, designers, entrepreneurs, and innovative leaders. We can make anything you invent faster, cheaper, and, in most cases, better. But we want to learn what role this ‘creative productivity’ focus plays in the production of creative and inventive people.”

This experience caused me to think about what may be the one great asset of the American education system — an asset we may unwittingly be losing as attention is turned more and more to cranking up our achievement-test scores.

How much are new ideas worth? What are we willing to pay for the persistence, creativity, and task commitment that research scientists or industrial designers devote to following through on innovative ideas with potentially high-stakes payoffs? Can we calculate the economic value, job opportunities, and contributions to social and political stability that result from investments in the young people whose potential for creativity and innovation will produce new products, find solutions to unsolved problems, and even develop entire new industries?

Innovation resulting from research and development is widely recognized as a key ingredient in economic productivity, but the United States may be losing its edge in the culture of innovation. A quiet crisis is building that could jeopardize our nation’s pre-eminence and well-being, and this crisis could reverse the global economic leadership Americans currently enjoy. U.S. productivity growth has

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showed significantly since 1973, and continues to grow at a slower rate than that of our major trading partners. And patent data, one of the best indicators of R & D productivity, also raises concern about future U.S. competitiveness. Approximately 43 percent of all new U.S. patents are granted to foreign inventors, and the quality of those patents is weak, especially in the high-technology areas.

Although many factors contribute to a nation's overall productivity, the education system in any country is a prime source for producing the R & D people of the future. In a recent report, the National Science Board pointed out that the United States faces a major shortage of scientists because too few Americans are entering these fields. We already are experiencing a decline in the indicators for making international comparisons in academic achievement. The 2003 Program for International Student Assessment ranked the United States at 42nd in 28 countries in the Organization for Economic Cooperation and Development, a Paris-based group that represents the world's richest countries.

Our most talented students each year leave the United States to attend universities and universities in other countries. This loss of talent is a major problem for the United States, which has a long history of training the world's best scientists and engineers.

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International education among students from foreign countries remains a major source of income for American universities. In 2003, foreign students accounted for 28 percent of all international graduate students in the United States, and a decline of 15 percent in the enrollment of full-time international graduate students. The largest drop in applications was in engineering, with a decline of 15 percent.

International students are turning in greater numbers to the higher education systems of our global competitors and in some cases to other industrialized nations in mathematics and science. This trend is likely to remain and may employees in these countries following graduation. Although our capacity to attract top college and graduate students from abroad remains high, the unemployment opportunities in other countries for the most talented foreign students are increasingly being offered to these students to return home, and tightening immigration and security regulations threaten to raise the number of foreign students.

In the months leading up to the presidential election, a major concern of the federal government was to ensure that qualified and talented students have the tools needed to succeed in their fields. The government has introduced measures to strength the education of gifted and talented students. And there has been a sharp decline in state-level expenditures for the education of gifted and talented students.

But what about support for the highly gifted, creative, and innovative young people who are entering college? Do the products and programs that serve gifted and talented students benefit from a targeted funding initiative? The federal government provides only $11.2 billion for research and development programs for gifted and talented students. But the National Science Foundation provides only $17.1 billion for research and development programs for gifted and talented students. And there has been a sharp decrease in state-level expenditures for the education of gifted and talented students.

A recent report from the National Science Foundation found that the number of new research grants for gifted and talented students has dropped significantly since 1990. The report noted that the number of new research grants for gifted and talented students has dropped significantly since 1990. The report noted that the number of new research grants for gifted and talented students has dropped significantly since 1990. The report noted that the number of new research grants for gifted and talented students has dropped significantly since 1990. The report noted that the number of new research grants for gifted and talented students has dropped significantly since 1990. The report noted that the number of new research grants for gifted and talented students has dropped significantly since 1990. The report noted that the number of new research grants for gifted and talented students has dropped significantly since 1990. The report noted that the number of new research grants for gifted and talented students has dropped significantly since 1990.
EDUCATION WEEK

Published Online: July 14, 2008
Published in Print: July 16, 2008

COMMENTARY

Engagement Is the Answer

By Joseph S. Renzulli

Closing the achievement gaps between advantaged and disadvantaged students constitutes the biggest challenge facing today’s schools. We all know the statistics on test scores and dropout rates. But a sadder commentary may be the resulting collateral damage that has dragged down good instruction, de-skilled many teachers, squeezed subjects other than math and reading out of the curriculum, and produced data juggling and test falsification by desperate administrators trying to avoid having their schools branded as “failing.”

How did this mess happen? Why hasn’t the estimated $3 trillion spent on school reform since the 1960s made a difference? We’ve tried just about everything: smaller schools, year-round schools, single-sex classes, after-school mentoring, school uniforms, charter and magnet schools, school-business partnerships, merit pay for teachers, payments to students for performance, private management companies and for-profit schools, takeovers by mayors and state departments of education, site-based management, data-based decisionmaking, and just about every idea containing the words “standards” and “accountability.” All of these suggested silver bullets promised results, but little has changed. Most are built on structural changes and calculated to have an impact on entire school districts or states. But these structural changes have focused too much on low-level, highly prescriptive pedagogy intended to improve standardized-test scores.

The mainstream school diet for many poor and struggling learners is dominated by a remedial pedagogy that has failed to lessen achievement gaps. I believe it has actually contributed to their perpetuation. The instruction these children receive is often designed to determine what they can’t do, don’t like to do, and see no reason for doing. Then their teachers are told to focus on beating them to death with it.

Evidence of this failed pedagogy is apparent in one national report after another, and yet we continue to search for quick-fix structural solutions rather than alternative methods. The solutions, by whatever new names we give them, are always reiterations of the same pedagogy—the same drill-and-practice model for learning. And our universal criterion for accountability remains the same, with new names given to the same old achievement tests of
decades past.

The singular reliance on tests for accountability forces the pedagogy of prescription and hamstrings good instructors in the process. Is it any wonder that some excellent teachers leave the profession, or flee urban schools where prescription is almost universally practiced?

Isn’t it time to explore a counter, perhaps even counterintuitive, approach based on pedagogy radically different from what Pavlov used to train his dogs? Accountability for truly educated minds in today’s knowledge-driven economy should consider high-end learning skills—those that include the ability to do the following:

- Plan a task and consider alternatives;
- Monitor understanding and the need for additional information;
- Identify patterns, relationships, and discrepancies;
- Generate reasonable arguments, explanations, hypotheses, and ideas;
- Draw comparisons to other problems;
- Formulate meaningful questions;
- Transform factual information into usable knowledge;
- Rapidly and efficiently access information;
- Extend one’s thinking;
- Detect bias, make comparisons, draw conclusions, and predict outcomes;
- Apply knowledge and problem-solving strategies to real-world problems;
- Work and communicate effectively with others;
- Derive enjoyment from active engagement in learning; and
- Creatively solve problems and produce new ideas.

These learner-centered skills help develop young minds and promote genuine student engagement, thus increasing achievement. Focusing on these kinds of outcomes may be counterintuitive to the “more practice is better” pedagogy, but our track record with compensatory learning models should help us realize that we need more-creative approaches. We also need an infusion of motivationally rich experiences into the curriculum that will promote engagement, increase enjoyment, and produce a genuine enthusiasm for learning.

Common sense and our own experience tell us that everyone does a better job when working on something that is personally engaging. Extracurricular activities are based, for example, on instruction that is the opposite of drill and practice. How many unengaged students have you seen on the school newspaper staff or the debate team? In

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http://www.edweek.org/ew/articles/2008/07/16/43renzulli.h27.html?print=1

7/29/2008
the chess club or the concert choir? Engagement occurs when students have choices in what they participate in and how, when they can interact in a goal-oriented environment with like-minded students, and when they are able to use authentic problem-solving, interpersonal skills, and creative learning strategies. Engagement comes when they have the opportunity to produce a product, service, or performance, or to develop work for intended audiences. The enthusiasm and interest that result from such experiences exemplify a learning environment that differs completely from prescriptive pedagogy.

All learning, from diapers to doctorate, exists on a continuum that spans the deductive, didactic, and prescriptive on the one hand, and the inductive, investigative, and inquiry-based on the other. Students with lower achievement are subjected to endless didactic activities, and when their scores don’t improve, they receive double the drill-and-kill work. This has turned many schools into joyless places that generate mind-numbing boredom, a lack of genuine student and teacher engagement, absenteeism, and increased dropout rates. Proponents of popular but highly prescriptive programs may boast of test-score increases, but does the endless practice simply prepare students for more test-taking or help them learn to enjoy the act of learning?

Student engagement has been defined in many ways, but I view it as the infectious enthusiasm students display when working on something of personal interest pursued inductively. This and other highly engaging approaches motivate students to improve basic skills and complete higher-level work. True engagement comes from learning activities that challenge young people to stretch above their current comfort level. Such activities are based on resources and methods of inquiry that are qualitatively different from repetitive practice. The guiding principle in this kind of learning can be stated simply: No Child Left Bored.

Research in this area is clear and unequivocal: High engagement results in higher achievement, improved self-concept and self-efficacy, and more-favorable attitudes toward school and learning.

It will not be easy to turn around an education establishment that has made massive financial and policy investments in one particular brand of learning. Nor will it be easy to circumvent the powerful influence of the textbook- and test-publishing industries that thrive on prescriptive curricula and test-driven approaches to accountability.

But change is possible if we take advantage of the remarkable advances in information technologies that have given teachers the equivalent of a dozen teaching assistants in their classrooms. These technologies make it possible to quickly and easily assess students’ interests, learning styles, and preferred modes of expression. What formerly took teachers weeks or even months to learn about students’ strengths can now be determined electronically. Powerful search engines can then match engaging learning resources to individualized student profiles.

When technology does some of the hard work, true differentiation can occur. Yet while every
other field of study has made imaginative uses of technology, educators have too often settled simply for electronic worksheets and encyclopedias online.

We need the courage to explore bolder, more innovative alternatives, so that we can provide all students with highly engaging experiences—the kind of instruction available in the nation’s best public and private schools. A more engaging pedagogy, combined with greater and more innovative uses of technology, can deliver the resources to make these alternatives possible.

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Vol. 27, Issue 43, Pages 30-31
Going Beyond Gutenberg and Skinner: Fighting the Enemies of Personalized Learning

By Joseph S. Renzulli
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There are conferences for just about everything these days, but because of my interest in personalized learning, it appeared that this one on redesigning personalized learning would be just the ticket for gaining new insights into how learning can be more responsive to the divergent needs and diverse populations in today's schools. Most educators agree that the one-size-fits-all curriculum needs addressing, and this by-invitation-only "summit" showed so much promise that I wangled an invite. Resplendent with all the buzzwords of the personalization and differentiation mystique ("flexible," "student-driven," "authentic," "everywhere learning," "systemic redesign"—to mention a few), the event would be staffed by the gurus of school reform and attended by education power brokers and CEOs from the public and private sectors.

Wow! What could be more appealing and hopeful for a change from the harmful direction that education has taken since the No Child Left Behind Act turned the learning process into a gigantic text-consumption and weakness-based test-prep industry? And the expectation that technology was a major answer to this promise of a revolution in personalizing learning made the conference even more appealing.

The emergence of technology in education has certainly created a renewed interest in personalizing learning and providing teachers with the tools necessary for differentiating curriculum. Early efforts to use technology to personalize learning can be traced back to B.F. Skinner's teaching machines, which were designed to use rote-and-drill to
automate the task of programmed instruction. Get the correct answer and you moved on to the next question. A wrong answer recycled the student through more practice material until he or she answered the question correctly.

Teaching machines were another failure in the long history of so-called "innovations" in education, but when computers and the Internet came along we seemed poised to capitalize on technology that placed vast amounts of the world's knowledge at students' fingertips. Just as Gutenberg revolutionized access to knowledge, at least for the restricted number of scholars of his time, we now have the capacity to make knowledge public for anyone who can read and log in. It soon became clear that the general focus of the conference was on basic curriculum competencies and more-efficient procedures for mastery and improved achievement-test scores. Now, rather than covering material in a lock-step fashion for all students at the same time, teachers can direct content at different levels to students according to their varied achievement levels. Although this use of technology extends (by a giant step) the traditional one-size-fits-all instructional model, it only accounts for varying competency levels rather than examining at least three other categories of learner characteristics that define true personalization. This restricted focus led me to conclude that we are using today's technology for what might be called "Gutenberg-online"—the electronic shuffling of worksheets and standard-text material—and that, pedagogically, we haven't progressed much beyond the type of learning that Skinner advocated with his teaching machines.

A similar case can be made for the explosion of online courses currently available to school-age students. These courses have great value when not available locally, but they almost always follow a linear, sequential instructional model rather than a more inductive and investigative model of learning. To paraphrase Gertrude Stein, a course is a course is a course, or in education-speak: Standards-driven prescriptive material is geared toward answering the questions at the end of the chapter and taking another achievement test. Skinner's teaching-machine movement failed because we were treating students like Pavlov's dogs. We could face the same consequences with today's technology unless we expand our vision about what personalization could be and how technology can help make it happen.
True personalization requires more than just looking at achievement levels and trying to compensate for deficiencies. At least three other characteristics of the learner and differentiation of content and process are necessary to give us a more comprehensive profile of student potentials and point us in the direction of making modifications in the learning process. In addition to achievement levels, information about student interests, learning styles, and preferred modes of expression allow us to make decisions about personalization that take multiple dimensions of the learner into account.

This information can easily be gathered and analyzed through the use of computer-generated profiles and from search engines that match multiple categorized resources from databanks containing vast quantities of highly interactive online material. Teachers can use this technology to infuse into any and all standards-driven curriculum highly engaging enrichment materials that can make any lesson or unit of study more exciting, engaging, and enjoyable. Math concepts improve and become more relevant when students use technology to design and build their own roller coaster. Students can gain a greater appreciation and understanding of ancient Egyptian culture when they do a virtual dissection and preservation of their own mummy. The differentiation of content requires adding more depth and complexity to the curriculum rather than transmitting more or easier factual material. By focusing on structures of knowledge, basic principles, functional concepts, and methods of inquiry in particular disciplines, students are prepared to assume roles as firsthand inquirers rather than mere consumers of information. The differentiation of process requires the use of a variety of instructional strategies that differ from the traditional deductive, didactic, prescriptive approach used in most classrooms. Respect for learning-style variations can be achieved by using instructional strategies such as simulations, Socratic inquiry, problem-based learning, dramatizations, and individual and small-group investigations of real problems. Expression-style preferences can be accommodated by giving students opportunities to communicate visually, graphically, artistically, and through animatronics, multimedia, and various community-service involvements.

The biggest enemies of differentiation are time and the over-
prescription of learning. Before the availability of computers and the Internet, teachers simply did not have the time to find and direct customized resources to individual students.

Our obsession with content mastery and Skinner's behavioral theory of learning are slowly but surely giving way to an interest in personalization and differentiation. While it is understandable that our early use of technology was mainly an adaptation of Gutenberg-online and a teaching-machine mentality of what learning is all about, we now have both the pedagogical rationale and technological capability to use the many dimensions of student characteristics that clearly and unequivocally result in higher engagement, enjoyment, and enthusiasm for learning.

Amazon and Netflix know what we like to read and view, and they make use of this information to "differentiate" the material they send us. We can do the same thing to enrich the entire learning environment by capitalizing on a broader spectrum of learner characteristics, creating comprehensive computer-generated student profiles, and using the interactive capabilities of today's technology to revitalize learning. By so doing, we can minimize boredom and make learning the challenging, enjoyable, and relevant process that it should be.

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Vol. 31, Issue 22, Pages 21-22
Dealing With the Differentiation Debacle

Joseph S. Renzulli

The two recent Commentaries in Education Week on differentiation (Delisle, 2015; Tomlinson, 2015) have accurately described the criticisms and potential of an important concept that has captured unprecedented attention among American educators. Both commentaries, however, have overlooked the one thing that can make differentiation successful without burying teachers under a mountain of time-consuming resource acquisition and classroom management demands that would place unreasonable and perhaps even impossible demands on their time. This argument is truly a “baby and the bathwater” issue; however, there is a way of dealing with differentiating that makes it both feasible and an effective way for adding an element of personalization to all aspects of the curriculum.

So picture this. Students sit down at their computers or pick up their hand held devices and respond to a series of questions that document their academic achievement levels, interests, learning styles, and preferred modes of expression. A search engine then scans through various categorical data-bases containing thousands of both basic skill builders and highly engaging enrichment activities that are classified by common core standards, achievement levels, interests, learning styles, and preferred modes of expression styles. The search engine next matches these resources to each student’s individual profile and sends the resources directly to the student’s computer.

Teachers can use the same technology to find topics, subtopics, and sub-subtopics within any general curricular area, unit of study, or pre-selected standard. Using their class lists and categorized student profile data teachers can then identify and send differentiated resources at various grade and achievement levels to their students. They can use their knowledge about various student needs and interests to create and name computer generated achievement level groups and/or interest groups on their classroom dashboard and they can send differentiated resources to individuals, small groups, or their entire classes. The ability to differentiate using this technology is now available and as one teacher who has used it said, “It’s like having a dozen teaching assistants in my classroom, every day, all day.”
The unfortunate reality of today’s standards driven curriculum and the demands on most teachers to improve standardized test scores at all costs has left little time or motivation for teachers to accommodate the many differences that exist in today’s demographically diverse classrooms. Our research on reading, for example, has shown that as many as twelve reading levels exist in some heterogeneously grouped middle grade classrooms (Reis et. al, 2011) and in most cases when differentiation strategies are applied, the only changes taking place are content level adjustments (i.e., more drill and practice for low performing students and more advanced content for high achievers). True differentiation must also deal with variations in instructional strategies and classroom organization and management as well as simple adjustment to content levels. Some students learn best through group work and some by working alone. Some students learn more effectively by doing projects, while others learn best by discussion, simulations, computer assisted instruction, or by tracking down on the web just-in-time information and resources needed for a project they are pursuing.

Teachers can also differentiate the learning environment and how they manage it by infusing differentiated activities into the standard curriculum. Students can be given opportunities to work individually, in groups with other students who share similar interests or learning styles, or in groups in which every student has a chance to demonstrate his or her own unique style of learning. Students also have preferences for the ways in which they like to express themselves – orally, visually, graphically, dramatically, through construction, digital media, or through various written genres. In basic skill areas there is an almost unlimited amount of material that covers math and reading/language arts concepts at various levels. These materials can easily be directed to individuals or small achievement level groups electronically by letting the computer do the heavy lifting, making the very valuable concept of differentiation a workable reality.

Many of the resources available from the web incorporate opportunities for addressing the kinds of student differences mentioned above and they extend differentiation beyond mere content modifications. A board game called *Escape to Freedom* allows students to learn about the Fugitive Slave Law through a competitive simulation that capitalizes on students who prefer
an interactive style of learning about the Civil War. A virtual dissection and mummy preservation activity called *Fun with Mummies* allows students to study Ancient Egypt through a highly engaging and hands-on experience that incorporates anatomy, Egyptian history, language, and culture into the activity. Students interested in STEM applications can build their own roller coaster or underwater Remotely Operated Vehicles. Existing software makes thousands of resources such as these easy to locate, download, and direct to individuals or groups. In places where this approach to differentiation has been used we have witnessed remarkable turnarounds and improved achievement test scores on the parts of struggling or turned-off learners (Field, 2009). In addition, high achieving students have had opportunities to engage in challenging problem-based enrichment projects that extend their thinking skills and creative productivity far beyond what is typically covered in the standards driven curriculum.

As is almost always the case, education is usually slower than other professions to adapt to changes in technology. Conversely, the entire field of health care is now driven by “personalized medicine” literally “differentiated” for patients’ needs. Amazon and Netflix know our preferences and only send us selections in which they know we have an interest. And what about the pop-up ads that appear in almost every document downloaded from the Internet? They are always posted by companies from which previous purchases have been made. Differentiation or personalization (my preferred term) in education is a powerful concept and I agree with critics who say that implementation is challenging. But we need to figure out how to make it work and the use of technology that is now available is one approach that will enable teachers to easily access the almost unlimited resources that will not only improve achievement, but also make learning the enjoyable, engaging, and exciting process that it should be. Although the previous commentaries on this topic present what appear to be opposing points of view, they serve a very useful purpose of calling our attention to the powerful potential of an instructional strategy that can increase at least a part of the personalized learning process for all students.

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