



The *BEACON*

News from

The Coalition for Excellence in Science and Math Education

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From the President

Dear Members and Friends,

The year is 1884 and a five-year-old boy is home in bed sick. This is, of course, long before TV, video games, and even radio. The boy's father brings him a compass, and the ill child is fascinated by how the needle always points in the same direction—as if by some mysterious, invisible force.

Many years later when Albert Einstein was asked about when he first awakened to the mysteries of science, he told, and probably embellished, the compass story.

My guess is that each of us has a similar story. I remember vividly my grandmother giving me a Mickey Mouse watch when I was about seven. I wore my very first watch proudly for a few days. Soon, however, curiosity got the better of me, so I opened it up to find out how it worked. It never did get put back together correctly.

My fascination with how things work hasn't ended. I have, however, gotten much better at putting things back together. It's no surprise that I now teach middle-school science. Watching my students figure out how the world works is a wonderful job.

We are members of CESE because we have a passion for science and math. Perhaps a childhood event, or maybe a much slower realization later in life, brought each of us to this place. Our mission is to share our passion.

As your fourth president, I see a passion-filled year ahead. We have a wonderful and talented membership. Our work with HotSpots and Inez Elementary School, the Instructional Materials Commission, local and state science fairs, speaking engagements, and many other activities should fill the coming year.

Let us be like Einstein's childhood compass and awaken the natural curiosity of children and adults to the power of science and math.

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State Board of Education Meeting

June 13-16, 2000

The New Mexico State Board of Education met for four full days. Most of the first day was spent on refining the details of the Accountability Plan. Public input was solicited and the Board often engaged in dialogue with the audience as well as among themselves and the State Dept. of Education.

The Board committees met the next two days, and the regular meeting took place on Friday from 8:00 AM to past 6:00 PM. The following discussion is based on topics, rather than chronological order.

Accountability

The SBE has almost completed the accountability system. It is composed of two major parts: An Accreditation Matrix and an Action Plan for Schools in Need of Improvement.

Accreditation Matrix:

Schools and districts will be rated in 5 categories: Exemplary, Exceeds Standards, Meets Standards, Probationary, and Disapproved. Performance in three areas will determine accreditation status: Statewide Indicators, Strategic Planning (Education Plan for Student Success – EPSS), and Regulatory Compliance. Only above-average performance on the statewide indicators can move a school into the two highest categories.

The statewide indicators include:

- 1-2. Norm-referenced tests in five areas (reading, language arts, math, science, and social studies) analyzed both in terms of status and growth (improvement).
- 3-4. Standards-based tests in four areas (language arts, math, science, and social studies) analyzed both in terms of status and growth.
5. High school competency exam.
6. Achievement assessment in Spanish

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The Beacon is published quarterly (almost) by the Coalition for Excellence in Science and Math Education (CESE). A non-profit corporation, CESE is incorporated in the State of New Mexico. See www.CESAME-NM.org, for the new CESE web address.

The Coalition for Excellence in Science and Math Education (CESE) is composed of interested citizens throughout New Mexico and the nation, including scientists, engineers, educators, university faculty, members of the clergy, and parents. CESE is nonpartisan and non-sectarian, and welcomes members of all religions and political philosophies. This coalition works to improve science education and science literacy for all citizens. The organization also provides support to teachers, students, the public, and state officials who deal with education issues. We want to ensure that the Beacon of Enlightenment is not extinguished in 21st century America.

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Membership Information: please contact any of the above officers. The only requirement for CESE membership is the acceptance of our mission, above, as a statement of the organization's purpose. The CESE annual dues are currently \$25 for an individual, \$35 for a family membership, and \$10 for students. This is to help defray costs of postage, insignia, envelopes, etc. No members will be asked to do anything more than they wish to do on behalf of the common cause. Please make checks payable to CESE and mail to 11617 Snowheights NE, Albuquerque, NM 87112.

7. Dropout rates

8. Attendance rates

School performance in each of these 8 areas will be rated on a performance scale that increases from probationary to exemplary. In addition, the assessments will be disaggregated into five components that separately evaluate English Language Learners and Economically Disadvantaged Students. The purpose of this latter component is to ensure that ALL students increase their achievement levels.

Although the assessments are extensive and treated on both performance and improvement levels, the SBE recognizes that even this picture of student achievement in a single year might entail variations and uncertainties. For that reason, the accreditation classifications will only require that 50% of the data points fall into the specific accreditation classification. Furthermore, even probationary schools will be allowed a second year in which to improve their indicators. This system can in no way be characterized as "a single high-stakes test."

The numerical goals for dropout rates and attendance rates and their relative point values will be completed by the SBE at their August meeting.

I believe that this process will fairly and accurately identify schools in need of improvement.

Assessments

The SBE discussed the theory and application of norm-referenced and criterion referenced tests. Although there are advocates for one or the other of these test types, we concluded that both would be maintained as part of the accreditation system.

The SBE also discussed the weaknesses in the current TerraNova tests. Many past decisions were based on the limited funds available for developing these tests. The legislature will be asked to provide additional funding to develop high-quality tests when the current contract with McGraw-Hill is completed.

Action Plan for Schools in Need of Improvement

If a school or district is probationary, they will be given a warning and a set of prescribed actions that will be required of the school itself, the district, and the SDE. At the end of the warning year, the schools will be rated again. If they remain probationary, they become candidates for school improvement. Additional, more severe actions will be required of the school, district and SDE.

If by the end of the third year, the school remains probationary, the SBE will initiate a state takeover of the school or district and take any action it deems appropriate.

Important to understand is that this entire process is aimed at improving all New Mexico schools. Accreditation is intended as a corrective process, not a punitive procedure. As Superintendent Davis recently remarked, it

would be highly desirable if parents and community members of designated probationary schools offered to help the schools improve.

Language Arts Content Standards, Benchmarks and Performance Standards

The SBE approved the new Language Arts standards and incorporated all of them (including performance standards) into regulation. These standards have adopted high-quality material from the best state and national standards, and subjected them to extensive review throughout the state. They address every grade from kindergarten through 12th. I believe they are excellent, and will provide substantive guidance to classroom teachers in developing their own curricula. Students that master this material should excel in all state assessments, and should be well prepared for the 21st century.

Full-Day Kindergarten Literacy Readiness Program

The SBE adopted regulations to implement the Full-Day Kindergarten legislation passed by the Legislature and Governor in the last session. The regulation defines eligibility and prescribes the program elements that will help ensure that the program meets its objectives. These elements include literacy programs and strategies, ensuring that the programs continue through the first and second grades, creating an assessment system to measure results, including a professional development program, and providing for an end-of-year evaluation. If the programs do not achieve their intended goals, then subsequent funding will not be provided.

Alternatives and Options for 21st Century Secondary Schools

The SBE has embarked on an ambitious project to review innovative options for middle schools and high schools. The SDE will prepare a concept paper for the August Board meeting: 21st Century Diverse Pathways to the High School Diploma. The goal is

to create student-focused options for secondary schools. These can range from the “traditional” schools to completely new concepts that are more focused on future careers and/or preparation for higher education. This movement is spreading throughout the nation. The SBE work will involve both the Strategic Planning and Vocational Rehab, Career Education and Adult Services Committees. This joint effort will ensure that the academic and vocational needs of ALL students will be addressed, regardless of a student’s future plans. Business and university communities, both of whom have been highly supportive of this initiative, have already made presentations to the SBE. High school students will provide their insights at the next meeting.

Baldrige Training and Deployment

The BiE IN (Baldrige in Education Initiative) is moving strongly forward. The SBE took its own training at the last meeting. Almost every major organization in the state has joined the leadership team. The SDE has a goal to train its entire staff.

Strategic Planning

The Board’s Strategic Plan continues to provide the framework for all Board and SDE activities. The SDE is now working on an Operational Plan which will develop the detailed approaches to implementation. A major goal is to align SBE policies, SDE activities, and legislative priorities, so that all components of the education system are moving in the same direction. Of course, as you can tell from these notes, many initiatives in the plan are well underway. ;-)

Many other items were addressed that cannot be presented in detail in this summary. Some of these include: adopting a new bilingual teacher certification test, new regulations for bus safety, the initiation of a voluntary performance-based budgeting system

to ensure that funds are properly appropriated, approving waivers for charter schools, changes to NMAA regulations, mapping legislative priorities, beginning a plan to improve the efficiency and effectiveness of SBE practices, progress on the Instructional Materials process, revoking teacher licenses for criminal actions, and a very valuable discussion of a Hate and Intolerance Prevention program. *Whew!!*

Marshall Berman □



A Life Examined Closely

Dava Sobel’s latest work - *Galileo’s Daughter: A Historical Memoir of Science, Faith, and Love* (Walker & Co, 1999) is an outstanding examination of Galileo through the letters that his daughter wrote to him over the course of her life. The basic facts of Galileo’s life are well known: the swinging chandelier in church, dropping the weights from a tower, his trial before the Inquisition and his subsequent house arrest.

Much less known is that Galileo had three illegitimate children; the oldest of whom entered a convent at age thirteen and took the name Maria Celeste. Although cloistered, she and Galileo carried on a long and wonderful correspondence. Alas, only her letters have survived. Even with “hearing” only half of the conversation, a fascinating peek is given into Galileo’s life.

Ms. Sobel has translated these letters from Italian, and woven them into a first-rate biography of Galileo. The broader historical context is explained with great clarity, and, at the same time, the very human side of Galileo is seen via these wonderful letters. As a postscript to one of her letters Maria Celeste wrote: “I am returning the tablecloth in which you wrapped the lamb you sent; and you, Sire, have a pillowcase of ours, which we put over the shirts in the basket with the lid.”

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Here is one of the greatest minds of the millenium being politely reminded by his daughter to return a pillowcase. What a delightful image.

If there's just one book you plan to read in the next six months, let Galileo's Daughter be that one book. The characters are fascinating, the story line better than fiction, and there is meaning for us, even today, in the 400-year-old struggle between science and faith.

Steve Brügge, President

Accountability and the Chamber of Commerce Report July 4, 2000

The Coalition for Excellence in Science and Math Education (CESE) has analyzed New Mexico TerraNova scores for a specific purpose: To better understand the state of education in New Mexico and to assist the State Board of Education (SBE) in making policy decisions based on data, rather than opinions. The most important results include 1) the observation that there are two distinct groups of districts (schools) in New Mexico; and 2) the results depend strongly on grade, with relative achievement decreasing in the higher grades.

The major problem in education reform in the past 50 years has been its focus on fads and silver bullets. Some of these include: phonics, whole language, new math, fuzzy math, smaller class sizes, all-day kindergarten, early literacy, vouchers, hands-on science, higher teacher pay, merit pay, professional development, different governance models, higher standards, more money. *Everyone* recognizes the problem. *Everyone* "knows" the key. And *Everyone* has good intentions. But as one magic bullet after another failed, it was not surprising that teachers responded to these "assaults" with a

bunker mentality, businesses with frustration, and political leaders with increasing desperation.

Although many of these measures have merit, no one of them alone is likely to fix anything. For example, in California, smaller class sizes led to an extreme shortage of good teachers, which led to a drastic drop in student achievement. Nor is more money the universal answer. There is little correlation between dollars spent per pupil and student achievement.

The standards reform effort is very different from these earlier approaches. Treating education in a quality and systemic fashion requires that we define what we expect students to know and be able to do, measure how well that is being accomplished, and take the steps necessary to improve outcomes through a fair and effective accountability system. This is a systems approach that requires continuous assessment on progress—strengthening what works and abandoning what doesn't.

TerraNova Bimodal Analysis Heredity and Environment

The goal of our education system is to maximize student achievement through equal opportunity and world-class schools. The goal is NOT equal outcome. Student achievement depends on genes, home environment and school environment. Research has not definitively resolved the average contributions of each of these three factors. But it is obvious that any one of these three can negatively impact student success, regardless of the other two.

All school environments should contribute as much as possible towards student and adult success. If we are successful, and if the negative effects of poverty and inequity can be overcome, then we would expect to find a normally distributed range of outcomes (that is the famous "bell curve"). If assessments are appropriately constructed and delivered, then test scores should also be normally

distributed, reflecting the natural variations in ability of people. This should be true regardless of whether the tests are normed or standards-based.

Analysis of TerraNova Composite Scores

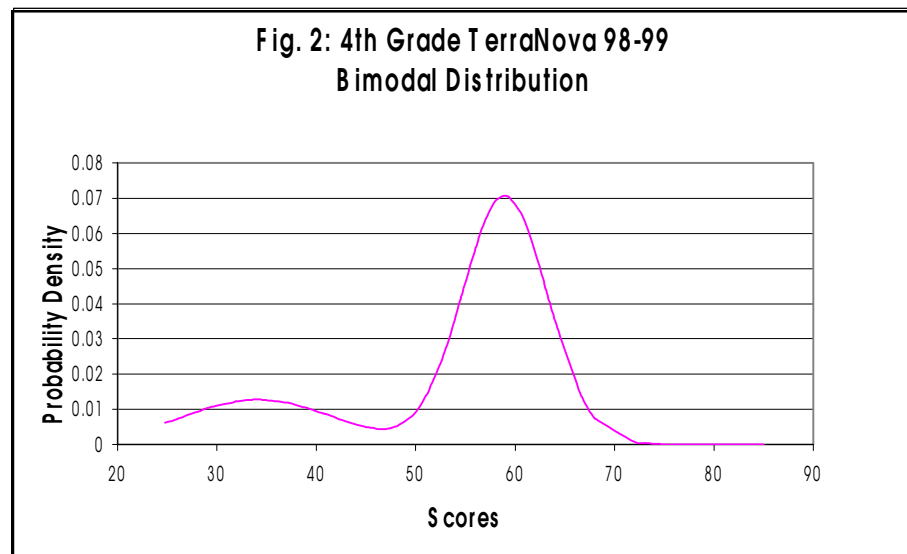
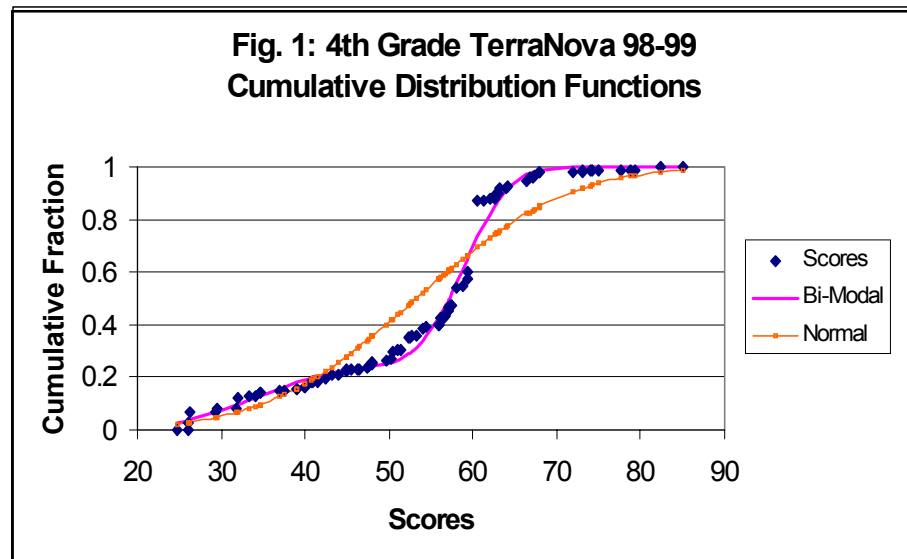
Figure 1 was developed from 4th grade district median composite test scores from the 1998-1999 normed Terra Nova. The composite scores include reading, language arts, and math. The median scores of each district were sorted in ascending order from lowest to highest scores. The cumulative fraction of 4th grade students was then plotted against the ordered scores. These are the diamonds shown in the figure. The Cumulative Distribution Function represents the fraction of students in all districts whose district-median scores were less than or equal to the indicated scores. The data were then compared to a normal distribution, as shown, but the agreement was very poor.

However, the data points look as if they might be represented by a bimodal curve (the sum of two normal distributions with different means and standard deviations). The data were then approximated by such a bimodal curve shown in Figure 2. This figure shows the probability that a district will have the median score in a small range about the specified score. In Fig. 2, the most likely score is about 59, the peak in the second mode. The area under the curve is normalized to one. The fit is now very good (Fig. 1).

What does this mean? The reanalyzed data appear to demonstrate that there are two very distinct populations of students in the state, when viewed by district. Those in the lower distribution are doing very badly.

I initially expected that the normed TerraNova tests would be roughly normally distributed, and the focus of the SBE accountability system would be to improve those schools and districts in the lower tail of the distribution. I had no *a priori* idea that New Mexico schools

were so dichotomized that they could be clustered into two distinct groups (0r modes). This observation, extended across the different grades pver two years, has provided us with extremely important information concerning what needs to be done and with what priorities.



The following table shows the 1998-99 means and standard deviations for the two modes and the 3 grades examined, together with the statewide medians:

1998-1999 TerraNova Normed Tests					
Grade	Lower Mode Mean 99Score (% in mode)	Lower Mode SD	Upper Mode Mean Score (% in mode)	Upper Mode	Statewide Median
4 th	34.1 (24.5%)	7.7	59.0 (75.5%)	4.3	52.9
6 th	33 (20%)	8.2	51 (80%)	5.5	47.4
8 th	33.5 (29.8%)	8.5	55.6 (70.2%)	2.5	49.3

K-4:

Most (~75%) NM early elementary schools are doing very well! About 20-25% are doing very poorly. Programs on all-day kindergarten and early literacy only make sense if applied to the lower group. The remainder of the schools should be congratulated and left alone.

Grades 6-8:

There appears to be a significant drop in student achievement in the middle grades. This is shown both by the bi-modal analysis and by the drop in the statewide medians, compared to national norms. This confirms other studies like the Third International Math and Science Study (TIMSS), that shows that U.S. students move from among the best in the world in early grades to near the bottom by the end of high school. Many reformers have ignored this extremely important period in a child’s education, perhaps because they have no easy answers or because slogans like “All children reading by 3rd grade” sound more exciting than “Reinvent Secondary Schools.” But education reform is not accomplished by mouthing slogans. It requires solid research, good data, quality processes, and hard work.

High school:

Our current ability to assess high school achievement is woefully inadequate. The extremely high percentage of students passing the high school competency exam and the lack of any benchmarking against other states make it quite useless. But the feedback

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from businesses and higher education, together with the high dropout rates, certainly imply that many high schools are failing both the community and the students themselves.

Additional standardized tests are necessary, but not sufficient. We need to employ a wide variety of assessment instruments in high school, some of which can be voluntary. For example, different businesses could supply the State Department of Education (SDE) with entry level exams they use for their employees. These can be provided to high school students interested in those fields. SAT, ACT, and NAEP scores should be carefully studied to see what information they can provide concerning the adequacy of high school diplomas as predictors of college success. To avoid being misled by grade inflation, high school grades need to be compared as success predictors, especially to distinguish the different meanings of A, B, and C at different schools. Business and higher education must become active partners in secondary school reform efforts. To enhance the meaning and value of high school diplomas, we should consider adding *cum laude* and *magna cum laude* designations and awards.

SBE Accountability System

The SBE and SDE began the standards reform process several years ago. Standards have been developed in four core areas and assessments have been given. The accountability system has received extensive review among all stakeholders in New Mexico, and was adopted at the June SBE meeting. It will be used to evaluate schools and districts later this year.

The bimodal analyses indicated that roughly 20-30% of the districts are in the lower mode. That might translate roughly into similar percentages of schools. However, the SBE accountability criteria are less stringent than the raw scores might imply in the CESE analysis, since only *half* of the SBE data points need to be in Meets Standards. However, a significant frac-

tion of the schools in the lower mode might still appear on the list of probationary schools. The bimodal analysis also implies that several districts might end up probationary. Twelve districts appeared in the lower modes for all the grades and years.

However, some of the scores are so extremely low that we have to question the test conditions and environment. I suspect that, in some cases, the students simply did not take the tests seriously, and probably just ignored many items. The tests themselves need to be improved.

The SBE and SDE have developed a very good initial accountability system. It will be improved over time, but it should accomplish its immediate goal of fairly and accurately identifying schools in need of improvement.

School Improvement

The goal of education reform is to improve student achievement. Identification through objective measures is only a beginning. Actually effecting reform is very difficult.

I expect the SBE accountability system will have an extremely positive and rapid effect on test scores as teachers, principals, and superintendents begin to take the tests seriously. A significant fraction of the probationary schools may move up to Meets Standards in only one year, simply as a result of parent and community recognition of the need to make improvements and mustering the will to change.

Several research-based programs could prove useful (e.g., Success for All or Direct Instruction). But there are many examples of schools rapidly and dramatically improving their performance with a variety of different approaches. Perhaps the most important stimulus will be the recognition of poor results, and the motivation and resolution needed to effect change.

The Albuquerque Journal North article (June 24, 2000) on the Santo Domingo School is a cause for great optimism. Their improvement was dramatic, but not necessarily unusual. In less than one year, the percentage

of 4th graders reading at grade level improved from 3% to 38%; for 7th grade; the increase was from 2% to 26%. The low test scores seemed to have provided the impetus to the entire community to take effective action.

This is a wonderful success story that could be repeated many times throughout New Mexico.

Similar results were demonstrated in Azalea Elementary School in Pinellas County, Florida, where kids who could not even take a test advanced to reading at grade level in only one year.

For the large majority of our kids, I think that early literacy will be achieved rapidly, regardless of poverty or language problems. Fixing middle school and high school might be a much more difficult problem.

Albuquerque Chamber of Commerce (CoC) Report

The Albuquerque CoC has proposed an extensive reform effort in their report "Every Child: Reinventing Albuquerque's Public Schools." Most of the goals discussed are similar to the standards-based reform efforts now underway in almost all states. Indeed, the SBE strategic plan has much in common with this report. However, there are some areas where the CoC does not appear to be aware of current actions being taken by the SBE and SDE. For example, the report states: "While New Mexico's State Board of Education has developed a good strategic plan, it is more of a visionary document, and lacks well-defined steps to help the state meet its very worthy goals. It is seen as more process oriented than results oriented." This statement does not recognize the large effort underway in the SDE to define those necessary steps in an operational plan. Nor is there recognition of the many steps that the SBE and SDE have already taken.

The report says: "On the CTBS5/Terranova Tests in 1998-99, students in grades 4, 6 and 8 consistently under-performed the median national

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percentile in reading, language, math, science, and social studies.” The results actually show that statewide medians exceed the national averages in 4th grade. APS exceeds the national average in both 4th and 8th grades. The bimodal analysis clearly shows the distinction between high- and low-performing districts (schools) in the state.

The report says: “New educational performance standards should be set for all students in Albuquerque Public Schools (APS). The standards should be benchmarked to the highest in the United States and with the countries we compete with globally.” I certainly agree. The SBE and SDE need to move the development of high standards to first priority.

The report also says: “A key missing link: APS lacks rigorous performance standards (what a student knows and is able to do, and how it looks when it is good enough) tied to school curriculum and assessments, with a supporting accountability structure.” Standards should be developed by the state. Input from districts—indeed partnerships with districts, businesses, and universities—can only improve these standards and ensure that they reflect the widest community input. The statement does not recognize the recent completion of high quality performance standards in language arts, and their adoption by the Board as regulation.

Major media attention has been focused on the CoC’s governance proposals. I personally believe that people are more important than organizational structure. A military hierarchy may be a good way to organize an army, but battles are won or lost regardless of organizational structure. Generals can produce brilliant maneuvers or bloody defeats. Similarly, organizations can be overly subdivided so authority is so distributed that no one is ultimately responsible for results.

This country has a myriad of school governance models that range from fully elected to fully appointed, and all gradations in between. An analysis of 42 states and their NAEP scores does not show a significant correlation be-

tween student achievement and governance models.

I suggest that we stay the course in standards, assessments and accountability. Businesses should become major partners in this process. But if they choose to focus more on governance than student achievement, they would only find this to be another magic bullet that will fail. Partnership has a much higher probability of success.

Acknowledgements:

Major contributions to the TerraNova statistical analyses were made by CESE member Walt Murfin, with review, suggestions, and support from CESE past President Kim Johnson and the author.

Marshall Berman

Annual Meeting Account

CESE held its Fourth Annual Meeting on Saturday, June 17th, at the First Unitarian Church in Albuquerque, New Mexico. Distinguished guests and audience members were introduced. Several CESE members and/or guests, including State Senator Pauline Eisenstadt, State Representative Rick Miera, and Cibola High School valedictorian Louie Metzger, made brief statements or acknowledgements. Rep. Pauline Gubbels attended, as did State Board of Education members President Flora Sanchez, Marshall Berman, and Christine Trujillo.

Outgoing president Kim Johnson reviewed CESE accomplishments for the last year, focusing on HOTSPOTS (an ongoing learning project with Inez Elementary school), new alliances (such as Hispano Chamber of Commerce and the NM Partnership for Math & Science Education), the excellent CESE Web page (www.cesame-nm.org), the speakers’ bureau, participation at open house booths, and, most significantly, getting evolution and the age of the earth back into science standards.

State Superintendent of Education Michael Davis gave the keynote address. He discussed many issues of concern to CESE, such as how science and math education fit into the State

Board’s Strategic Plan (available at www.sde.state.nm.us). Davis also commented on civility in political dialog, school safety, and the Albuquerque Chamber of Commerce’s new education initiative.

After the Treasurer’s Report the slate of new CESE officers submitted for the 2000-2001 term was heartily approved by the members present along with a number of proxy votes sent in prior to the meeting.

The new board for 2000-2001 is:

Steve Brugge	President*
Tim Moy	Vice President/ President Elect
Nancy Shelton	Treasurer
Dave Thomas	Secretary
Kim Johnson	Past President*
Jon Weiss	Member at Large
Marilyn Savitt-Kring	Member at Large
Marshall Berman	Member at Large
Cindy Chapman	Member at Large
Bill MacPherson	Member at Large

*No vote required per Bylaws

CESE’s new president, Steve Brügge, talked about plans for the coming year. He discussed passion for science, describing vividly Einstein’s fascination as a child with a compass given him by his father. Steve outlined some of his initial goals, among which were more Beacons, science fair judging, increased membership, and more as opportunities present.

After adjournment members and guests enjoyed a social gathering on the patio around appetizing refreshments donated by an anonymous CESE member.

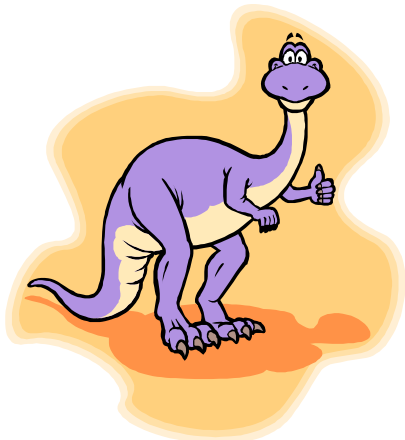
David E. Thomas

Say nothing of my religion. It is known to God and myself alone. Its evidence before the world is to be sought in my life: if it has been honest and dutiful to society the religion which has regulated it cannot be a bad one.

Thomas Jefferson

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