Science & Math CESE Education

The BEACON

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A NEW TWIST

In a new twist in the Evolution/Intelligent Design creationism struggle, the Ohio State Board of Education is considering a course of action that could avoid the issue of including ID in science curricula altogether. The idea is to include it in the standards for Social Studies rather than the Science standards.

This idea would be perfectly acceptable to most members of CESE since it would not require teaching of non-science in a science classroom. The three members of the Ohio Board who proposed this idea were responding to public pressure to teach "alternatives to evolution." Science, of course, doesn't recognize any such alternatives, not because of narrow-mindedness, but because there is no evidence for any other mechanism that could produce the vast number of species in nature today. ID proponents tend to think that methodological naturalism causes scientists to reject religion. This is a profound error in judgment on their part since many scientists are religious and many mainstream religions accept evolution as an established fact and God's way of doing business. But, opinion polls do not reflect facts, only opinions, and it is opinions that are a politician's lifeblood. The Ohio board members are seeking a way out of the impasse by putting ID in the Social Studies standards.

Social Studies, or a Philosophy class (hard to find in secondary school) or a class on comparative religion would be the correct place for Intelligent Design. Of course the ID proponents don't like that solution because that means their pet idea will have to compete in the market place of ideas with all of the other creation myths, such as Scientology, the various native American religions, Hinduism, Buddhism and myriad others including the Greek, Roman, and Egyptian Gods and Goddesses. Just because ID has the veneer and terminology of science, doesn't make it science.

I think this solution will also sit well with the public. They just want their children exposed to ideas and if those ideas came out of Social Studies classes, there's nothing wrong with that. Also, I think that the American people will respond to the basic fairness of presenting religious ideas in competition with other religious ideas rather than trying to have them compete with science.

I think this is a perfect way of handling ID if the question should come up in New Mexico, and a good stance for CESE to take. We must also stress that if ID is taught in Social Studies, other mainstream religions are taught too. It is the only fair thing to do.

Bill MacPherson
CESE President

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MEETING HIGHLIGHTS
July

It is becoming a tradition that the incoming president throws a summer party for the rest of the CESE board. So we convened at Kim's house at 2 P.M. on July 14, 2002, with Bill providing the barbecue.

Board members and guests attending were Bill MacPherson and Laurie Thomas; Art Edwards, Jerry and Nancy Shelton; Marshall Berman and Gail Willette; Paul Bolduc, Steve Brugge, Cindy Chapman and Bill Harris; Kim Johnson, Dave Thomas, Sema and Lou Wynne; and Marilyn Savitt-Kring.

After the burgers, we conducted a business meeting. Jerry reported about $1500 in the treasury.

Marshall is working to get the Executive Director of the Biological Sciences Curriculum Study to participate in revising NM's science content standards. The state Department of Education (SDE) is agreeable, but we need to continue to pursue this. It may also be appropriate to have assessment companies involved.

Art Edwards, Kim Johnson, Malva Knoll, Timothy Moy, and Marilyn Savitt-Kring have volunteered to review the new science standards for the SDE.

Marshall also said that an ad hoc committee of the state Board of Education was to meet that following week to discuss this year's and last year's TerraNova test scores and the concerns raised by some of the state's superintendents. The goal is to develop a methodology that is fair and equitable, and involves few or no major changes in the SBE's accountability regulations.

The state Board of Education and state Department of Education have begun to explore some innovative concepts for integrating and restructuring high school curricula. The CESE board voted to support and advance this initiative by proposing a pilot program for Los Lunas High School. This will be tried at this high school if they agree.

The pilot program will integrate many of the subjects required for graduation, reduce the number of required credits, and expand the electives into career-related subjects. Currently, legislative statutes specify the number and mix of course units needed for graduation. The experimental model would provide much greater flexibility to meet the differing needs of students.

Twenty-three credits are currently required for graduation, including four units of English, three units of social studies, three units of math, two units of science, one P.E. course, one unit of communication skills, and nine electives. The experimental model would combine the eight units of language arts and social studies, and it would eliminate the separate unit of the communications skills requirement. It would also combine

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math and science into a six unit interdisciplinary course. These course. These courses would still follow New Mexico's Content Standards, Benchmarks, and Performance standards. And students would still be assessed using standard performance procedures.

The rest of the nine electives plus the P.E. class would be replaced by a "learning pathways" of six units to include a selection from such areas as agriculture and natural resources; architecture and construction; arts, A/V technology and communication; business and administration; finance; health services; and hospitality and tourism. The learning pathways would be developed by the students, parents, and school personnel, considering the student's individual interests and the current labor trends.

Los Lunas is a good candidate for this experiment because of its demographics. They are at the midpoint for NM in such categories as minority percentage, English proficiency, poverty level, mobility, etc., and they have shown a willingness to experiment with pilot projects. The legislature would have to provide funding and statutory relief for this pilot. Other high schools around the state have also shown strong interest in this program.

August

The CESE board convened at 6 P.M. at Quasar on August 28, 2002. Those attending were Bill MacPherson, Jerry Shelton, Marshall Berman, Paul Bolduc, Steve Brugge, Kim Johnson, Timothy Moy, Dave Thomas, and Marilyn Savitt-Kring.

Jerry reported $1513. in the treasury.

Marshall discussed the state Board of Education meetings. He said about 700 teachers failed one or more parts of the NM Teachers' Exam.

There are three parts to the test: basic skills, pedagogy, and general knowledge. The Board had already provided an extra year to pass, and this was extended to another year. A proposal was discussed that would result in a special restricted license. If requested by their districts, teachers who fail the exam would be allowed to teach only in their respective districts with a restricted license. They could not teach in Title I schools. The federal law will take over in 2005, and then no waivers will be accepted. The SBE will consider this proposal at an upcoming meeting. Marshall also said the recent State Board of Education meetings were well attended. Many of the states' superintendents and local board members have been testifying that last spring's TerraNova tests were unfair because it was a new test and some scores were lower. However, some elementary school scores were as good or better, although mid-school's and high school's scores were less so. It was decided to use 1996 norming for status scores and to make accomodations for growth scores using New Mexico comparisons rather than national. Thirty-six schools are candidates for correction. There are three possible corrective actions.

1) Turn the school's management over to someone else.

2) The state Department of Education would take over and bring in its own people.

3) Work with the district on a voluntary or involuntary basis. Marshall also discussed two reform strategies that seem to be working well: DAY (Direct Action for Youth) a tutoring program after school, and SQS (Strengthening Quality in Schools) a Baldrige Quality approach.

Marshall mentioned the upcoming NM Academy of Science Centennial Conference on November 16th.

Moy, on behalf of CESE, will work with UNM astronomy professor, Michael Zeilik, who has a grant from the National Science Foundation to develop educational assessment tools. Zeilik is interested in collaborating with CESE on a further grant on public outreach regarding education statistics.

CREATIONISM IN NEW MEXICO

David E. Thomas
President, New Mexicans for Science and Reason (NMSR)

The history of creationism in New Mexico is typical of many rural states. It has long followed national teaching trends, with occasional punctuations like the "Evolution is just a theory" disclaimer pasted on school biology books by the State Board of Education in the 70's.

Subversion of NM Science Standards

But things really heated up in the summer of 1996. In spring of that year, a committee of teachers and scientists had finished draft science standards for public schools, which included (of course!) evolution and the age of the earth. But these standards were unacceptable to a Governor-appointed Board member, Roger X. Lenard, of Sandia Laboratories. He took on the task of opposing them, and was joined in his new quest by Board member Millie Pogna. In the version of the standards released to the public on the day before the acceptance vote, August 21, 1996, Lenard's and Pogna's work was finally revealed. Evolution and the age of the earth were completely omitted, replaced by the vague "various theories of origin." On August 22nd, 1996, dubbed "Black Thursday" by many New Mexican scientists, the State Board of Education, swayed by Lenard's persuasive anti-Darwinian rhetoric, passed the set of Content Standards with Benchmarks for Science.

Several academic, science, religious, and other groups vigorously opposed these changes. Groups stating opposition to the gutting of science from the standards included New Mexicans for Science and Reason, the New Mexico Academy of Science, the National Center for Science Education, several University of New Mexico Departments (Faculty and Students: Physics, Biology, Earth and Planetary Science; Faculty: History, Anthropology, Psychology), individuals/faculty from New Mexico State University and from the New Mexico Institute of Mining and Technology, individuals from the New Mexico Senate and House of Representatives, members and the Rabbi of Temple Albert, The Albuquerque Journal, The Albuquerque Tribune, The Santa Fe New Mexican, The United Church of Santa Fe, Christ Unity Church, and many other groups.

Senate Bill 155

Even with these numerous protests, efforts to change the newly-adopted creationism-friendly standards were making little progress. So, State Senator Pauline Eisenstadt (D-Corrales) introduced Senate Bill 155 to the New Mexico state legislature on Jan. 28th 1997. The Bill said simply "In determining public school curriculum policy or prescribing courses of instruction for public schools, the state board shall adopt curriculum standards for life sciences and earth and space sciences that conform with the National Academy of Sciences' National Science Education Standards for Life Sciences and Earth and Space Sciences." Since the National Standards included evolution (of course! Chemistry was included too!), the bill would get evolution back into New Mexico standards, if only in an indirect way. The Bill narrowly passed the Senate Education committee by 4 to 3, and went to the full Senate on Feb. 17th. During a lengthy debate, Sen. Leonard Lee Rawson of Las Cruces waved a stuffed ape he called "Uncle Harry" as he denounced evolution. Ex-UNM Biology chair Jim Findley and I provided Sen. Eisenstadt with answers to questions during the hearing on the bill. I was honored to be the scientist standing on the floor of the State Senate that day to affirm that the best modern science really does show that the age of the Earth is four and a half billion years. The Senate passed the bill 24 to 17, in a strongly partisan vote (Democrats for, Republicans against).

Creationists Strike Back

Meanwhile, a counter-offensive was launched in the House. House Bill 1321 said, among other things, that "no fossil or any other evidence exists for this common ancestor and noted evolutionists have described the extreme scarcity of transitional forms as the 'trade secret of paleontology.'"

On Tuesday, March 11th, 1997, the bill came before the House Business and Industry Committee. After much discussion, including passage of an amendment calling for "balanced treatment," the bill was tabled by a 10 to 2 vote. Three days later, Rep. Tim Macko tabled his creationism bill (HB 1321). SB 155 still had one last gasp of activity. On March 15th, the

Business and Industry Committee suddenly untabled the bill, and passed it without recommendation to the House Education Committee. The bill came up the morning of Friday, March 21st, the day before the end of the session. Sen. Eisenstadt presented four speakers, including Nobel laureate Murray Gell-Mann. After testimony from board and department of education members against legislating standards, a roll call vote to table the bill passed 6 to 5. And that was the end of Senate Bill 155.

CESE is Born

In the meantime, members of several of the opposition groups banded together to form CESE, the Coalition for Excellence in Science Education. CESE drafted a set of suggested changes to the standards, and the Department of Education appeared to be considering them seriously. A survey was carried out on the suggested changes. What happened after that was "rather disturbing," in the words of UNM science history professor Timothy Moy. In a September 1997 radio interview, Moy said that the State Board spent tens of thousands of dollars of taxpayer money to do the survey, sending it to hundreds of scientists, and engineers, teachers, and parents. It listed the changes that the CESE had proposed on how to fix the standards. When the results were returned and tallied, the CESE recommendations passed by overwhelming margins — 60 to 70 percent for each of these recommendations. The State Board reviewed these results and announced that they were not going to make any of the changes.

On the Campaign Trail

With no results from efforts with the Legislature or with the State Department of Education, concerned citizens turned their attention to politics. Lenard's appointed position ended in the upcoming election cycle (1998), and creationist incumbent Millie Pogna was running for reelection. At first, the dubious task of defeating a 20-year incumbent in a primary election seemed difficult indeed. But CESE founder Marshall Berman accepted the challenge as a candidate in the Republican primary. Berman built up a tremendous grass-roots effort staffed by dozens of volunteers, including many of the scientists and teachers who had opposed the new standards. Near the end of the campaign, on May 27th, 1998, several noted community leaders took the unusual step of holding a press conference to endorse a candidate for the board of education. The dignitaries included Senator Harrison "Jack" Schmitt, the last man to walk on the moon.

On Tuesday, June 2nd, District 2 handed Marshall Berman a two-to-one margin of victory. His primary opponent, Millie Pogna, lost her 20-year position on the board, getting just 33 percent of the vote. Berman faced no opposition in the general election in November. During the campaign, Pogna tried to claim that she also opposed creationism in the science classroom. Perhaps voters remembered statements like one from the October 9th, 1996 Albuquerque Journal, where Pogna said "The only thing the standards do is it kind of opens the door to a discussion of creationism."

Echoes in Kansas

On August 11th, 1999, the Kansas State Board of Education voted 6-4 to remove evolution from school standards and testing requirements. As happened in New Mexico, a diverse group of teachers, parents and scientists worked hard to develop accurate and complete science standards, modeled on national standards developed by groups like the National Academy of Sciences or the American Association for the Advancement of Science. And, just as in New Mexico, a few members of the school board threw out the work of the committee, and introduced their own standards—heavily biased against evolution.

Science Rescued

Marshall Berman advanced quickly in the State Board, and was soon leading a number of innovative efforts. But the board consensus at that time was that it was too soon to re-visit the science standards. Once Kansas was in the spotlight, however, and with New Mexico receiving renewed attention for its own anti-evolution standards, the Board decided to revisit the science standards quickly. And so they did. At 1:06 PM Mountain Standard Time on October 8th, 1999, the New Mexico State Board of Education voted 13 to 1 in favor of a proposal to revise state science teaching standards to include evolution and related concepts, such as the age of the earth. And so the fuzzy language in New Mexico's

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standards, which encouraged creationists and anti-evolutionists for three years, officially became history. Both major newspapers in the state strongly endorsed the action. The *Albuquerque Tribune* wrote on Oct. 14th "How odd that public officials should draw praise for doing perfectly sensible things. But given the state of teaching standards for science classes across the nation these days, the New Mexico Board of Education has earned its accolades." The state's largest paper, the *Albuquerque Journal*, said on Oct. 17th that "The religious beliefs of students and their parents must be respected—but the beliefs of some must not be allowed to curtail the science education of all." Even Archbishop Michael J. Sheehan of the Diocese of Santa Fe weighed in, saying in two state newspapers that "I don't believe there is any real contradiction between the theory of evolution and the creation of the world by God. The Church has no problem accepting the theory of evolution, provided that it is understood that God infuses a human soul at a certain point in the evolutionary process and that, in fact, God is the force behind the evolution process." (*Albuquerque Journal*, *Santa Fe New Mexican*, Oct. 15th 1999).

The board member who sponsored the new proposal, Sandia physicist /CESE founder/NMSR member Marshall Berman, was interviewed in the Oct. 22nd '99 *Science* (page 659), as was CESE member Kim Johnson. Berman's efforts were also discussed in "Speaking up for Science" in the November '99 issue of *Scientific American*.

Creationists Regroup

The creationists, and their new incarnation ("Intelligent Design") continue their efforts to remove evolution from New Mexico schools. On February 15, 2000, the Senate Education Committee gave Sen. Rod Adair's "Creation Theory" Bill a "DO PASS" recommendation, by a vote of 9-0. The bill, Senate Joint Memorial 47, was titled "Requesting The State Board Of Education To Allow The Use Of Materials In The Classroom For The Study Of Creation Theory." It never got to the full Senate. Adair is now the Republican candidate for Lieutenant Governor.

Signs are looming that New Mexico is the next target of anti-evolutionists, who have been most active recently in Kansas and Ohio. There has been an ongoing Intelligent Design Blitz at New Mexico universities (UNM, NM Tech) and state science labs (Sandia, Los Alamos). Several of the most prominent ID theorists have recently visited New Mexico. Phillip Johnson stumped the state in February of 2001 (http://www.nmsr.org/johnson.htm), William Dembski in November of 2001 (http://www.nmsr.org/dembski.htm), and Michael Behe in March of 2002 (http://www.nmsr.org/behe.htm). A Christian activist group, the New Mexico Family Council (NMFC), claimed credit for sending out hundreds of copies of Michael Behe's book on Intelligent Design to science teachers around the state, but the name on the cover letter only stated the author's affiliation with the University of New Mexico (http://www.nmsr.org/omdahl.htm). The formation of a New Mexico chapter of the Intelligent Design Network (IDNet) was announced on July 23rd, 2002 (http://www.intelligentdesignnetwork.org/PressReleaseNewMexico.htm).

Members of NMSR (http://www.nmsr.org) and CESE (http://www.cesame-nm.org) have long participated in the never-ending struggle to keep real science in science classrooms. We were there in Santa Fe in 1996 as the science standards were being gutted, and we were on the Senate floor as teaching evolution was being debated. We were there in 1998 when the State Board overturned the anti-science standards. We were there on the editorial pages, and in the university halls giving pro-science talks to balance ID rhetoric. And we are there on the Internet, defending and explaining science, and debating creationists from New Mexico to Minnesota.

Seeing the clouds on the horizon, we in New Mexico know it's only a matter of time before creationism rears its ugly head once again. But next time won't be like 1996.

Next time, we'll be ready.

UNCERTAINTY

Here is a little exercise. Measure the length of the thumb joint of your left hand from the knuckle to the tip of your thumbnail. Mine is 3.4 centimeters. To make sure I have it right, I'll do it again. Oops! Now I get 3.5 centimeters. Try it again. Now it looks like 3.35 centimeters. How can that be? It surely didn't change length in less than a minute.

The great general rule of life is this: **every measurement is only an approximation.** If I need to know how long my thumb is, can statistics help? As a matter of fact, statistics does have something to say about this, although not as explicitly as we might like.

First, there is the reliability of measurements; how repeatable are they? Suppose several friends volunteer to help me measure the length of my thumb. If all their measurements are close to each other the reliability is high. That doesn't say that the measurement is accurate; maybe our ruler is wrong. However, if many people repeat the measurements using many measuring devices and they still always come out close to each other, we can be reasonably confident.

We assume that any measurement has a "true" or invariant component, and an "error" component, and the same is true of the variance of many measurements:

V(total) = V(true) + V(error).

We define "reliability" as the ratio of the true variance to the total variance, or 1 minus the ratio of error variance to total variance:

Reliability = V(true)/V(total) = 1 – V(error)/V(total).

The actual calculation of reliability is beyond the scope of this lesson. If anyone wants to know how to do it, I can provide details. The value can range from zero to one. A reliability of 0.95 or above means that measurement is highly repeatable. A reliability below 0.5 means that a measurement is not very repeatable. For such a simple thing as the length of fingers, a reliability of 0.9 or higher would be reasonable. For more complex questions, especially if the answer involves some subjective evaluation, perhaps 0.7 is all we can expect. There are specialized methods for computing reliability of standardized tests.

What we really want to know is how close any given measurement is to the "true" value. The true value of most measurements is unknown. Sometimes we are given, or can calculate, the "Standard Error of Measurement", abbreviated as SEM. Numerically, this is the standard deviation times the square root of (1 - Reliability). There is 50% probability – a fair bet at exactly even odds – that the measured value is within ±0.67 SEMs of the true value. There is 95% probability that the measured value is within ±1.96 SEMs of the true value. The figure shows the probability of the true value being within a band of any width centered on the measured value. These statements are true if (and only if) errors are normally distributed. Perhaps by now you have gathered that a normal distribution is nowhere near as common as some statisticians would like to believe. If we know how errors are actually distributed, we can calculate these probabilities for the actual distribution.

If many measurements are to be averaged, the combined standard error is the square root of the sum of the squares of the SEMs of the individual measurement, divided by the number of measurements. If one or more of the measurements has a large SEM, it does not necessarily mean that the mean will also have a large uncertainty. This makes it possible to average all the scores for a school and wind up with acceptable uncertainty, even though some individual scores might have high uncertainty.

A similar uncertainty applies to sampling from a large population. Suppose you have a very large container filled with marbles of various sizes. There are too many to count, but you would like to know the average diameter. You take out 100 and measure each one and find the average. Take out a hundred more, and almost certainly the average diameter of that sample will be a little different.

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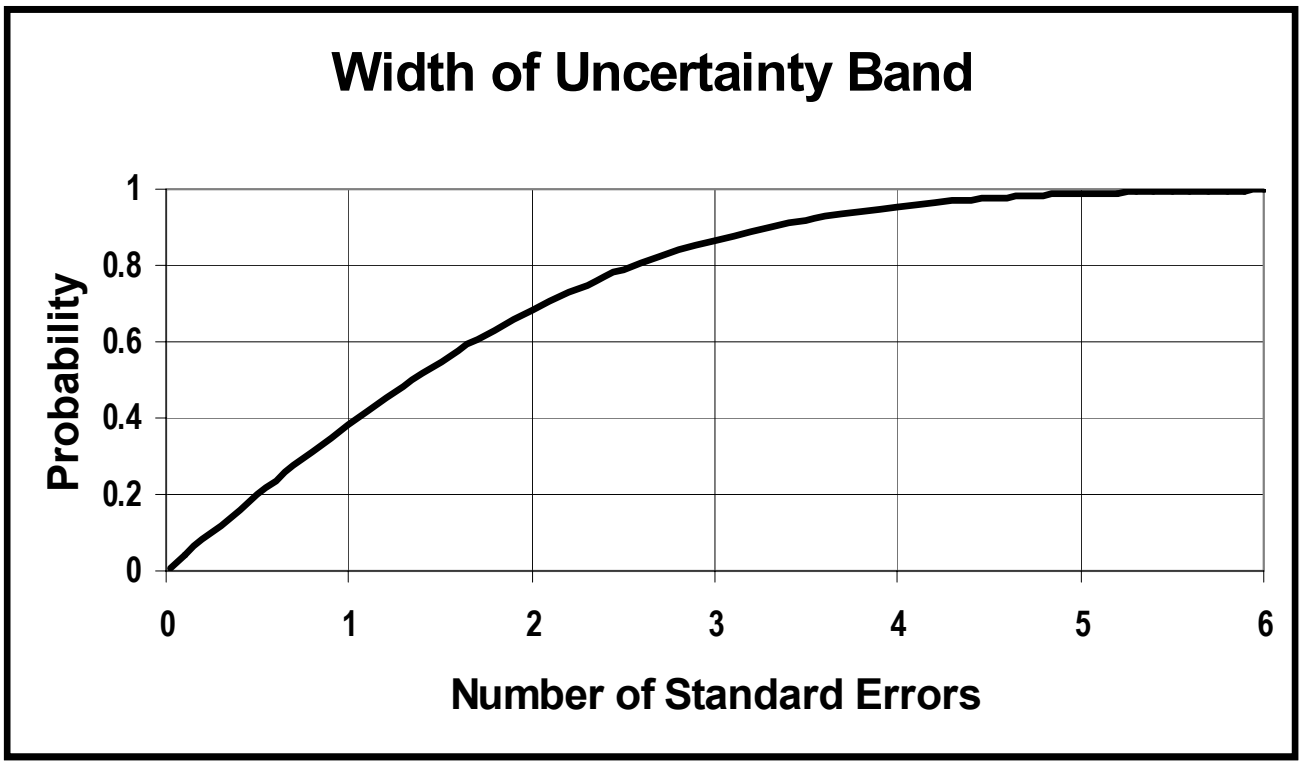


Is usually impractical to measure every item in the universe. We are restricted to measuring samples and estimating the true value by the sample average. However, we know that each sample does not perfectly represent the whole population. We might not know exactly the average diameter of all the marbles in the container, but we can estimate the probability that the mean diameter of a sample of marbles is within certain limits of the unknown average. Here we use the "Standard Error of the Mean." Numerically it is the population standard deviation divided by the square root of the sample size. The *population* standard deviation is unknown, so we estimate it with the standard deviation of the *sample*. You see that a large sample will give us a smaller standard error because N is larger, and the sample standard deviation will be a better approximation to the population standard deviation. The same rules of probability apply. There is a 95% probability that the sample mean is within within ±1.96 standard errors of the entire population mean.

You may have heard of confidence limits and confidence levels. At a confidence level of 95%, the upper and lower confidence limits are at 1.96 standard errors. As a practical matter, it means the same thing as the probability statements, although there is actually a subtle difference in meaning, which need not concern anyone but specialists.

Walt Murfin
CESE Statistician

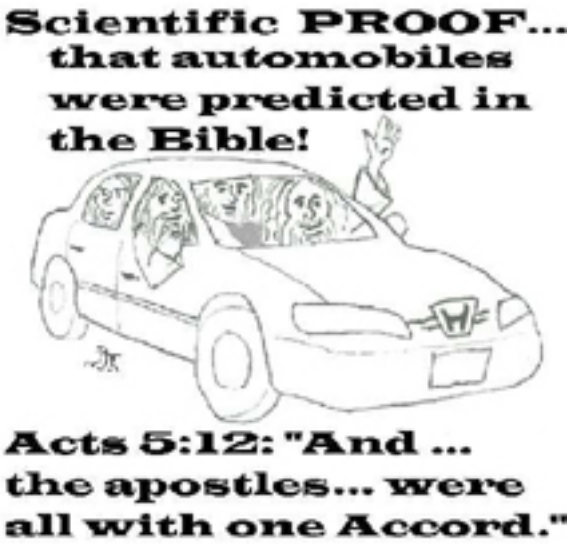
CESE HAPPENINGS

Kim Johnson has been presenting a data briefing to various public officials, with a goal of promoting data based decisions on education issues. The data cover various topics and derive from Walt Murfin, Marshall Berman, and Kim's data reduction and analysis (mostly Walt's!) Marshall has handed out the briefing to key education personnel in the state.

Jerry Shelton regularly attends monthly meetings of the Albuquerque Business Education Compact's Management Committee <abec-web.org> (CESE is a member) and is a member of the Education Committees of the Albuquerque Hispano Chamber of Commerce <www.ahcnm.org> and the Albuquerque Partnership <www.abqpartnership.org> In this way, CESE can keep in touch with these organizations and, when appropriate, articulate our positions on issues.

Jerry also represents CESE at meetings of the Education Partnership in Santa Fe of which CESE is a member. The partnership now meets monthly in anticipation of the legislative session in January, when meetings will convene weekly.

Marilyn Savitt-Kring carries on a voluminous e-mail correspondence with boards of education, newspaper reporters and others in Kansas, Hawaii, Ohio, and lately, Cobb County, Georgia. Her generous sharing of what's happening keeps the CESE spirit alive and thriving.



Toon by Thomas

ANOTHER EDUCATION FORUM

The Albuquerque Partnership will host a one-day forum on education in New Mexico on Thursday, November 14. If you would like to attend, please phone 247-9222 or contact the Partnership at miguelg@abqpartnership.org . You will then be notified when exact times, location, and other details are known.

The topic is firming up around options available among charter schools and other non-traditional choices and experimental projects within the Albuquerque Public School system. A keynote speaker hasn't been firmed up yet, but there will be several speakers for break-out groups. Typical attendance at this forum is 100 to 150. Target audience this year is parents of school-age children, but anyone interested is welcome.

"The Albuquerque Partnership is a project of New Mexico Advocates for Children & Families, a state-wide non-profit organization dedicated to assessing and vigorously advancing the interests of children, youth, families, and communities through research, evaluation, education, organizing, and advocacy.

For more, see <www.abqpartnership.org>"

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The New Mexico Academy of Science was founded in 1902, ten years before New Mexico became a state. Please join us in celebrating the Academy's 100th anniversary at an outstanding conference that will highlight New Mexico scientists and educators, and scientific solutions to problems facing our state and nation.

New Mexico Academy of Science
Centennial Conference 1902-2002

November 16, 2002
7:00 AM to 4:30 PM
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Albuquerque, New Mexico
505-843-6300

Conference Registration Fee:

Non-members (fee includes one-year NMAS membership):	$50.00
NMAS Members:	$35.00

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