Science & Math CESE Education

The BEACON

News from

The Coalition for Excellence in Science and Math Education

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PRESIDENT'S MESSAGE

There They Go, Again!

It seems that we are off to the races—again. That is, the intelligent design (ID) creationist races. This time, these people are trying to get legislation passed in the 2007 session of the New Mexico Legislature. By the time you read this, it may be legislatively all over. However, some interesting things have been said that bear repeating.

First, you might ask: "What's all over?" The answer is that identical bills and identical joint memorials were introduced into the legislature this year. As I write this, one bill and one memorial are in the House, and the same pair are in the Senate. So far, the memorial in the House has been heard before the Judiciary Committee and tabled. One down, three to go.

If you don't have a clue as to what I am talking about, these bills and memorials are fairly standard fare for the intelligent design creationists. They attempt to make things *fair* by taking away all punishment of teachers for teaching 'scientific data' regarding 'evidence for and against' 'biological origins.' The bills go on to define scientific data as everything but peer reviewed, consensus science. In fact, the bill's title is **"An Act Relating to Public Education; Providing for School Science Content Standards and Rules Regarding the Teaching of Theories of Biological Origins."** Therein lies the first clue: "biological origins" is a term used almost exclusively by ID creationists— not scientists. Yet, this bill purports to improve the state's Science Standards. There is more, much more, which you may read by going to http://legis.state.nm.us/lcs/BillFinder.asp and searching for these bills and joint memorials—SB 371, SJM 9, HB 506, HJM 14.

Instead of a blow-by-blow description and analysis of these, I thought it might be a bit more interesting to provide a story in quotations. These are not "cherry picked." They contrast what people say in public, with when they think only their allies are listening. I shall add comments, where necessary. Here we go with the quotes in bold and with my comments in brackets:

In the Federal Trial of Kitzmiller, et.al., vs the Dover School District, et. al ., Judge John E. Jones, III, wrote in his final ruling: **"An objective observer would know that ID [intelligent design] and teaching about "gaps" and "problems" in evolutionary theory are creationist, religious strategies that evolved from earlier forms of creationism."** [This is exactly what these bills and memorials do. This case has already been tried in federal court. The ID creationists lost.]

Objectives [Intelligent Design Network of New Mexico]

• Promoting the principles of religious and philosophical neutrality, academic freedom, intellectual integrity, and objective bias-free science education in New Mexico's public schools;

• Promoting intelligent design as a scientific theory of cosmological and biological origins; and

• Informing parents, students, teachers, public school administrators and state officials of the scientific, religious, and legal issues associated with the teaching of theories of biological origins in public schools. [This is from the web page of the Intelligent Design Network of New Mexico headed by Mr. Joe Renick (http://www.nmidnet.org/). There is nothing about God here!]

"Joe Renick, with Intelligent Design Net New Mexico, says the real problem is not the science-based content, but rather evolutionists,who don't want anyone hearing an opposing view; "If there's no transcendent designer or creator, such

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WebmasterJesse Johnson

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as the God of Genesis, well then, that's going to say a whole lot about what this life is about and what it means.'" [From a broadcast of the Family News in Focus program, January, 2005 (sponsored by "Focus on the Family" the audience being fundamentally evangelical Christians). It seems that the honesty displayed on the broadcast program does not carry through to the ID Net NM web site that the general public gets to see.]

"However we evolved, we're here. What we evolved from we will never figure out," Williams said. "There are many people who are absolutely convinced God did all of this and if you have the faith I have, God did it all." [The House Joint Memorial's sponsor, Rep. W. C. Williams in a House Judiciary Committee hearing where the memorial was tabled on 29 January, 2007 as quoted in the *Albuquerque Journal*, 30 January, 2007. Representative Williams is being honest and is to be commended for that, even though what he is sponsoring is contrary to both the US and State of NM Constitutions.]

RE: "'CREATIONISM' MEASURE Tabled" article The (sic) article quotes opponents to the legislation as saying the resolution attempts to shoehorn creationism or intelligent design into science classrooms. As one of the people who helped draft the legislation, I can assure you that the resolution does no such thing. ... This legislation is about intellectual freedom and teaching science objectively, not about creationism, religion or intelligent design." [In a letter to the editor from Michael Edenburn in the *Albuquerque Journal*, 13 February, 2007. Edenburn is an ID creationist and member of the ID Network of NM—at least as of November, 2005. It would seem that the memorial's sponsor and one of the "drafters" do not agree on the central point—is this about religion, or not?]

That is all for the quotes. There are many more that could be added, but not in the space available. Besides, it does get old after a while. With the few notes added, these quotes tell a story. This is a story of the ID creationists that they do not want the public to hear. Some are honest, but many simply tell you what they think you need to hear to get their way—their specific kind of theocracy into the public schools. Even if they are defeated here, they will be back.

Please keep your eyes peeled and yell really loud when you see something indicating the ID creationists are at it again.

Kim Johnson
CESE President

AN INTRODUCTION TO EVOLUTIONARY THEORIES OF AGING

By
Brian D. Berman, M.D.

While I thought that I was learning how to live, in fact I was learning how to die.—Leonardo da Vinci
In this world nothing can be said to be certain, except death and taxes—Benjamin Franklin

Introduction

In 1513, the Spanish explorer Juan Ponce de León is alleged to have grown discontented with his riches and set out on an expedition in search of the Fountain of Youth. While he may have discovered Florida during his likely apocryphal voyage, the Fountain of Youth remained elusive.

Tales of healing waters such as a Fountain of Youth, as well as legendary keys to immortality, have continued to capture human imagination throughout much of recorded history. And throughout the ages, shamans, witch doctors, and ritualistic healers have worked to impede the unrelenting and inescapable deterioration known as aging. Even today billions of dollars are devoted annually to study aging as well as treat its inexorable consequences. However, an understanding of the reasons why we age has lagged far behind.

Why do we, along with all other animal species on earth, weaken and die with age?

The origin of senescence is a fundamental and yet unsolved problem of biology. Although Charles Darwin would help revolutionize the field of biology, his theory of evolution by natural selection further puzzled scientists who attempted to understand the phenomenon of aging in this context.

In 1859, Darwin aptly described how the force of natural selection and variation of biological traits between individuals can drive biological evolution and produce species that are amazingly fit to a given environment. By this process, evolution was able to produce the astounding number of complex and exquisitely well-adapted creatures who develop from a single cell at conception through birth and then to sexual maturity and a productive adulthood.

So how could these same forces that created such varied and successful species from conception through adulthood then act to produce the destructive and degenerative features of decay and death instead of immortality?

Certainly, evolution has led to diverse, if not patently bizarre, life cycles. There are the well-known suicidal missions of the pacific salmon, which after a few years in the ocean may travel thousands of miles and battle strong river currents and waterfalls to reach their hatching place, spawn, and then die. And of course there is the infamous female praying mantis which, during copulation, often devours the male's head (the body of the male still capable of completing the act of mating before it too is eaten by the female). In fact, peculiar life cycles are ubiquitous in nature, including even the plant kingdom.

Evolution has also spawned a wide variety of life spans. Just last year a giant tortoise named Adwaita died in a Calcutta zoo at a venerable age of around 250 years. This would probably feel like an eternity to the female mayfly, which has the title of the shortest adult reproductive life, surviving less than five minutes after her final molt during which she must mate and lay

Why do some species have short lives while others have long lives? And *why* must species grow old and die at all?

Although we have made numerous discoveries and advances in identifying specific biological mechanisms involved in the aging process, there is still no agreement in the academic community as to *why* we age. I will briefly review some of the past and current concepts that have tried to clarify the process of aging and death through an evolutionary perspective, referred to as evolutionary theories of aging.

The body is at its best between 30 and 35 —Aristotle

Theory of Programmed Death

One of the earliest attempts to explain the process of ag-

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using evolution was made by the German biologist August Weismann in 1889. He believed that there must be an evolutionary advantage to having a limited lifespan and theorized that natural selection led to the design of a finite limit to the number of times a cell can divide. He further postulated that this specific death-mechanism[1] exists to help eliminate older members of a species population so that they no longer compete with younger reproducing generations for food, living space, and other resources. His theory has come to be known as the Theory of Programmed Death.

Although modern experiments have confirmed that there is a limit to the number of times a cell can divide, potentially limiting an organism's lifespan, there is now a great deal of compelling evidence against the Theory of Programmed Death.

First, if the theory were true we would not expect to see large differences in the lifetimes of species across different environments. As might be expected, researchers have observed a significant difference between the lifespan of an animal in the wild exposed to hunger, cold, disease, and predation, compared to when it is raised in captivity where conditions are much better. For example, mice live about twice as long (about 24 months) in captivity than they do in the wild. For primates, the median lifespan of chimpanzees living in captivity is between 23 (males) and 30 years (females), but in the wild the median lifespan is closer to 8 years.

Observations like these are common for many biological species, including humans whose life spans have changed significantly throughout history with improved sanitation, medical science, and nutrition. Currently, the mean life expectancy in developed countries is between 70 and 80 years, while as recently as the Middle Ages, mean life expectancy at birth was about 27 to 29 years.

Given the many examples that demonstrate the life spans of organisms in protected environments greatly exceed the life spans observed in natural conditions, it is hard to imagine how evolutionary forces could act to create a self-destruction program.

Secondly, if the theory were correct we would expect to see an age-dependence of death rates which should increase dramatically after some critical age later in life when the alleged death program comes into action. However, hundreds of published life tables compiled for many dozens of different biological species, including humans, have shown that age-dependence relationship of death rates is very smooth and monotonic without any signs of some critical age or breaking point later in life corresponding to a mortality explosion.

Furthermore, studies have shown that there is no particular age at which animals raised in protected conditions begin to die off more quickly and that the actual death rates at extreme old ages actually start to slow down, which is the opposite of what would be expected if death was preprogrammed.

Lastly, if the theory is approached from an evolutionary point of view, a programmed death mechanism for the termination of life could hardly help an individual fight successfully for its survival and the survival of its progeny. Also, if a spontaneous mutation should arise in a gene that encodes for delaying the self-destruction program in a species, an increasing number of their descendants with longer life spans might displace many of the remaining individuals, if they remained prolific!

In the end, even Weismann abandoned his own theory of aging. Nevertheless, he should be credited with suggesting the first evolutionary theory of aging as well as correctly predicting the existence of a cell division limit without even having collected any data.[2]

Anyone who has never made a mistake has never tried anything new.
Albert Einstein

Mutation Accumulation Theory

From an evolutionary perspective, if an adaptation does not provide a reproductive advantage, it is not likely to be supported by selection pressure and maintained in future generations; there is not much selection pressure for traits that would maintain viability of individuals in a species living beyond their age of being able to reproduce. Thus, aging may just be the inevitable result of the declining force of natural selection with age.

In 1952, English scientist and co-winner of the 1960 Nobel Prize in Physiology or Medicine, Peter Medawar, first posited the Mutation Accumulation Theory of aging. His theory suggested that aging might in effect be an incidental byproduct of natural selection and could be considered a non-adaptive trait.

Medawar noted that if a genetic mutation kills individuals before they have a chance to reproduce, they will be strongly selected against in subsequent generations. In such conditions, deleterious mutations expressed at a young age are strongly selected

against due to their negative impact on fitness (number of offspring produced). But if a lethal mutation is acquired that kills a species beyond its reproductive years, it will experience no selection because this mutation will have already been passed to offspring by that age.

Thus, a late-acting deleterious mutation is relatively neutral to selection and might spread across an entire population over time and over successive generations, eventually accumulating and leading to an increase in mortality rates late in life. In this way, throughout evolutionary history, we could have accumulated the many genetic defects which cause the deterioration observed as aging.

Analogies exist in some genetic mutations that cause disease in humans. A spontaneous (non-inherited) mutation that leads to a child's death before he or she reaches sexual maturity will not be passed on to future generations. However, a deleterious inherited mutation that is not phenotypically expressed until after an individual reaches the age of reproduction, such as the genetic defect that causes Huntington's Disease, is much more likely to be passed on to offspring and lead to increased prevalence of that disease among older individuals over time. Thus, the Mutation Accumulation Theory predicts that the frequency of genetic diseases should increase at older ages.

Unlike the Theory of Programmed Death**,** the Mutation Accumulation Theory allowed scientists to make some testable predictions. For instance, the theory predicts a nonlinear dependence of progeny lifespan on parental lifespan with a slope that becomes steeper with higher parental ages at death rather than a linear relationship seen for other quantitative familial traits such as body height. This prediction was tested through analysis of genealogical data on familial longevity in European royal families, data well known for their reliability and accuracy, and it was found that the dependence of offspring lifespan on parental lifespan increases with parental lifespan exactly as predicted by the Mutation Accumulation Theory.

Despite its successes, the Mutation Accumulation Theory is generally considered a work in progress and serious criticisms have begun to surface.

One such criticism suggests that the natural environment is not forgiving and so any mutation that might lead to senescence could be fatal for animals. Indeed, modern studies of demography in natural environments suggest that elements of senescence (e.g. slower movements) do indeed make a substantial contribution to the death rate in nature (e.g. being eaten by predator). Since changes due to aging could have a high survival cost, natural selection probably does care.

Another criticism of Medawar's theory surfaced in the late 1990s when the widespread use of genomic analysis revealed that many of the genes linked to aging were not random mutations, but rather families of genes some of which have been conserved through evolutionary history and were discovered across species including humans, mice, worms, fruit flies, and even in yeast.

Footnotes

[1]This refers to a mechanism that acts on the organism as a whole and leads to its ultimate demise and does not correlate with the genetically coded and regulated process of somatic cell death, or apoptosis, which plays an important role in early development of species and is thus not specific to aging. The process of apoptosis likely contributes to aging and has been implicated in various neurodegenerative diseases. A dysfunction of the pathway that leads to cell death is often necessary for cells to become cancerous.

[2]In the early 1960s, the American cell biologists Leonard Hayflick and Paul Moorhead first showed the ability of cells to divide in tissue culture was finite and this limit on cell replication has been termed *The Hayflick phe-*

To be continued in the next Issue of the Beacon.

NAEP versus State Standards-Based Assessments
New Mexico Maintains High Standards
January 16, 2007
Coalition for Excellence in Science and Math Education (CESE)
Dr. Marshall Berman and Walt Murfin

Introduction

At the request of the NM Public Education Department, the NM Office of Education Accountability, and the Baldrige in Education Initiative (BiE IN), we have analyzed the relative proficiencies of every state's Standards-Based Assessments (SBA) against the National Assessment of Education Progress (NAEP, the so-called "gold standard" of educational assessments). This study provides an indication of whether individual states have maintained high standards for their K-12 students, or have relatively lower standards and/or easier tests, that will in general lead to state-measured student proficiency fractions that are significantly higher than the national standards provided by the NAEP tests. We have found that New Mexico has maintained relatively high standards compared to most other states. Given our comparatively poor state demographics, we have nevertheless not compromised our high standards and rigorous assessments.

Education Week Quality Counts 2007 Results

Quality Counts recently released their latest assessment of American education from birth through adulthood. For the first time, they presented a new Chance-for-Success Index, developed by the Editorial Projects in Education Research Center. It provides a state-focused perspective on the importance of education throughout a person's lifetime. The index is based on 13 indicators that highlight whether young children get off to a good start, succeed in elementary and secondary school, and hit crucial educational and economic benchmarks as adults.

Unfortunately, New Mexico ranked at the bottom of all states, based on this index. However, only three of these indicators were quantifiable output measurements of K-12 student achievement: 4th grade reading, 8th grade math, and high school graduation. The other indicators dealt primarily with socio-economic conditions, higher education participation and achievement, and inputs (like pre-school and kindergarten enrollment). Some of these indicators have been changing recently; others reflect the obvious fact that we are a poor and culturally diverse state with a large non-English speaking population. Changing many of these factors will take years or even decades.

Some Consequences of the No Child Left Behind Act

In contrast to the Chance-for-Success Index, New Mexico was ranked fourth in the nation for our standards, assessments and accountability system. The No Child Left Behind act had laudable goals, including the desire to accurately assess student achievement, and to close the achievement gaps between Asians and Caucasians on one hand, and Blacks, Hispanics and Native Americans on the other. But as CESE and many others predicted, the unrealistic NCLB goal of 100% proficiency by 2014, coupled with the punitive sanctions for schools that do not make Adequate Yearly Progress (AYP), has resulted in huge state-to-state differences in the fraction of schools making AYP. We believe that it is very important that New Mexico maintain high standards, and portray to students, parents, and the government, an honest picture of what students know and can do, and how well they are prepared for higher education, good citizenship, and adult success.

Results

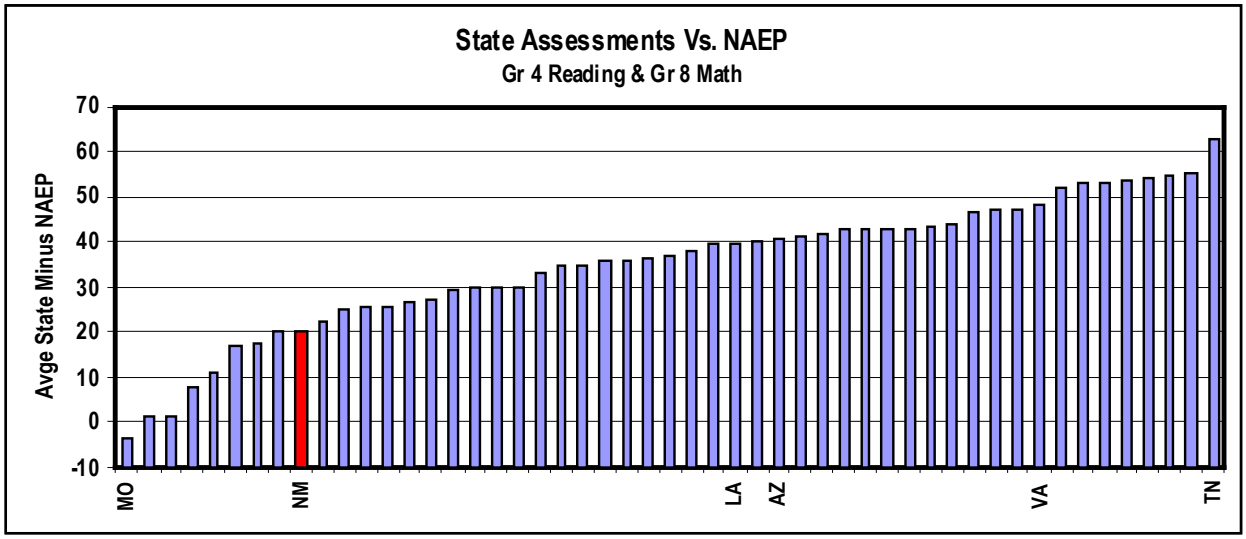
The figure below shows the difference between proficiencies (and above) measured by individual state assessments (SBA) compared to proficiencies measured by NAEP. In every case but one (Missouri), state proficiencies are higher than NAEP. Some states have argued that these differences are due to different curricula, different assessments, and different definitions of proficiency and above. However, in our opinion, a state-to-state comparison against a fixed test (NAEP) and a fixed definition of proficiency is a good indicator of relatively high or low state standards and rigorous or easy assessments.

The ordinate in the bar graph was calculated by computing the differences between NAEP and state SBA proficiencies for 4th grade reading and 8th grade math, and then averaging them. New Mexico ranks very well, ninth lowest in the average differences out of 51 states and the District of Columbia, indicating relatively high confidence in the validity of our standards and assessments; the NM average proficiencies were about 20% above NAEP. In contrast, KS, LA, TX and AZ assessments were twice those of NM, i.e., about 40% above NAEP. Virginia, the state that ranked at the top of the Success Index, had average proficiencies that exceeded NAEP by 48%. Tennessee proficiencies were 63% greater than comparable average NAEP proficiencies. These are very large differences that strongly suggest that many states have lower standards and/or easier assessments than the "gold standard."

The NAEP 4th grade reading and 8th grade math data can be accessed at http://nces.ed.gov/nationsreportcard/nrc/reading_math_2005/ ; the state assessments are provided by Education Trust: http://www2.edtrust.org/edtrust/summaries2006/states.html

Conclusion

Despite some of the impossible and draconian components of NCLB, New Mexico has maintained high standards and valid assessments, as noted by Quality Counts. Our goal should be to continue to honestly represent the status of student achievement and work diligently to improve the results. We need to accurately gather the data and determine which schools are exceeding expectations and which schools are underperforming, given the same student demographics. Knowing this, the state Office of Accountability has appropriately designated our challenge using data-based decision making with this question: "What are the schools that make such a positive difference for their students doing and how can we take the lessons learned and apply them to other schools?"



CAN WE MEET THE OBJECTIVES?

NCLB Requires schools to make "Adequate Yearly Progress—AYP" toward eventual goals of 100% proficiency in reading and mathematics by 2014. This requirement holds for all groups of 25 or more students in every demographic group: ethnic groups, economically disadvantaged (newspeak for Free and Reduced Price Lunch—FRPL), English language learners, and students with disabilities. There are escalating consequences for failure to achieve AYP, starting with a plan to do better in year 1, and culminating with fairly severe consequences in year 6. Those final consequences can include reopening as a charter school, replacing the staff, being taken over by the Public Education Deaprtment (PED), and such other governance changes as the PED in its pleasure may decree. If a school achieves its AYP targets in two consecutive years, it can get off the bad list. A school can also be credited if it reduces the fraction non-proficient by 10% or more —the "Safe Harbor" provision.

In addition to meeting AYP, the whole school (if N is at least 40) and each subgroup of at least 40 must meet a 95% participation rate. Elementary and middle schools must also meet a 92% attendance rate. High schools must meet an ever-increasing graduation rate—100 % by 2014.

There were earlier tests of three grades (4, 8, and11), but the first real tests were given in school year 2004-05. Even the tests for the grades that participated earlier were substantially changed, and earlier tests don't mean much. The levels reported are "Beginning Step" (newspeak for below Basic), "Nearing Proficiency" (Basic), "Proficient" and "Advanced." The reported fraction proficient includes both proficient and advanced students. Only full academic year students are counted.

So, you ask, what are the AYP targets? Annual targets have been set for each type of school grade configuration. The most common configuration is K to 5, 6 to 8, and 9 to 12. This corresponds to elementary, middle, and high schools in most districts. Other configurations have been set up to match districts with different schemata. The annual targets are called "Annual Measurable Objectives" or AMOs. If a group equals or exceeds the 99% lower confidence bound for the AMO, it will have met AYP for that year. In 2005, 268 schools out of 737 made AYP. Of the 469 failing schools, 377 failed for low academic performance. 71 of those failed in only one subgroup.

Figure 1 shows the AMOs for reading for K-5 schools. Those unsightly jogs are not an error; they are part of the official table. The figure also shows the average fractions proficient for Anglo, Hispanic, Native American, and FRPL students in 2005. Average Anglo students could just about stand still for six years. Minority and FRPL students already barely have their heads above water. It would take enormous improvement for them to make AYP in the future. I have not shown students with disabilities because they clearly have little chance. Figure 2 shows the AMOs for math at K-5 schools. The chances of meeting AYP are a little slimmer for math.

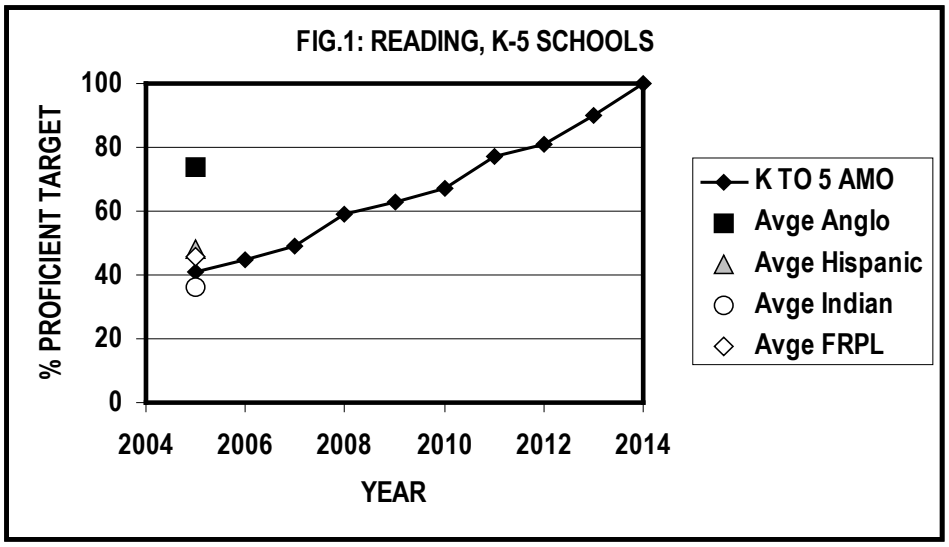
Table I shows the K-5 averages for the whole state, for Albuquerque Public Schools (APS), and three other large districts. The figures for the state are simply an unweighted average of the data for grades 3, 4, and 5, and might differ slightly from the weighted averages. Los Alamos and Rio Rancho have more favorable demographics and Las Cruces has less favorable demographics. Both Anglos and Hispanics at Los Alamos have a better chance at consistently meeting AYP than the same groups in APS. The chances at Rio Rancho are at least as favorable as at APS, perhaps even better for Hispanic students. Neither group at APS is conspicuously different either from the state average or from Las Cruces. In fact, Las Cruces did slightly better in spite of less favorable demographics.

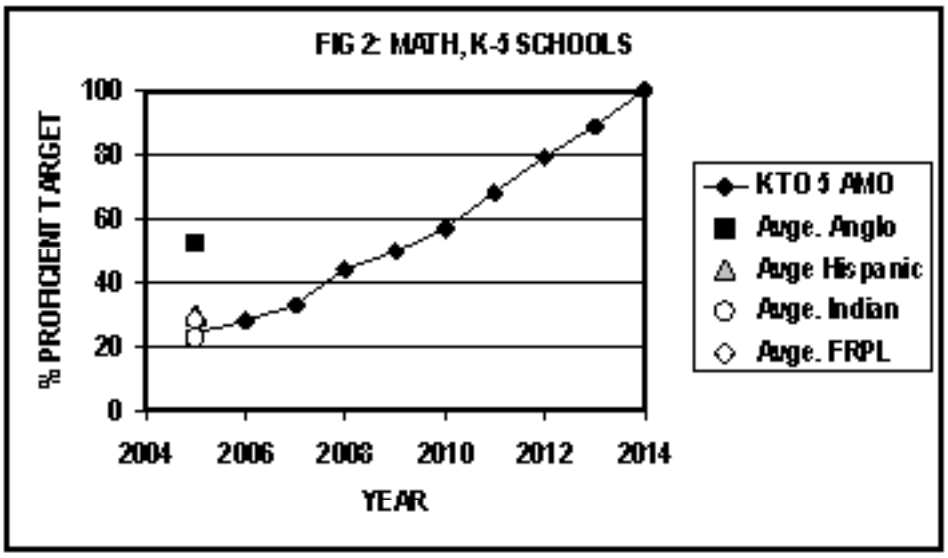
Figures 3 and 4 show the data for 6th to 8th grade schools. The AMO curve for middle school math is steeper and the 2005 performance was lower. It will be enormously difficult for average middle schools to meet AYP in math. Of course these are all average values. Some schools are already doing much better than average. Unfortunately, an equal number is doing much worse. Anglos in some middle schools in 2005 had well over 70% proficient in math, but were below 10% in some schools. Minority and poor students in some schools do very well, even though most are in trouble. A few schools will probably meet the AYP goals with little difficulty for several years, although it is a safe bet that almost none will meet 100% proficiency by 2014 unless the tests are made a lot easier or the cut point for proficiency gets a lot more lenient. That could happen. It is also a pretty safe bet that Native Americans in most schools will have severe difficulty.

Table I

Average Percent Proficient in Elementary Schools				
	READING		MATH	
DISTRICT	ANGLO	HISPANIC	ANGLO	HISPANIC
STATE	73.8	48	52.2	29.9
ALBUQUERQUE	74.8	46.3	55.6	30.6
LOS ALAMOS	87.1	81.4	72.7	60.7
RIO RANCHO	76.5	67.5	59.9	45.9
LAS CRUCES	73.9	51.4	56.9	31.4

The bottom line is that Anglos and Asians look to be safe in most schools for a few years, although some will doubtless fail. There is no history to tell us whether poor and minority students can possibly improve enough to meet the goal, but it would be a reasonable prediction that they will fail in most schools. At any rate, a sane Congress will surely modify NCLB before every school in the nation has failed.





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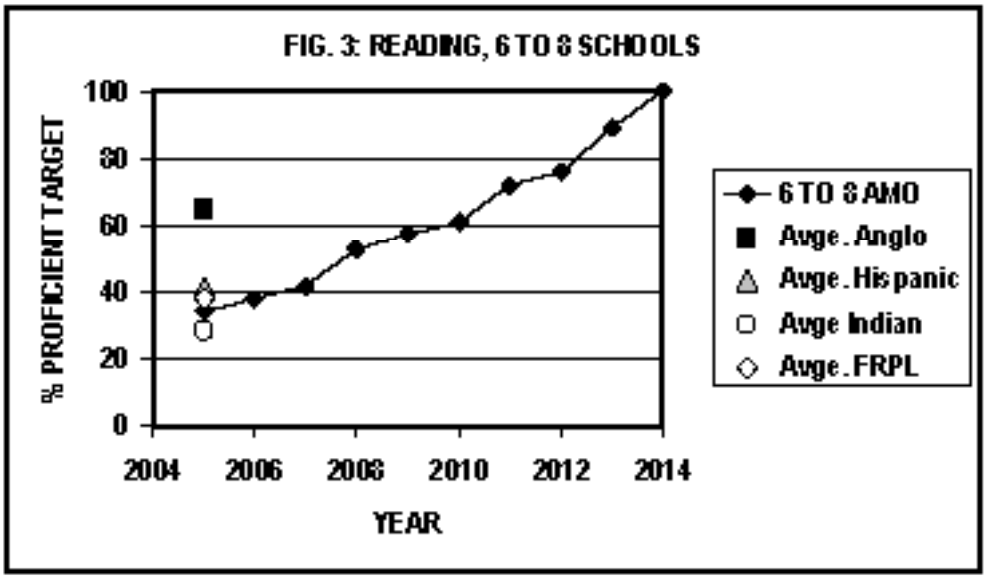

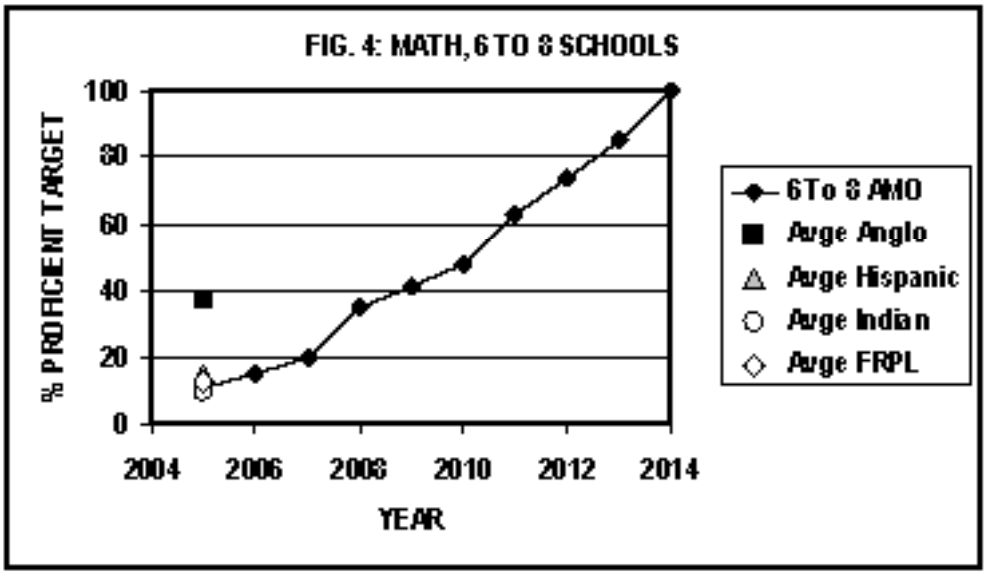

Walt Murfin
CESE Statistician

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CESE APPRECIATES YOUR SUPPORT !

CESE's influence and paid membership continue to grow, ten years after our founding. (Non-paying recipients of Beacon mailings include NM public officials, public school officials, chambers of commerce, and others.) Since the December issue of the Beacon, four new members have joined, and four older members have added contributions to their dues payments (in the up to $250 range). Some members contribute thru United Way. We've also received an extremely
generous donation to be split between CESE and NMSR.

As always, we're open to suggestions on how best to make a difference in New Mexico, as well as in the larger community. Also, we need to continue recruiting younger mem bers who can spend some time getting acquainted with public officials. In the long run, this is the best way to inform them of issues associated with math and science education.

Please notify Marilyn Savitt-Kring if your Email address changes. marilynsavitt-kring@comcast.net

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