Proceedings

(10:05 a.m.)

Dr. Washington: I wonder if everybody could take their 'seat, please.

On behalf of the National Science Board I want to welcome all of you joining us today to consider the establishment of a new commission on the 21st Century Education in Science, Mathematics and Technology.
The Board is sponsoring this activity because of our conviction that it is absolutely essential for the future of our nation that we address the weaknesses in our science, technology, engineering and mathematics, especially at the precollege level. The National Science Board is an independent policy body established in 1950 by the National Science Foundation Act.

The Board has 24 members appointed by the President and confirmed by the Senate. The Board has dual responsibilities to oversee and guide the activities of established policies for the National Science Foundation and to serve as an independent national science policy body that provides advice to the President and Congress on policy issues.

Some of these issues are related to science and engineering that have been identified by the President, Congress and the Board itself. In its role as a policy advisor to the President and Congress, the Board initiates and conducts studies on a broad range of policy topics related to Science,
Engineering and research in education. It is under
the second National Science Board responsibility that
we are considering the establishment of the
commission.

The Board is authorized to establish
commissions as a tool to accomplish its statutory
functions. A National Science Board Commission is a
rare undertaking for the Board and has been employed
only at the rate of a single commission every 10
years or so since the establishment of the National
Science Foundation. The Board has spent a great deal
of time studying and developing recommendations
towards improving the student achievement in Science
and Engineering and, this has been reflected in a

number of reports by the Board and some of those
background materials are out there on the table.

The Board feels strongly that the
condition of the U.S. education system demands the
highest level of attention. It is therefore
appropriate for the National Science Board to study
this question of establishing a commission. If the
Board moves forward on the commission idea, all of us
are going to be asking you to assist us in developing

a charge.

The Board is grateful for the strong

support it has received from members of Congress. In

particular, we are hoping that Representatives Wolf,

Boehlert, Vern Ehlers and Johnson and Culberson are

going to join us and make statements. We especially
1 appreciate the support of Congressman Wolf and the
17 assistance of his staff in arranging for this
18 meeting. I’ve asked Steven Beering to chair the
19 Board’s meeting on STEM education.
20 Dr. Beering is the past president of
21 Purdue University and holds an MD. from the
22 University of Pittsburgh. He serves as a professor
1 of medicine at Indiana University and a professor ‘of
2 pharmacology at Purdue University. He has served on
3 the National Science Board since 2002 and is
4 currently chairman of the Subcommittee on Science and
5 Engineering Indicators that has prepared a 2006
6 report that will be soon released. I turn over the
7 meeting to Steve.

8 DR. BEERING: Thank you very much, Dr.
9 Washington, for the kind introduction.

10 I would like to begin by introducing the
11 other members of the National Science Board who are
12 with us today. Drs. Dan Arvizu, Ray Bowen and
13 Elizabeth Hoffman. Dr. Arvizu is director and chief
14 executive of the. National Renewable Energy
15 Laboratory. He holds a Ph.D. in Mechanical
16 Engineering from Stanford University. He was
17 formerly the senior vice president and chief
18 technology officer of the Federal Industrial Client
19 Groups at CH2M Hill Companies, Ltd.
From 2002 to 2004, he chaired the congressionally chartered blue ribbon panel on the workforce of the future as part of the Building Engineering and Science Talent Initiative of the Council on Competitiveness. He has been a member of the National Science Board since 2004.

Dr. Bowen is president emeritus of Texas A&M University where he served as president from 1994 to 2002. He earned a Ph.D. in Mechanical Engineering from that institution after receiving an MS in the same field from California Institute of Technology. He has held two management positions as NSF in the Engineering directorate. From '82 to '83 as director of the Mechanical Engineering and Applied Mechanics. Division and from 1990 to '91 as deputy assistant director for Engineering. He has been a member of the National Science Board since 2002.

Dr. Hoffman is immediate past president of the University of Colorado system where she served from 2000 to 2005. She has a Ph.D. in History from the University of Pennsylvania and a Ph.D. in Economics from the California Institute of Technology. She is currently the chair of the Board’s standing committee on Education and Human
Resources. She has been a member of the Board since 2002.

I would also like to introduce Dr. Arden Bement, the Director of the National Science Foundation. His credentials are lengthy, most recently director of NIST, and in addition to that he has been a distinguished professor at Purdue University and head of Nuclear Engineering.

I would also like to mention that in a few remarkable months Dr. Washington will end his 12-year term on the National Science Board, the last four years as our chairman. He will then be able to focus more on his position as head of the Climate Change Research Section and the Climate and Global Dynamics Division and his active participation in the many scientific societies of which he is a member, including the National Academy of Engineering, the American Meteorological Society, the American Association for the Advancement of Science, the American Geophysical Society and the American Philosophical Society, among others.

The Board is pleased at the great interest that has been generated by our activities in regard to the proposed Board commission on pre-College education in science, mathematics and technology.
We are gratified by your attendance here today. We especially appreciate the support and encouragement of Congressman Frank Wolf and his five colleagues who have agreed to be with us today.

Now a few words about why the Board is considering a new commission on education. A commission on education would serve primarily to discharge our statutory responsibilities on national science policy, although all science policy recommendations by the Board will provide guidance to the National Science Foundation as well.

If the Board establishes a new commission, it will be the second Commission on Education and Science, Technology, Engineering and Mathematics. The first having been established in 1982 with the stated purpose to define a national agenda for improving Mathematics and Science education in this country. It was specifically charged to develop an action plan that will include a definition of appropriate roles for federal, state and local governments, professional scientific societies in the private sector in addressing this problem of national dimensions. We are very pleased that the co-chair of
the 1982-1983 commission is with us today, Dr. Cecily E. Selby. We look forward to her thoughts on the new proposal.

At the National Science Board meeting at the end of March this year, Dr. Washington informed us of a number of requests from a range of organizations for the Board to reconstitute the ‘82/’83 effort on pre-college education in math, science and technology. Perhaps most notable was the request we received—during Dr. Washington’s testimony earlier this year at the House Appropriations Subcommittee hearing on the NSF FY ’06 budget.

The charge for such a commission has yet to be determined by the Board, but we have received a number of suggestions on the direction this activity might undertake. Therefore, in ‘September of ‘05, the Board agreed to implement a process for considering a charge for a new commission. I would like to also mention that the ‘82/’83 commission study was coordinated with another commission under the Department of Education.

The Department of Education Commission produced the report entitled “The Nation at Risk” that effectively drew attention to the
weaknesses in the U.S. education system generally. Because the efforts of that commission and other studies convincingly established the problem the '82 Board commission aimed toward an action agenda stating that for all sectors of society to address the very serious problems facing America’s elementary and secondary educational systems in Math, Science and Technology directed towards the nation’s achieving world educational leadership as measured by student achievement and participation levels and other non-subjective criteria in Math, Science and Technology in elementary and secondary schools—by the year 1995. Sadly, the excellent work of this previous Board commission and many subsequent organizations concerned with the quality of Science, Math and Engineering education have not produced the desired results in U.S. student achievement that are needed to sustain our eminence in Science and Technology for the future. In fact, the Board has recently completed and approved the next volume of Science and Engineering indicators to be issued early in ’06. The data reported in this new volume suggests that
American education in Science, Technology, Engineering and Mathematic fields is still not preparing our children commensurately for the future needs of a nation so dependent on excellence in Science and Technology. That is why we have invited you to participate in discussing the development of a charge that will focus on raising U.S. achievement in Science, Technology, Engineering and Mathematics to world-class levels. We look forward to hearing your thoughts on why the excellent advice and ideas from the previous commission and other organizations and reports from many imminent bodies have failed to improve performance of U.S. students.

We are particularly interested in how a new Board commission could contribute toward implementation of effective solutions to the problems of U.S. STEM education. We’re also eager to cooperate with the Department of Education, which recently appointed a new commission of its own and provided the catalytic effort by working together with them. We expect that your input today and the other hearing which we’ve already scheduled across the nation will help focus the charge for a new Board commission on education and to go beyond merely good.
9 ideas and advice to implementation of a world-
class

10 education in STEM fields for all Americans.

11 It is widely and increasingly

12 recognized

13 that achieving this goal is crucial to our future

14 national prosperity and security. We must not fail.

15 ~We must be successful. There are three burning15

16 questions that I would like to propose that our

17 panelists and other speakers might wish to address.

18 Why have we not improved~in the last two decades?

19 Second, can another commission, as contemplated,

20 really add value. And, third, what incentives can we

21 propose for students’ families and communities to ~get

22 with this effort.

22 Before we begin hearing comments from our

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1 invited guests, I’m going to ask the National Science
2 Board executive director, Dr. Michael Crosby to
3 explain how we will proceed for this hearing.

4 Michael?

5 DR. CROSBY: Thank you, Dr. Beering.
First, I need to make the usual announcement that we would like to have all cell phones and any other electronic noise-making devices turned off during the hearing.

As your agenda shows, we have four panels.

Board members will hold their questions until the appropriate point in the session indicated on your agendas as roundtable discussion. We request the speakers keep their formal remarks to no more than five minutes to allow time for discussion and please speak up into your microphones. We’ll help you keep time and we’ll signal how much time is left by the clock that is in front of the panelists table and we’ll thank for your assistance in advance for keeping to the schedule.

Due to a very full schedule today, we cannot accept questions from the audience at this hearing. However, at the next two hearings scheduled for Boulder, Colorado on February 10th and in Los Angeles, California sometime in early March, we will be setting aside time for public comments. I will remind everyone that this hearing is being
broadcast 6 live via internet and we have a court reporter
7 recording the entire hearing. We will be pleased
to 8 have any additional written comments for the
Board to 9 consider from any of the speakers or any members
of 10 the audience.

11 Thank you very much, Dr. Beering.’

12 DR. BEERING: Thank you, Dr. Crosby.
13 We’re delighted to have our congressional
14 representatives with us. We understand with their
15 pressing other business they will, be in and out.
I 16 believe that the ranking member of the panel is
17 Congressman Sherwood Boehlert. Let me invite him
to 18 begin now.

19 CONGRESSMAN BOEHLERT: Thank you very
20 much, Mr. Chairman. I assure there is no place I
21 would rather be than right here and I can speak
for 22 my colleagues, particularly on the Science
Committee,

1 because the work we are about is extremely important.
2 I greatly appreciate the extent to which the
Board as 3 consulted with the Science Committee and our very
4 able staff, and indeed on a full range of issues
5 before the Board.

6 As you know, I’ve long been a
7 supporter of
8 the National Science Foundation. As a matter of
fact, I’m an unabashed cheerleader. Particularly,
I’m supportive of the education programs. As I always point out, no step the United States can take—no trade policy or tax policy or defense policy—will secure our future if we do not have a strong educational system at all levels. That’s the foundation on which everything is built.

The challenges facing our education system has been outlined repeatedly. Most recently in a National Academy report “Rising Above the Gathering Storm,” which was a foundation for the document put out yesterday at the Innovation Summit that worked on closely and collaboratively with Mr. Wolf, Dr. Ehlers, Mr. Gordon—all of us. But the budget of the National Science Foundation hardly reflects the ever-growing sense of crisis.

The education director at NSF received $944 million in ’04. In ’05 that number dropped to $841 million and the Administration’s request for ’06 was another 100 million below that. You should know I started my day yesterday morning at 3:30 to catch a plane down from Washington to have a White House breakfast at 8:00 with Mr. Bolton, Director of the Office of Management and Budget, and we pointed out these figures, Dr. Ehlers and I, to Mr. Bolton.
said that’s hardly good enough. You’ve got to do better.

I had a nice omelet in the White House mess. I hope I get more than mushrooms in an omelet.

But fortunately, and thanks to the effort of Chairman Wolf and Congressman Ehiers, among others, approximately $40 million of that proposed cut for ’06 was restored. That was a great political achievement, but it hardly made it a banner year for education funding. We’re still the funding debate reflects a larger problem, a lack of consensus and understanding about the vital role NFS has played and

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1 must play in improving math and science education at all levels.

NFS’s peer review processes, its openness to innovation, its connections with higher education, its single-minded focus on and expertise in Science and Mathematics, its willingness to evaluate its programs, although that still needs some improving, it’s statute in the education community and its
on excellence as well as equity make NSF a unique and indispensable player in education.

I realize I’m preaching to the choir but this sermon will continue. That was true when Congress made education a central part of the NSF mission back in 1950 even before the Sputnik crisis. It’s equally true today. The question is how do we ensure that NSF is doing the best possible job at fulfilling its mission in a way that capitalizes on its unique roles and strengths. These are the questions that need to be the focus of an education commission. I know there are many who want the education commissions to cover the waterfront. If folks want to have the commission look across the board at education despite all the reports that are already out there, so be it. But I will tell you bluntly that the commission will be a waste of time and an unaffordable missed opportunity if it does not provide a very clear, concise and cogent statement of the NSF role in education at all levels, and if it does not provide clear and very specific guidance about what activities NSF should be undertaking.
fulfill that role.

Your model should be the Neal Commission Report on NSF undergraduate education which had an enormous impact in shaping policy in that area. I understand that to make a clear statement about an NFS a commission will have to know what problems are out having needs the report focus on those matters. The focus having needs the report focus on those matters. The focus needs to be NFS. That’s the Science’s Board primary charge — not it’s only charge, but its most important one and the only one that is not duplicated elsewhere and it’s where the Board has the greatest influence.

please, please make sure that any commission gives us the specific guidance that the Administration and the Congress need to enable NFS to make the most of its unique capabilities in K through 16 education.

So much is at stake at this pivotal time. You have the chance to ensure that NFS education programs and therefore U.S. education have a brighter future and nothing could be more important. As H.G. Welles wrote “Civilization becomes more and more
race between education and catastrophe.” I know which one I want to win. Thank you. ...

DR. BEERING: Thank you very much for those encouraging words.

Let me now turn to Congress Bart Gordon.

CONGRESSMAN GORDON: Thank you.

Let me first say amen to Brother Boehiért’s sermon as I usually concur with him. Let me also welcome everyone to this meeting and to the United State’s capitol and say, even though we have these artificial batriers between us today, we’re going to have to push them aside and all work together to accomplish what we want to get
accomplished here. I do appreciate having the opportunity to comment on the National Science Board’s proposal to convene a commission on the 21st Century Education in Science, Mathematics and Technology.

I have two basic points that to make this morning and I’ll be not believe that there is a need commission to take a broad look science education in the nation. there have be several such commi

panels of experts that have done 20 years. The findings of these brief. First, I do to create another at how to improve As we’re all aware,
fairly consistent. So I to identify what needs t make a serious national resources and create the critical needs that have

Recently, at committee organized by the National Academies and chaired by Norm Augustine looked at what steps are necessary to ensure that our nation remains

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1 competitive internationally. The highest priority
2 recommended of this committee is to improve K to 12
3 Science and Math education. The Augustine report’s recommendation on education were focused mainly on improving the education of new Science and Math teachers, increasing the number -of new teachers and strengthening the subject-area knowledge and teaching skills of current teachers.

The Augustine report goes beyond generic recommendations and includes specific policy items alpng with associated costs. The report’s education recommendations are not surprising because almost all problems with Science and Math education start with shortcomings of teachers in these subjects. The foundation for making lasting improvements in Science and Math education is teachers with deep knowledge of- their subject matter and effective teaching-skill.
I agree with the recommendations of the Augustine report and believe the highest priority action we could take at this time would be to implement those recommendations.

Consequently, I have introduced legislation yesterday to do just that. These are concrete steps that will have an almost immediate impact on the quality of Science and Math instruction in our schools. I introduced this legislation to serve as a call for action. I don’t pretend it’s perfect and I’m open to suggestions on ways to make it better. But I would hope-the-National Science Board will review this bill and provide me with your thoughts and recommendations. And, of course, I hope the Board will support this effort to implement the Augustine report’s recommendations.

The second point I would like to make is that the new education commission board is contemplating should narrowly focus its work on what the National Science Foundation is doing and could do to improve K through 16 Science and Math education. This would be timely because we have seen erosion in
the Administration’s support for education activities in the Foundation over the past couple of years. I would suggest the Commission should assess whether the NFS is setting the right priorities in its education activities, whether it is supporting effective sufficient resources that reasonable prog goal of improving K

Once again opportunity to bring I would also like to from minority leader legislation that was
programs and whether it has devoted to these programs so ress can be made in the overall to 16 education.

n, thank you for giving me the my suggestions to this Board and enter into the record comments Pelosi supporting the just introduced.
Vernon Ehlers. Thank you, Mr. 0333

[Committee Insert]

DR. BEERING: Thank you very much,, indeed, for those good words.

Our next speaker is Dr. REPRESENTATIVE EHLERS:

Chairman. Thank you all of you for your service to the country. Your job is absolutely essential. I don’t know if my idea of what your responsibility is accords with either yours or the law’s but I regard you as the public voice of the National Science Foundation. Someone who reflects the thinking of the scientific community and transmits that the Administration, including, of course, the director of
the National Science Foundation. I urge you to be fearless in doing that.

First of all, let me say I totally agree with the testimony of Chairman Boehiért and ranking member Gordon and their statements. I don’t think we need another detailed study. What I believe we need from you is a structure by which the National Science Foundation can achieve the goals and meet the problems that are outlined in the various studies, particularly the latest one, the National Academy study called the Augustine Report. So I look forward to you doing that.

As far as I’m concerned, we have to reform STEM ed from pre—school through grad school. Every area needs your attention and your thought. The National Science Foundation is involved at all of those levels, perhaps not pre—school yet, but certainly everything from first grade through grad school and teacher training is essential. So I thank you for the opportunity to participate in today’s discussion on K through 16 STEN education in the United States. I hope it does spill over into the
1 other areas and not just K-16.
2 As most here today understand, Science
3 education in this country is in need of great
4 improvement. Our students are not graduating with
5 the skills the need to compete locally. If we are
6 not committed to seriously strengthen the science
7 education of our nation, centers of innovation,
8 technology hubs and continued economic growth
9 will
10 not be sustainable.
11 In response to your question of why
12 have
13 we not improved, I don’t believe the people of
this
14 nation and most of the leaders of this nation at
all
15 levels understand the importance of the problem and
14 how we must solve the problem. That is your jo-b to
15 elucidate the nature of the problem to the public
and
16 come up with good concrete solutionth by which
the NFS
17 can seek to solve the problem. The National
Science
18 Foundation has a unique responsibility for both
19 science research and science education.
Therefore,
20 you’re the logic agency to develop solutions for
21 science education in this country.
22 I am pleased that you’re considering

1 revisiting the 1983 commission study. It’s certainly
2 needed. It was an urgent message to the nation.
It’s failing to provide its own children with the intellectual tools needed for the 21st Century.

The public didn’t recognize it then. They’re starting to become aware of it, but they still really don’t recognize it and so you’ve got your work cut out for you.

Looking back at that commission’s work and the parallel report of the Department of Education called “The Nation at Risk” many of the recommendations are still relevant today. The Board must find a way to effectively update the report and delivery it in a way that is certain to have an impact. A hearing like this shows the Board’s commitment to ensuring that this report will not become just another report. There are many approaches the commission could take and I have several suggestions for areas the commission should consider investigating.

First of all, on K-12 education, I am pleased to see that the commission plans to focus on the interface of education and include undergraduates. The reason that students are not attracted to STEM undergraduate degrees are numerous and must be examined as a continuum. But I want to emphasize that NSF should not lose sight of its
commitment to K-12 STEM education and should target actions early in the educational experience. The commission should look at the development of high school programs that seamlessly allow undergraduates to enter Science, Technology, Engineering and Math majors.

Another essential examination would be the uniformity or the lack thereof of entrance requirements for Science majors at higher education institutions. One very useful product of the commission could be an outline of ideal collegiate entrance requirements for Science majors so that high school students would not risk being under-prepared to enter programs in Science as university freshmen.

That, incidentally, is a continuing problem. The commission should explore tools that leverage information available on Science careers and education from one institution to another.

Additionally, the commission could coordinate the national assessment governing board to strengthen state curricula standards and high school graduation requirements. Regardless of whether or not a student chooses to pursue an undergraduate degree in the STEM field, the importance of K-12 STEM education cannot be over emphasized, given the
The necessity of a scientifically literate citizenry in the 21st Century. The skills obtained through the study of Science and Math are a requirement of most jobs today and likely of all jobs in the future. That’s something the citizens of this country must recognize. The parents have to recognize. Their kids don’t have to study Math and Science just to perhaps to becomes scientists and engineers. It’s just that any meaningful job in the future is going to require that.

Personally, I can tell you that having a degree in Physics has been absolutely invaluable in the political arena. It didn’t give me any more common sense, but the analytical skills that I’ve learned have been very useful and often I find myself to be a BS detector with some of the statements that float around, especially those coming from witnesses before our committee. Analytical skills are very useful and use strengthen those—in both Mathematics and Science. I’m going to deviate from my text because I see my time has elapsed, but I think it’s very important to recognize that every student should develop a fundamental understanding of Math and Science in order to make educated decisions and
understand scientific issues which may underpin personal and public decisions as well as their need for having that knowledge for the workplace.

The No Child Left Behind Act will be reauthorized in 2008 and another area of interest is the incorporation of science testing and the evaluation of adequate yearly progress for student proficiency. I was deliberately put on the Science Committee by Speaker Gingrich to ensure that the Education Committee rather to ensure that they would properly address math and science education and not just leave it in the domain of the Science Committee.

The best I could get in the No Child Left Behind Act, and it was a major accomplishment because initially it started off only addressing Math and Reading. I managed to get Science added to the list and science testing will begin in the 2007/2008 school year. But I could not get that included as something to be included in the evaluation of adequate yearly progress. That’s something that I hope you’ll work on. I will certainly work on it if I’m still here. But I’m going to need a lot of support in that. Parents are not necessarily supportive of that. But just having the testing alone and the publicity that will be given out around the United States when those first tests come back
will repeat what we had in Michigan when they
installed the MEET tests.

The first Science scores statewide
were 17 percent. It made headlines across the state.

We’re gradually creeping upward. We’re at 50 percent
-a great improvement, but still not good enough. I

also think it’s important for you to take note
of the limited English proficiency students in Science.
There’s a tendency to say, well, they can’t speak
English. All we’ll have to do is concentrate on
teaching them English. We’ll just have to let the
Math and Science slide. That flies in the face of
research in education which points out that teaching
Science and Math helps students learn reading more
quickly. Studying Math and Science leads to
intellectual development.

Some of you are familiar with Piaget’s
theory of intellectual development. It’s well
established through intellectual development achieved
by studying Math and Science a student is better able
to learn to read. So I think it’s very important
to emphasize that limited English proficient students
should also have Math and Science perhaps modified to
their level of language.

Finally, I will be very brief on this
because the previous speakers emphasized this
teacher training. When I was professor and I worked with
elementary schools, I taught two summer
training teachers. I learned from that never
the teachers, which is a very popular
this country. I have the greatest respect
classroom teachers. They desperately wanted
Math and Science properly. They did not know
because they had never been taught either
the teaching of Science. That’s why the
that we have developed for both the
Education and the National Science
considerably more funding than they’re
because we should be training many more
those subjects and how to teach those

In conclusion, you are faced with
difficult task of narrowing down many good
generated by public discussions such as
all other considerations I encourage you to
support of science leaders from all facets
academia, industry and government to help
commission work and to make sure that it
the role of NSF in the future of science
You’ve got a tough job. I thank you for
hope you’ll do it well. In fact, I’m sure
God bless you in your efforts. Thank you very much.

DR. BEERING: Thank you very much, indeed,

Dr. Ehiers. We’re delighted who is our host efforts in making the microphone to you.

REPRESENTATIVE WOLF: I’m really not a doctor. I graduated from Georgetown Law School. I got an LLB and then two years later—they offered me a doctorate if I sent in a hundred dollars and I never sent it in.

(Laughter.)

REPRESENTATIVE WOLF: I just have an LLB still. I just want to share the comments that Sherman Boehlert and Vern Ehlers and Mr. Gordon and I know Mr. Culberson has made and is going to make.

Actually, I follow their leadership on this issue. They talked about it long before I really got interested in it. I second everything do it well.

joined us, for your e We’ll give
that Dr. Frank Wolf has today and we’re thankful this hearin~ possible.
that they say. I’m really worried for the country, our country as the father of grandkids. Our generation is going to be okay. Probably even my children’s generation because they’re in their 30s and 40s, but my grandkids. For that reason I hope you’ll be bold, just really speak truth.

Hopefully, this Administration will grab on to everything. In a bipartisan way we can really make the end of this year and next year kind of a defining change whereby the nation almost the way that President Eisenhower did with regard to Sputnik, just dramatically, so it’s in all our papers. It’s in our conversation. It just really makes a difference for the country. Otherwise, I am very, very worried because now the competition is so great.

With that, I’ll just identify myself with the comments that Sherrie made and Vern because I’ve been with them a lot listening to them, and also Mr. Gordon and Mr. Culberson. Just really be bold. You’re the experts. Don’t hold back. You’ve got to just speak the truth and let everybody see exactly where we are. We may be falling faster and further
than many people even realize.

Thank you very much.

REPRESENTATIVE CULBERSON: I’m ceding to my good friend Congressman Eddie Bernice Johnson.

DR. BEERING: I’m delighted to recognize your distinguished colleague.

REPRESENTATIVE JOHNSON: Thank you very much to my distinguished colleagues and all of you distinguished members. I’m sorry I’m running a little bit late. As you know we have two or three meetings at the same time all the time, but good morning.

I first would like to begin by thanking the National Board for inviting me to provide testimony as a former ranking member of the Research Full Committee and the third ranking member of the Scientific workforce to be key indicator of national prosperity. As a matter of fact, the first legislation that I attempted to carry was when I was in the Texas House in 1974 seeing EDS and Texas Instruments pop up right in middle of where I lived. It was a message to me
1 that we needed to start to look toward young people
2 with this type of background. So I have
3 consistently advocated in favor of federal research funding.
4 I commend my colleagues who are here on
today’s panel. Like me, they have tirelessly
5 championed Science, Technology, -Engineering and
Math
6 education, also called STEM education. I’d like to
7 offer comments on why the goals, recommendations
8 and strategies provided by over 20 years of study and
9 reports are yet to be fulfilled.
10 The first reason is political philosophy.
11 The scientific advances made during the Sputnik
12 area resulted from a strong federal investment in
research. It is my view that the current
13 Administration and political philosophy of downsizing
14 and privatization has left science a little- bit out
15 in the cold. Investment in basic research -high
16 risk/high reward projects comes from the federal
17 government. Those investments have been severely lacking
18 for the physical sciences and for the health
19 sciences after the NIH doubling ended.
20 Another reason our nation competitiveness
1 is waning is due to our economy. When the economy tanks discretionary expenditures such as those for research are among the first to be cut. Research funding has been neglected year after year. I think one year since I’ve been on this committee we’ve been able to get what we felt was the appropriate amount. A direct reflection on the high employment rate, inflation, rising interest rates and other indicators of a weak economy.

Still another reason we’re losing our competitive edge is that other nations are catching up. Free nations are pouring money into STEM education and research. Communist nations, such as China, are becoming more capitalistic and are reaping large benefits. As our competitors strengthen we appear weaker. You have asked for my recommendations and how to improve STEM education at the K-16 level in America.

First of all, I recommend that we catch children early. Captivate them at a younger age. Middle school students need to be shown that Science, Technology, Engineering and Math are attractive. We must foster greater interest in these areas in these kids sooner than in high school.
Second, I believe we must restructure our achievement tests, put down our pride and look at nations such as Japan and Canada whose students excel. See how their education systems and achievement tests are structured and learn from them.

Third, America must make sweeping changes to its STEM education philosophy. Stop spoon-feeding kids and forcing them to memorize terms. Soon or later they begin to think Science is nothing more than memorization. Nothing could be further from the truth. Students should be learning the scientific method and how it’s used to solve modern problems.

They need to see mathematics and engineering in action. They should see how medical technology has resulted in safer surgeries with fewer complications. They should see real life people in STEM careers who love their jobs.

The fourth and final recommendation is teachers need better pay. We need better teachers. We will attract and retain quality educators if we compensate them fairly. Don’t push all the financial burden on the states. Federal and state governments must partner to pay teachers better and reward them when students achieve.
These are my recommendations. I think they will work. I have actually seen that they will work. I have an extraordinary school in my district. It’s a magnet school. It’s No. 1 in Calculus in the nation. It’s No. 6 on the best high schools, although there are six schools there and the highest ranking public school majority/minority in the State of Texas and I know that when you put the resources there kids can learn and they do.

I’d like to call your attention to legislation being introduced that is based on a recent National Academy of Science report “Rising Above the Gathering Storm,” specifically the legislation sponsored by Mr. Gordon and others addresses this issue of recruitment, compensation and retention of quality educators. It is no longer a secret we have lost our competitive edge when it comes to Science, Technology, Engineering and Math.

Look at all the published international comparisons. I commend your efforts to bring about change and support those efforts in any way that I can. I thank you very much for this opportunity.
DR. BEERING: Thank you very much, Ms. Johnson.

Now, Mr. Culberson?

REPRESENTATIVE CULBERSON: Thank you very much, Mr. Chairman.

It’s really a privilege to be with you.

I am the newest member here. A brand new member of Chairman Frank Wolf’s subcommittee. Thrilled to be working with that good man.

I have to agree with Mr. Gordon and some of the other testimony of Mr. Ehlers. I really don’t think you need a new commission. I would encourage you to focus as a National Science Foundation Board on organizing the scientific community. Every physicist, every scientist, every engineer, every university, every research institution in the country ought to be organized to be focused on communicating with their member of Congress, with the Administration and insisting that the nation reverse
this very dangerous trend that we’ve been in for the last 30 years of declining investment in scientific research and development.

I represent West Houston. I represent the Texas Medical Center, the largest group of research institutions in the world. A magnificent group of people and institutions. When I first was appointed to this terrific committee I introduced myself to them. My experience had been that each one of those institutions had historically competed against each other and fought hard to protect their own research grants. There were sort of like the Army versus the Navy, the Air Force and the Marine Corps.

Again, I’m new to this but my impression is that the scientific community does have a tendency to protect their own research program and not think about the collaborative work that can be done together, and we do not reverse this long decline.
that we’re in we will be passed up by China.

All of us know the numbers and it’s terrifying. Chairman Wolf, more than anyone else, is responsible for the modest increase that the National Science Foundation received this year and Chairman Wolf deserves our thanks and our gratitude. Everyone here was a part of that, but it really was that good man right over there that literally by himself, all of us on the committee help him. If Frank Wolf not done what he had done, you would see a cut this year in the National Science Foundation. He worked his tail off quietly and really on his own initiative, but I don’t recall receiving any real letters or communications from scientists or physicist around the country or engineers asking me to work to help Chairman Wolf increase National Science Foundation funding. You all came down and testified, which is terrific, but Dr. Bement you’re under certain political constraints as an advocate for the Administration.

When you came down to testify at our committee, you know how many friends you’ve got...
there. You know how many friends you’ve got here, but you’re handcuffed by political considerations.

personally think, and he’s my president and I love him, that the recommendations the President is making are absolutely unacceptable. The level of funding I that the Administration has put forward we cannot allow that to continue.

The icebreakers remember that? Out of the blue the Administration signed an executive order and gave the National Science Foundation, which they’re already under-funded, responsibility for these 30-year-old icebreakers in the Coast Guard that are going to require $500 million worth of renovations. You may not be aware of it, but after I left that hearing, I sort of personally on my own mission went out and with the help of Chairman Frank LoBiondo, I bird-dogged that personally and wrote some language that Chairman LoBiondo took, and we need to thank him, in the Coast Guard Reauthorization bill. There’s language that I drafted that he put in there transfers responsibility for the icebreakers
back to the Coast Guard. And I had a good meeting with Josh Boiton. He’s agreed to look- to make sure that there’s money there for the Coast Guard to pay for those icebreakers. That’s a $500 million liability that kind of is a personal project just aggravated me.

Frank Wolf took care of it, but we don’t hear anything from the scientific community. So rather than a commission to restudy what we already know, what Mr. Gordon has correctly said, what all of us have said, we’ve got boatloads of commissions that have told us what the problem is. We know what the problem is—organize like the realtors, like the engineers do professionally. I was in the state legislature. You don’t tug on Superman’s cape or aggravate the realtors or the teachers,— for that matter. The school teachers are a magnificent organization.

Every scientist, every physicist, every engineer, every university in the country ought to have their hair on fire because we’re going to thrive over a cliff. This country is absolutely going to
1 head into oblivion if we do not reverse this trend. The only way it’s going to happen is if the
2 National Science Foundation gets as active politically, and I don’t mean with contributions, but we need to
3 hear from you. We need to have every member of Congress be as zealous as all of us are about investing in
4 our future.

8 My daughter is nine years old. Chairman Wolf’s exactly right. This next generation may be
9 okay, but I’m really concerned about Caroline Virginia Culberson. She’s my highest priority and
10 that’s why I’m so passionate about it. The Chinese are going to bury us if we do not reverse this trend.
11 It is terrifying. The country will drive off a financial cliff because we’ve got to control spending
12 up here, but it is only the productivity of American workers that has really saved us over the years and
13 it is primarily the result of investment in research and development in the high technology sector and the
14 space programs that the universities have done that
21 have lead to the increases in productivity.

22 We will not see that if we stay on this path. I think a commission is frankly a waste of time and energy. You need to get organized and every member of Congress ought to hear the scientist, the doctors, the researchers they represent pounding on their doors. The Texas Medical Center, 17 institutions, 155,000 moving in and out of the Texas Medical Center every day.

There’s **50,000** employees, and when they first came to me as a new appropriator, and I’m one of the most fiscally conservative guys up here except when it comes to the sciences and medical research and the space program - they came to me at the Medical Center with all these different projects and I said come to me with a collaborative project that I can go to my fellow committee members and say if you invest money here it will help all of the institutions.

force them to think only way they’re successful. One of a chance to meet and reat good man who you He really discovered
I’ve done my best to collectively because that’s the going to survive and really be the spinoffs of that was I had work with Dr. Rich Smalley, a g know just passed away recently.
the Bucky ball, discovered a way to manufacture carbon nanotubes in large numbers. Dr. Smalley was a great inspiration to me and I pushed the Medical Center and encouraged them to come up with a collaborative project and they came up with the idea with the alliance for nanohealth and nanoenergy to use nanotechnology to cure cancer, and identify and cure human diseases and to make the country independent.

I would suggest one of the good questions you, asked is what do we offer? How do you encourage students to go into the sciences? I guarantee a new-commission isn’t going to be much help. You need-to organize politically. What will I think work is what Dr. Smalley suggested and that is that we should encourage kids to go into the engineering and sciences and help the United States become energy independent. Dr. Smalley’s vision was to have, with nanotechnology, a device about size of your refrigerator that would store electricity off of the grid at night while electricity is cheap. You could buy it. Store it that box—tat big battery. Use
1. it run all your appliances in the house during the day and you would have enough electricity left over that you could sell it back to the utility company at night.

2. I’m a republican and—sort of a libertarian at heart and I think most Americans ought to be able to drop off the grid. I don’t want the government to know how much money we make and I’d like to be able to get off the electrical grid. You could really inspire kids, I think, to go into the sciences and physics, as Dr. Smalley, suggest by giving them a role and making the United States energy independent of the Middle East, of making the country not only competitive again,—but truly free and independent from relying on foreign countries for energy.

3. So I’m just thrilled—to be here. I can’t tell you what a fan I am of the National Science Foundation, delighted that you’re focused as you should be on science and engineering education at the primary level. Chairman Wolf, again, stepped up on his own initiative and took care of restoring the
22 cuts that were proposed that the White House

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1 proposed in basic science education. It wouldn’t
2 have happened, but he needs help. We all need help.
3 Those that are here for you we need every other
4 member of Congress to be as spooked about going
after
5 same
6 science and research funding. They’d have the
7 aversion to trying to cut or reduce science and
8 research funding as they would if they tried to
9 go in
and
10 tried to go let banks, for example, sell
réalestate.
11 We all know, as members of Congress, what
12 happened there on that one. You need to be that
13 well-organized politically. And as I tell my
14 constituents, when you communicate with a member of
15 Congress, scientists and physicists, ‘when they
16 communicate with us it’s not about money. It’s about
17 the vote and knowing that our constituents that are
18 communicating with us know when they finish their
19 letter I always tell people I will share my letEer
20 and your response with my friends, my family, my
20 neighbors, my co-workers. Sincerely yours. And then
21 sign your name and put your voter registration number
22 underneath it. Really it’s that simple. Without

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1 that level of commitment from every scientist, ever
2 physicist, every engineer in the country, I think
3 this trend will continue and you’ll have the same
six
4 or a dozen members of Congress that love you and
care
5 about you. We’re all here. This is bipartisan.
6 Other members of Congress want to help you, but
we’ve
7 all got priorities and districts and we’ve got
other
8 people beating on the door that are a lot louder
and
9 better organized and I want you to succeed. We’re
10 here for you, but don’t give us another
commission.
11 Mobilize the scientific community.

12 DR. BEERING: Thank you very much, indeed,
13 for all six of you. Your wonderful vision and
wisdom
14 and your valor, your courage and your passion for
15 Science, Technology and Engineering.

16 I spent 14 years as dean of a medical
17 school and I can tell you that the best Prepared
18 students entering medical school were engineers
19 because they’d learned to think critically and
20 analytically and they were disciplined and
organized
21 and ready to go.

22 I’d like to take these next few moments
1 and ask our National Science Board members if they
2 would address any questions to our six
distinguished
3 testifiers here.
4 Betsy

5 DR. HOFFMAN: I’m really interested in
the
6 question a couple of you addressed it and
7 there’s been a number of you said don’t do a
8 commission, figure out what NSF should do. But we
9 worry about the fact that there have
10 been commissions in the past and their
11 recommendations have not been followed. We
continue
12 to slide.

13 Congressman Ehlers and Johnson, you
14 addressed just a bit, but I really would like to ask
15 you some specific suggestions about why we
continue
16 to slide despite the fact that there have been
17 numerous suggestions in the past. What do you
think
18 are the very specific things that we need to take
19 away from those previous commissions?
20 REPRESENTATIVE EHLERS: Since you
asked
21 me, I’ll respond first. I don’t object to a
22 commission. I think what we’re objecting to is a
1 study. Of course, it also depends what you study. But I think it’s legitimate to ask the question that you raised here in your document. After you did a commission in 1983 nothing happened. Well, it’s legitimate for you as a commission to say why didn’t anything happen? In other words, what we’re talking about is a study of the actions needed more so than of the analysis of what’s wrong now.

In other words, lay out a plan where we have to go. Tell the nation very clearly what we have to do and where we have to go. Tell the Congress what has to be done. But I totally agree with my colleague from Texas, the male colleague from Texas, who say, you-know, get organized. It’s not your job to go out and form a union or an organization, but it appalling how little interest the scientific community takes in what goes on here unless we happen to cut their particular project.

I’ve given speeches to a number of organizations on how to lobby effectively and my first words are don’t be so arrogant. Most of the scientists I know come in and believe they know so much that they’re going to educate their member of Congress and put some sense in his or her head. That’s not a good approach. The people who get elected here are honorable people. They’re trying to do a good job. They may not know everything in
world, but they got elected and -the scientists didn’t.

The scientists have to recognize that they each have their own rule. When they’re coming to lobby, they’re there to help, not to criticize and there are lots of other features of that, but you really have to get the scientific community activated. I think you should try to get the teachers unions activated. Teachers are directly affected but there are very few science teachers and so they tend to get ignored even within their own union. But if you can offer a special program for them, I would hope that the NEA and state teachers unions would be supportive and work to get time off for teachers to take those classes and those courses.

Just a start there. I could go on for an hour on this.

REPRESENTATIVE GORDON: If I might suggest, I think what we’re saying is we don’t need a commission to find out what we want to do. We know what we need to do. If you want to have the S commission, the commission should be an action commission. How do you accomplish it? What I would suggest, again, to save everybody time, again, the Augustine Commission went through this, laid out some
very good proposals. They now have been put into legislation. So really it’s a matter of getting folks around that legislation. It all boils down to really using, to a great extent, existing National Science Foundation programs and expand- them. They’ve proven to be worthwhile. Just a quick summary of something that we all know. The vast majority of teachers in this country are both dedicated and able, but many of the science and math teachers don’t have the background. My father is an example. My father was an agriculture major, a farmer at heart. A bright, decent fellow but to help raise a family he taught school after he got out of college. He taught high school science and was coaching the girl’s basketball team. He didn’t know much about girl’s basketball, but he didn’t know anything about science other than what he’d learned in that program. That’s what we seeing across the country now. What we need to do is we’ve got to do.
two things. One, and again this legislation goes into that we need to take the existing science teachers that we have and then help raise their science skills. We can do this by summer programs - things of this nature. Then we need to bring in new teachers. We need to have scholarships that allow students to come into the system that want to go into both Science and Math and education, pay for their school, give them five years, if they’re teaching, that will be then forgiven. These are pretty basic things.

Then we can also take existing good science - when I say good science teachers, science teachers with backgrounds and help them with summer programs and other programs to gain master teaching positions. These are things that, by and large, are already being done within the National Science Foundation. We’re not trying to invent anything new.

These are recommendations that have been pulled together. We’ve got legislation. I would say review
those. Make them better. That’s fine. Make them better if you can, then let’s move on with implementation and implementation strategy.

REPRESENTATIVE EHLERS: May I interrupt just a second. I have to run to a markup, so I’ll have to leave after this. But one point that I haven’t raise and I think it’s very important, but isn’t been addressed. And that is sequencing of topic mat-ter in both Math and Science. We have a very mobile society, transient people. School kids transfer from one school to anothe-r. It’s very easily possible for a student who gets transferred in mid-year who was going to learn fractionsthe next spring transfer to a school where they taught fractions the previous fall. That’s just one example.

I think you could do a great service to talk about curricula without talking so much about developing new ones, but trying to s-tandardize curricula and particularly sequencing across the country in both Math and Sciences. You’d be doing a great service to the teachers and the kids and perhaps the textbook manufacturers would st-art following your advice. I should say publishers not manufacturers, although some of them are manufacturers. But, be that as it may, I think that
9 would be a good public service and you don’t need to spend a lot of meetings to develop new curricula. You’ve done that already. Pick the best and try to say everyone should use this program.

Thank you. I’m sorry. I have to leave.

REPRESENTATIVE GORDON: Vern, if you would quickly yield, part of my legislation does that in the area of curriculum. Again, we’ve got it laid out. We just need to try to implement it.

REPRESENTATIVE JOHNSON: You see how these men try to snuff women out?

(Laughter.)

DR. HOFFMAN: I’ve been working on getting you in.

1 REPRESENTATIVE JOHNSON: I agree with what’s been said, but I want to say a little bit more. That is, our prosperity and our health depend on these very areas. The area we just had with the technology, the opportunity came right out of these committees. It is really whether or not we want a decent future and whether or not we can keep our
8 businesses whole by furnishing them people who can do
9 the job. We need to get teachers into these industries so they can see what’s going on. It
makes
11 them real for them and we do have legislation Dr.-
12 Ehiers and I carried on partnering.

13 This committee is not lacking in its
14 knowledge or its effort. We need some outside help
15 and we need some people who come here and talk in
16 plain language. When I first got here the
17 supercollider was on the line. I really wanted it
to
18 survive. We brought scientists here and nobody
19 understood what they were talking about. We need
20 someone to talk about what it does for the health.
21 What type of technology that space exploration can
22 bring. Space exploration has brought more new.

1 technology than any other part of research, but the
2 average American does not know that.
3 That’s what we need to start talking
4 about. Yes, all of us get elected, but all of us

S aint’s smart.

6 (Laughter.)
7 REPRESENTATIVE JOHNSON: All of us
don’t

8 know where all of this comes from. When that
9 supercollider was being described, you couldn’t find
10 10 people outside the committee that knew what

was
going on. Now that we’re talking about nanotechnology, they don’t know what that means either and that’s no reflection on them. They have not majored in these areas. But it’s the scientific world’s responsibility to help to educate people. Without research we might as well close our doors and shut down as a nation. We cannot make it without it. That’s the only way we have maintained a competitive edge, which we are losing.

I don’t believe in throwing money at education. I hear a lot of people saying it. I started to say republicans, but I hear a lot of people saying it.

It is not throwing money at anything if you use that money correctly and in the ways that you’re suppose to. We don’t throw enough. As Bill Gates said just recently, we don’t invest in education. We get the greatest gain on that. If we don’t do that, what else is important? We have go to make sure we have the students and the teachers out there that have that interest that will guide those young-people because, if we don’t, we can’t keep our living going.

We can’t keep an economy going by playing football. Thank you.

DR. BEERING: Thank you very much;

REPRESENTATIVE BOEHLERT--: Mr. Chairman,

there’s a datiger that we’ll try to overwhelm you with all the input from this side. I think what we’re all saying is basically the same thing. Be very specific, be very focused, listen to the- good words and advice of Mr. Culberson. You’ve got to have a political strategy -not a republic/democratic
strategy, but how in the hell are you going to get
the support you need for what you outline as an
objective that you want to achieve? We all say

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Science and Math education, K-12, very important.. We all acknowledge we have dedicated
teachers in the classroom teaching Calculus who may have majored in French, teaching Physics who may have majored in History. We need people who are more

conversant with the subject matter they’re teaching.

You don’t have to reinvent the wheel. We have the NOIS Scholarship program. The law of the land right now. That is a program that emanated from our committee on a bipartisan basis under which we provide stipends for juniors and seniors in college majoring in Science, Math and Engineering. For every year of the stipend they agree to teach two years in the public school system. I took us five years when it was authorized before we got one dime. Now we’ve got the grand total of $500 million for the wealthiest, most technologically advanced nation in the world that’s how much we’re investing. That could be a specific objective. Build upon that program.$500 million? That’s tip money for a coffee break in the Pentagon.

We’ve got to be serious about this. We

22
1 really have to be serious. What our combined message
2 is, is we’ll work with you. We’ll work for you in
3 the national interest. Be specific. Be focused and
4 develop a political strategy.

Thank you very much. I appreciate the
good work your doing because we’ve meet in our
offices, in our committee room, our staff is
interacting with you. We’re here to help. But the
last thing we need are more studies that are going
to sit on the shelf- and gather dust. There isn’t
enough storage space in this town for all the
studies. We’ve got plenty of studies. We’ve got to
have a study of all the studies we’ve done. Now we
need implementation with specific goals in mind
and a
strategy to see those goals achieved.

Thank you very much.

REPRESENTATIVe CULBERSON: If I could,
Mr.
Chairman. i don’t know if any of us knows. How many
scientists and engineers are there in the United
States -just ball park? Not enough but my point
is, what, there’s got to be hundred of thousands
easily. Those people organize. How many of them are

registered to vote? How many of them have even been
communicated with to try to talk to their member
of
Congress? These are really fundamental, simply
really. It truly is very straightforward, simple.
And, as Chairman Boehlert said, I would really urge you more than anything else is to get a political strategy to get those folks organized.

And to restate very simply, I don’t think I did it correctly, Dr. Smalley’s vision to inspire kids to go into the sciences would be make the United States energy independent and to make each American energy independent. You can drop off the grid.

DR. BEERING: Thank you.

other comments from our panel?.

(No response.)

DR. BEERING: I want to thank Chairman Wolf for this generous offering of all of these facilities and for your leadership. Thank you very much indeed.

We’ll take a quick break and then we’ll go on with the other panelists.

(Recess.)

DR. BEERING: Ladies and-gentlemen, I’d delighted with the commentary we were privileged to have by our congressional delegation this morning and
we now have a series of distinguished panelists, beginning with Tom Luce, Assistant Secretary, Office B of Planning and Evaluation—and Policy Development of the U.S. Department of Education. I invite Mr. Luce to address us.

MR. LUCE: Thank you. Thank you for the opportunity to appear before you.

What I wanted to try to do from the Department of Education perspective is maybe mention a couple of points that would not otherwise come to your attention—as you consider your important work.

One, we totally agree on the absolute necessity of improving our math and science performance in K through 12. As a matter of fact, I think the priorities stated by the National Academy report clearly indicate that we’ve got to improve the pipeline. The last statistic I saw that 3 percent of the people who take the SAT, which, of course, is a narrower band than our high school enrollment, only three percent indicate an interest in Math and Science. That, goodness knows, doesn’t mean they’ll be qualified to then proceed in higher education.

So we’ve got to improve the K through 12 pipeline and take that very seriously and hope to convene soon.
National Math Panel to discuss that the changes needed in the curriculum to do that.

I wanted to mention to you that I think two big points I’d like for you to consider. One is the need for more cross-administration collaboration with respect to various programs that involve the Department of Education, NASA, NSF, the Department of Homeland Security. If you look at the recent GAO report you see that we have a lot of different agencies that are spending funds on Math and Science. This does not speak to changing anything that the National Science Foundation is doing. But, for instance, we have I believe the opportunity to capture the attention of America’s K through 12 system by what’s in place with No Child Left Behind.

By that I mean the requirement, for instance, that every school have a highly qualified teacher in every classroom. That is a specific pressure that our schools are going to feel that’s required by No Child Left Behind. So we ought to be thinking about how do we address, let’s say, at the National Science Foundation offering programs to those teachers who are not highly qualified to get them highly qualified.

We find often in the Department of Education, for instance, when we offer summer
institutes often it’s the teachers who come to those institutes are the ones who are already highly qualified. But schools and districts and states are going to be looking for ways to get their teachers highly qualified. So I think looking at the principles of No Child Left Behind and applying them to whatever agency is working on a program would give us more leverage.

Another examples is schools that are not making adequate yearly progress are required by No Child Left Behind to take certain actions, including how you restructure a school and how you redo the curriculum. Well, again, that’s a vacuum that we can take advantage of by saying here’s a way to change your Math and Science curriculum. Assessment, I think, is also a very strong principle that needs to be brought to whatever program we’re doing to improve Math and Science, getting the data to know did academic achievement change in the schools where the teachers who were trained went to a Department of Education program or to a NASA program. So I think it would be important to try to apply the principles of No Child Left Behind to these programs so that we gain the leverage of what the Act permits us to do.
The second point I would like to make is I heard the discussion about organizing the scientific community, but I think we also need to speak to the public on this issue of Math and Science. When President Bush was Governor Bush and he spoke to the Texas population about reading in elementary school virtually every head would nod that that was understandable. If you say to somebody you need to pass Algebra in the- eight grade not every head would nod or they might not in a way we don’t want them to nod.

I think it’s important that we speak to the fact that in today’s world, and Congressman Ehlers said this yesterday, you’re either going to be a nerd or work for a nerd. And that’s a pretty graphic way of putting it. --But another way of putting is Math and Science is how youngsters in the information age are going to learn problem-solving skills. So I think we need to communicate the overall importance of Math and Science even -if you’re not going to be a “mathematician” or a scientists.

The last point which I’ll make quickly
is to call to your attention that states are required to have in place a science assessment in the school year 2007/2008. That requirement is in looking at how you might help states to make sure that those standards are high, I think it would be very, very important.

Last, but not least; I think we need to address the K through 12 curriculum issues so that children really are prepared to pass Algebra in the eighth grade which means we have to build in more pre-Algebraic concepts. But, in concluding, I would just urge you I think we need more coordination across boundary lines to make sure we’re maximizing the leverage of No Child Left Behind, which was passed by a large bipartisan majority. It’s in place. How can we use that to make sure we’re accomplishing the goals that we all want to accomplish?

Thank you very much.

DR. BEERING: Thank you very much for helping us here this morning.

Dr. Don Thompson, who is Acting Assistant Director of Education and Human Resources at the National Science Foundation we invite you to comment:

DR. THOMPSON: Thank you very much Mr. Chairman, Committee.

There have been numerous reports
certainly in the past relating to STEM education. They’ve all had multiple starting points and they certainly have all asked the same kinds of questions. The question has really been has it been positive movement based on the information that we’ve gathered from that.

The response from that is there has been some movement, but certainly not enough movement.

We all know the facts. Our students are in the middle of the pack when it comes to international achievement tests and we, for some time, held the No. 1 spot in a number of areas. But right now global competitiveness has caught up to us.

There’s a great lack of a sense of urgency about having a work force and also a globally-competent student population.

At ERR we’ve got to not just ask the questions but also answer the questions concerning how do we find ways of challenging our best-and brightest to do Science in terms of effectiveness? How do we know what works and why it works. How do we know what’s innovative and if that works and how are these things effective and under what circumstances? How do we decide what should be taught? When should it be taught and what are the best methods of instruction? How do we effectively
train our teachers and deliver knowledge and promote discovery? How do we make certain that when students complete their education they have the necessary skill sets? And, finally, how do we bring cutting edge Science to the K through 12 classroom and to teachers?

In answering these questions we’ve been asking, we’ve begun directing our internal activities to focus on connecting programs—than can work—effectively together and to improve efficiency: and rethinking and realigning our K through 12 programs in order to bring research efficiency to the entire portfolio. In our past we’ve done one thing exceptionally well and that is bring innovative concerns to the forefront. We have been at the frontier of knowledge and also working with our partners to bring new knowledge and new implementation strategies forward.

Currently, right now what’s important is beginning to propagate what we know and—to begin to talk about it and to begin to share and to begin to scale at size the things we know work and to test those against the models out there. What is most needed is full-scale implementation of many of the things that we know work. We know, for example,
1 the integration of education is critical, whether
2 we’re talking about K through 12 education or whether
3 we’re talking about undergraduate education, the
4 integration of education and research is part of the
5 solution in attracting and retaining students to the
6 S&E enterprise and producing scientists and
7 engineers.
8 who can contribute to the nation’s prosperity.
9 At the Foundation, we support projects
10 that establish horizontal connections among various
11 communities and we use these partnerships to move away from
12 episodic cooperation to long-term collaborations
13 that, in fact, have shown some great future for
14 us.
15 We know that evaluating programs and program
16 effectiveness is also important to be able to
17 identify promising procedures and promising progress.
18 We also that cutting edge research on curriculum
19 has been very, very important. And, lastly, that
20 collaborating with teachers and scientists and
21 working in classrooms is very, very important.
22 We must find ways of embracing and
23 challenging our best and brightest in Science to
1 choose Science as the option of choice. We do so by 
2 engaging our citizenry in understanding why STEM and 
3 why now and by renewing our commitment to the basic 
4 level of science and technological literacy for all. 
S We have to begin to align our cutting edge science 
6 and curriculum instruction to ithprove delivery of . 
7 knowledge in the K through- 12 classroom, uncovering 
8 the best strategies for teaching and learning based 
9 on creditable research. That’s a priority for u-S. 
10 Implementation of these -strategies will result- 
11 improvement in student achievement in Science and 
12 Math and produce a cadre of young scholars who are 
13 excited by Science. We must support higher 
education 
14 ins-titutiorts in defining and addressing what it 
means 
15 to be educated in the 21st Century from a global 
16 perspective. 
17 Post-secondary education must be 
18 responsive to workforce development needs and 
19 cognizant of the human capacity required for 
20 international competition in Science and 
En~ineering. 
21 Meeting these challenges will advance -the 
national 
22 agenda for Science discovery and exploration.
Going
forward, our students must lead and harness the scientific engineering innovations at a global scale.

Universities must prepare, not only with the fundamentals, but with a broad set of basic skills that are necessary when collaborating and communicating across disciplinary and geographic boundaries. Rapid advances in information and technology and emerging cyber-infrastructure are changing the methods of scientific inquiry and empowering individuals like never before.

We must prepare our country’s future science and engineering educators and professionals to fully exploit this new frontier. We must be mindful to give voice to the number of underrepresented individuals who will soon represent a majority of new enrolles at the nation’s public schools and many colleges. Development of that talent is at the core of educational mission. Our future is tied closely to our ability to be inclusive and to work efficiently in building capacity to sustain worldwide leadership.

It’s critical for us that we take a look again at the three things that we do that we know are
2 possible. One certainly is the innovation of
3 Science. The second is the propagation of Science.
4 And the last and most importantly, again, are those
5 things that we do that can, in fact, implement
6 exactly what we know. In order to implement those
7 things we have to continue to work across the lineS .
8 not just of the National ScienceFoundation and its
9 directorates, but rather a number of agencies on the
10 of outside, whether those agencies be the Departntent
11 Education, NASA, NIH or others. We must begin to
12 take a look very strongly at the programs that
13 and find ways for beginning to implethent these;
14 Finally, again, importantly, we --have to
15 begin to look across both the federal levels, the
16 state levels and local levels and find ways to
17 build partnerships and alliances so that the great
18 problems we face and the implementation of these things
19 can, in fact, move across all those lines.
20 Thank you very much.
21 DR. BEERING: Thank you very much, Dr.
22 Thompson.

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Next I would like to invite Cecily Cannan
Selby, the co-chair of our Commission in ‘82–’83 to address our group. While we’re getting ready for the next group, are there any questions for Don Thompson?

Yes, sir?

MR. BOEHLERT: Thank you for your comments. I appreciate them very much. Mr. Luce provided an idea which I’d sort of like to get your reaction to, namely look at the No Child Left Behind legislation and see that as a structure and design and perhaps an action plan which could then impact NSF among all the participants in the enterprise of K through 12 education. How does that strike you? Has that ever occurred? NSF has a broad portfolio, so I would guess there are a lot of areas of commonality;

DR. THOMPSON: We have given great thought to actually and yesterday I was at a meeting with Department of Education discussing exactly that same thing. We currently have a group that was called Tiger Team where we worked for a number of years looking at our programs, core programs to try to find ways, working across the agency lines, much of which
2 we do. Certainly, we’ve been able to use to work-
3 directly with the education departments Math-
4 Science partnerships and begun to share information
5 and share training and really begin to scale up much
6 of what we’ve been doing in our R&D efforts to some
7 of the broader state efforts. We certainly do see
8 that as a framework in which we can work.

9 DR. BEERING: Now we have five
10 distinguished panelist. Do we have them all here?
11 Selby, Shaw, Wheeler, Collette and Tinker? It
12 looks like we’re all here. I’ll ask Ms. Selby to start.

13 DR. SELBY: Can you hear me?

14 Mr. Chairman and members of the National
15 Science Board I do thank you for this opportunity
16 to participate in planning for what some of us felt is
17 find many parallels listening today to the testimony
18 between 2005 and 1982 when the National Science
19 Board decided there was a crisis in Science education
20 a commission was needed.

21 I’m very sorry that Lou Branscombe, the
commitment, their extraordinary, way beyond the
call of duty gift of time and talent made our report as

useful as I believe it is. And, as we say in New
York, may you be so lucky.

I will first answer the first
question

progress has been so long, trying not to be

with so many of the great testimony that well received and progress has happened in all those areas, particularly since we were the first national report as far as I know that really said that STEM education should be for all and that all kids can succeed, barring particular disabilities. -We also
has just occurred. But 1983 report, I’ll refer listed in the executive I think they’re reveal in formal education and technology in our sense just computers. These, referring specifically to our particularly to the topics as summary of our report because ng. The focus of all students technology education, and then meant all human-made not I believe, were very, very

introduced in form education, museums and after school programs which have made tremendous progress thanks primarily to NSF funding, which came as a product of our report. Industrial Arts and education has become more and more integrated with Science education, which is something I’ve always cared much about
and has had, I think, good results. Then we’ll turn to the next topics, improving what is taught and learned, new information technologies. "Their good outcomes but I think the success of the first three that they touched - public nerve and public appreciation very quickly and the recommendations that we made were not - expensive and they were particularly non-political about those. 

Turning to the ones where the bad news is, solutions to the teaching dilemma. This is where the recommendations we made have been particularly ignored and also leadership national, state and local, but particularly, I think, we have to say national and always finance. So what went-wrong with these three recommendations?

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No. 1, they were the most expensive.

Thanks to Bill Komen we costed out all our recommendations. I know there are pitfalls there and obviously one of the pitfalls is why funding for the promotion to our report to NSF did not succeed at first. I think we costed out the improvements in recruiting, retaining and advancing teachers to $349 million a year and the cost of the exemplary schools - a thousand elementary and a thousand high school was of the order of 800 and some odd million. We recommended over one billion and that, in '82, for
the most important recommendations and for both of these we suggested or asked for federal funds.

The political reaction was strong to asking for federal funds. No funds were made available immediately from NSF for promotion of the report and the Carnegie Commission supported me for a year to accept invitations to talk about the report nationwide. But there was virtually no publicity, which is why the nation knew more about the nation at risk than it did about our particular report.

The first need, as I see it, for the next action is whatever recommendations are made I would argue that attitudinal change is the most important. Public attitude about teachers and public attitude about national needs those were mentioned today. So, in terms of obstacles-politics, of course; finance, of course, but now I’m-going to add culture and I’d like to tell you why.

Crossing the country to report on the Commission in ’83 and ’84, I couldn’t find one audience that receptive to the idea of making major investments in teachers. I couldn’t find a journalist. I couldn’t find an audience where they said, oh yes, of course, we should spend a lot more
money in our local community to send teachers to NSTA meetings or to invest in their continuing education. Puzzling about why this was I came out with a conclusion, apart from the obvious diagnosis of the problem being the cost to local school committees, there is still a belief abroad in the land that good teachers are born and not made and good students are born and not made. And so, therefore, the strategy must be put the good teachers—with the good students and others probably couldn’t make it with Science otherwise. Truly, that was a live and well 23 years ago and I think it’s alive and well now as— I move in circles that are outside of the Science and education communities. If teachers are born—good, then it’s also their responsibility to: stay good for their lifetime. So my second recommendation or my
second establishment of need is to work on attitudual change.
We’ve heard already this morning wonderful, wonderful recommendations, but the attitudes about what Science is, what students are and what teachers are still seem to be more neglected.

In terms of specific recommendations, in my experience I think, as you’ve notice, when I left the Commission – when the Commission promotion was over I decided that teacher education was the black hole being neglected and that I should try to learn more about it. So I accepted a position teaching a professor of Science Education at NYU. The rest of my comments come from what I learned working with experienced, ambitious New York City mostly secondary school science teachers and in my own research of teaching materials since then.

This is where I find that the nature of Science, what makes Science Science is so badly misunderstood. Their perceptions, in the textbooks in particular and also sorts of educational
materials, fall back with teachers haven't had most teachers have had no research, independent research experience either in field sites or laboratories. so they have to fall back on textbooks and what science is that makes it different from other subjects.

And the textbooks are full of misperceptions. It takes a lot of time to find this out, but I’ve had the time in the last few years to look at textbooks, including college textbooks of very distinguished, prominent, famous universities.

You find the scientific method is still taught there. It’s still taught as an anonymous, universal abstract method and assigns means apply a method and that scientists are all alike and they’re all determinist and all very brainy. And as you read some of this text you understand immediately what it is that turns students off and turns teachers off and makes the public feel, well, Science is for the scientist. Meanwhile, Nicholas Kristof had a wonderful Op Ed in the New York Times—yesterday. I don’t know if anyone noticed it. He criticizes the snobby of the Arts and Humanities about Science as
part of our problem.

You’ll have to forgive me for the rather long-winded attachment in the pre-reading material, looking into what scientists say, not textbooks, but what scientists say Science is. It’s a human inquiry. It’s a human inquiry that involves personal and cultural perspectives in the choices you make in your inquiry. —The only place you can’t use personal perspectives in evidence. I have more of that in the attachment, but my dream is that we could be teaching Science as a human inquiry, differing really from the Arts and Humanities and Religion, let me add, in terms of the kind of evidence the scientists pays attention to.

If we could get away from sort of the outdated Isaac Newton definition of Science as

starting with observations and a method, which he had his reasons for promulgating, and if we could turn to science as human inquiry so that the teachers could say to the students, if you go into science you can
use your personal characteristics. Your person
matters. Who you are matters. If you’re female
you’re be adding different perspectives from males.
If you have a different ethnic background, you’ll be
enriching Science with your perspective.

I have to quit now because of time, but
the passion behind trying to change this attitude
about Science that lies behind the written
testimony on what makes Science Science. I want to add here
my remarks are necessarily general and philosophic.

It’s several years since I’ve been hands on with
students and teachers. That is why I asked my
three colleagues in New York—Allan Friedman, Pam Abda
and Julia Rankin, head of Science for the New York
City Board of Ed, to give some hands on direct
contemporary testimony, which is in the written
report.

My final—of course, you can see me

saying that I hope one of the things that, if there
is a commission or there is any activity for change,
that we look into how Science is presented—the
processes. I’m not talking about the products
anywhere here. —I’m talking about what scientists
do.
What makes Science Science. How that is presented to students and the public.

My final recommendation, as I’ve talked about the nature of Science and the nature of teaching, now let’s look at why we teach Science.

Another thing I added in my written testimony are some answers that teachers gave in my class went over a few years I used to spend the first class saying why teach Science? I copies some of their answers. I couldn’t have fudged them. They’re so good they have to be genuine. And they said, well, you teach Science for personal gain, to satisfy curiosity, to enhance your aesthetic appreciation, knowing about the spectrum enhances your aesthetic appreciation for sunshine. For personal gain, competency in problem-solving, confidence in problem-solving, preparation for jobs and careers, for personal gain.

Then there’s you teach Science for community gain to have citizens make informed decisions about health, about environment, as consumers and you teach Science for national gain, which is what we seem to be talking about most of the time and I worry if we’re not making quite enough about the personal gain and the student and community gain and the family gain. The gain for mothers and the gain for fathers to
learning about anatomy and physiology, et cetera.

In the 1980s very much is a follow-up of

our NSF report. The Commission on Education in New York State called some of us up to New York State to

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develop desired outcomes for K through 12 in Math, Science, Technology education. We developed nine outcomes what we want students to understand and be able to do and be able to do as a result of taking Science courses K through 16. We came up with nine outcomes. Only three of these were content. That’s the point I’m trying to make. One was the physical world. One was the natural world. The other was technology. The others were all to do with what the teachers were saying really preparation for jobs, how to access information through libraries, through people, from the internet, et cetera. Systems thinking. Getting away from all reduction teaching. Talking about how the system and interrelated complex phenomenon, the beginnings, of course, where the future of so much of Science is today, informed societal decisions. We had another one with the big ideas. Ideas that cross all subjects in the curriculum - time, balance, et cetera. I’ve lost track of my watch here, but sure my five minutes is up. What I’m really bringing to you today from my sort of alumnae experience, if you could say, is to work on the attitudal change needed, whether it’s in the classroom, whether it’s in the school boards, whether it’s in the Congress, whether it’s in the Administration the attitudal
change about why we care about Science over and above national workforce issues and why teachers could and should be treated as doctors, lawyers, electricians and other people where there is a community investment

in professional development for a lifetime. We know in terms of the international competition where we really, really fall back. I know mostly about Europe. We fall back in not treating our teachers as full professionals deserving the respect and the ongoing investment in their talent and their time.

Thank you. DR. BEERING:

May I ask you the light so at the end. Next, Dr. Shaw. DR. SHAW: I thought what I might do today is let me filibuster while I’m waiting for this to come up. I thought today rather than repeat a lot of the things that my distinguished colleagues are already talking about quite eloquently is to give my own perspective, first Of all, based on my life a working scientist. In my case computational biochemistry. Also, as it happens, I’ve worked for a
there with discussion
Thank you, Dr. Selby.

all to look at that cube box. we have a little time for Five minutes please.
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1 while in the field of financial economics mostly on
2 policy issues related to Science and Technology and
3 just sort of give some things about the intersection
between the two having to do with not education about
science and research, but rather research into
education.

The reason being, not that this is the
only important thing, we know a lot of things at this
point that are very valuable to transfer into actual
practice and I think that’s extremely important.

But just focusing on one issue, which is what’s the
engine driving this, I would argue that basically
what’s needed in order to make real changes in
education—is on the one hand compelling new pedagogical methods and tools and curricula, and
also solid scientific evidence that they work. That we
shouldn’t forget about that for the long term.

I think it would be a mistake to use that
as an excuse to do nothing now. But I just wanted
to take a little look at what we have been doing,
which needs
to be done in the area of generating new knowledge
about what actually works in the classroom. My
feeling is that’s something which, in itself, is a-
powerful driver for convincing-educators, parents and
lawmakers to actually implement some of those
changes.

First of all, some have said—actually we
already know what to do. All we need to do is to get
people to do it. I would argue that, first of all,
that’s never true and that in particular right now in the field of education it’s particularly not true.

The panel I chaired for the President’s Committee of Advisors on Science and Technology some time ago on educational technology oddly enough it’s major recommendation had nothing to do with educational, per say, but rather the need to invest much more in research on education. And, in fact, I saw Bob Tinker, who was a very valuable contributor to that report, cited one important statistic in his written comments, which is that the pharmaceutical industry invests something on the order of 23 percent of its annual revenues for all of its different revenues in research and development efforts, whereas the comparable figure, historically and actually in a few years out of date, has been about 1/20th of 1 percent to the total investment our country has in education has gone into research on what I would call real research on what works in education. So it’s not surprising that we still have a long way to go.

We’ve also come a long way since the PCAST report. I think the notion of empirical, randomized perspective controlled clinical trials is something that was largely absent from the vocabulary with some rare exceptions, but they tended to be excellent quality but hardly funded at all. That’s now very much a part of the vocabulary. People are talking about it and there are some steps being taken to actually introduce that in a meaningful way in evaluating a number of educational interventions, especially in the area of software and technology education. But at least it’s something that is beginning to pervade the field. It’s a big step forward, but this is a very expensive enterprise. It’s still dramatically under-funded and I think that
without a significant investment in research, just as

1 we do in number of other areas, basic scientific and
2 technological areas, we’re not like to know as much
3 as we ought to be able to substantively and also
4 credibly drive the process of encouraging people to
5 adopt educational reforms that really matter.— But
6 evaluation isn’t enough. It’s funny. That’s
7 something we’re worried about more than anything else
8 at the time the PCAST report was issued I think in
9 1998.
10 At this point I’m more concerned about
11 some of the other things. In fact, because that’s at
12 least a concept that’s being widely talked about
13 because in Science evaluation - the part of
14 formulating a hypothesis and subjecting it to
15 testing, having a refutable hypothesis, something
16 that could be shown to be false and then testing in
17 various ways to see if holds true is only part of what
18 needs to be done.
19 As Dr. Selby was saying, probably the
20 bigger part, actually, of Science is formulating
21 those hypotheses. Where do we get the ideas?—. How do
22 we come up with the underlying basic research that
1 generates new ideas to be tested? I think this is a
2 terribly important thing for the federal government
3 to be involved with because of an economic imperative
4 and that is what’s often called an economic
5 externality. Economists call it the “tragedy of the
6 commons.” In any areas where the returns from doing
7 research are captured, not by the ones who do that
8 research, but by them, in small part, and by
9 everybody else in large part, there will be a
10 systematic under-investment in what economists call a
11 “social welfare perspective” in that kind of
12 activity. It’s less true in things like developing
13 software where you see some of the software companies
14 now conducting evaluative studies. But in other
15 areas, for example, educational interventions that
16 aren’t captured in a particular product. If the
17 federal government isn’t supporting that kind of
18 research, it simply won’t be done, at least at an
19 optimal level, because the returns from that, whether
20 it’s done at a university where it will be published
21 or whether there’s some other form of private sector
22 investment that can still be captured by all other.
competitors, then the benefits are spread whereas the costs are channelled into one institution. That means there won’t be enough of a research investment to make as much progress as should be made.

And then the final thing I wanted to just mention briefly, because I think I’m out of time now, is the notion of technology transfer. Once we’ve come up with good science, once we really do understand what works, that’s a point in which we really have to form that bridge, not just tell people they ought to adopt it, but invest in the process of transferring what we know in to practice. That’s something, again, where I think there’s no substitute for federal support.

DR. BEERING: Thank you very much:

It’s like researching rare diseases, development of orphan drugs. You can’t make enough money to recapture the research costs.

The next speaker is Gerald Wheeler, Executive Director of National Science Teachers Association.

DR. WHEELER: Thank you for the opportunity to testify today. My name is Dr. Gerald Wheeler. I’ve been involved in science education for about 40 years. I was a Sputnik kid in ’58. It’s too bad Dr. Bement out right now. I took a special NSF-sponsored physics curriculum course as a junior in high school. It was on mimeograph sheets for those of you that remember that technology.
For the past 10 years I’ve served as executive director of the National Science Teachers Association, which is the largest science teachers group in the world. I’ve cut my comments a little short because I read other people’s comments and I don’t want to bore you with redundancy.

I believe the ideas and strategies I’m presenting today are critical for NSF’s new role in improving science education. I look forward to a healthy debate about the issues during the Commission’s deliberations. I’m not going to discuss the many challenges we face in K through 12 STEM education since the National Academy of Sciences, the Business Roundtable, Higher Ed Forum, the Council on Competitiveness and many others have so actively articulated those goals. We know the problems are huge and that reform is overdue.

NSF must pay a significant role in STEM reform. It’s a requirement of a physicist to always quote Einstein, but to quote Albert Einstein doing the same thing over and over again and expecting different results is insanity. We need to craft a new direction and a new position, and I applaud the idea of a commission helping do that.

First and foremost, NSF must dramatically expand its R&D efforts in Science, Math and Technology education, ongoing investment in R&D -that builds the infrastructure and addresses our nation’s most significant challenges is absolutely critical.

I won’t beat that too much because I’ve read Bob Tinker’s replies and you’ll see some of the same.
through his ideas.

But R&D provides our nation with new ideas, new technologies, new curricula, new resources material and new talent through which those new ideas will flow. Investment in R&D is something that’s an

1 automatic response for corporate America and NSF needs to mimic this successful practice, including mimicking the level of R&D investment.

I want to focus on four key strategies that I think represent, if you will, a mind shift for NSF in the next decade that I think should be considered as the new road map to real success in K-16 STEM and consequently, NSF’s long vision as developed. I call these the four S’s — skill ability, sustainability, success indicators and science content. So I’ll use my short time to chat a little bit about those before concluding.

Skill ability for too long we’ve been satisfied with supporting excellent projects for numbers of teachers and students. To sustain a world-class science and engineering workforce NSF must develop more innovation, more programs at the proper scale to have an impact. We talk about pockets of excellence here and there, but few initiatives ever get the skill that will result in a substantial increase in student achievement. We must commit to more innovative programs that are funded.
appropriately and can have a positive impact from Maine to California, programs that help teachers enhance their content knowledge and deliver effective instruction as well as programs that offer new insights in how students learn.

Sustainability—the second S—any long-term vision for meaningful reform must include programs that are not only scalable, but sustainable.

NSF-funded programs that move ideas from research to practice, develop new and improved materials and assessments, explore new uses of technology to enhance K through 12 instruction and create better teacher training techniques must be sustained long after the grant funding expires if we really want to see real results. To often we’ve been satisfied with the promise of sustainability. NSF needs to lead the way in developing new business models that ensure that worthwhile initiatives can, in fact, be sustainable.

NSF and the education community could learn these strategies from the business community and employ more business practices ensuring that
working projects remain viable and show results over a long period of time.

The third S is what I call the success indicators. Again, following the many examples from the business world, NSF must take the lead in insisting on reliable success indicators for R&D initiatives and show how these indicators can be replicated. Part of this challenge is to improve Science and Math assessments so they can truly demonstrate a student’s ability to think and apply knowledge. And, in this context, provide reliable indicators of progress. I think it’s possible to miss the significance of the strategy because of NSF’s dual roles in basic research and education.

I’m a nuclear physicist by training and I’ve always been fascinated by the differences and the tensions between the education world and the science world. Success indicators in education are extremely important because, unlike traditional research, the education enterprise has a much less developed progress model and I think a commission has to deal with that—the fact that the progress model in education is significantly less robust than the progress models, say, in my own field of nuclear physics.

Finally, the fourth S is science
knowing the science we’ve been assigned to teach. It was mentioned by a couple of our congress people earlier. I’m just amplifying what they said. NSF must take the lead in addressing the fact that far too many of our nation’s science teachers’ need help in gaining a deeper understanding of the science they’re assigned to teach. Knowing how to teach Science and understanding how students learn is very important, but the bottom line is teachers can’t teach what they don’t know.

I would say that the biggest hole in the dike in Science education reform, I can’t speak for Math, is teacher content knowledge, with the exception of NSTA members.

(Laughter.)

DR. WHEELER: Solving this critical national need in a significant and scalable way will require innovative ideas from the university teacher prep programs and innovative ideas from the in-service professional development providers such as NSTA and the other professional societies just as we did in the early ’60s after Sputnik. NSF can and must lead the nation with long-term, properly scaled projects that ensure our K through 12 science teachers know the science content.

Before teacher education, continued’
professional development and in-service must be addressed. I’m sorry. That’s an incomplete sentence. Forget that last sentence.

In addition, we must align the classroom practice and the latest advances and knowledge about learning and the latest advances and ‘knowledge in Science. Quickly, ‘on that last point, I’~m scared that as we think of all the ways to get new results will revert back to the Sputnik summer institutes. There’s nothing wrong with those, but they’re not at the right scale. We have to think very innovatively about how do we bring our nation’s science teachers up to speed in the science content we’re assigning’ them to teach.

Finally, in summary, NFS must continue to expand its role in Science and Math R&D. I’ve said that future innovations and strategies need to be developed that are scalable so that we can reach a greater number of a reasonably sized number of teachers to have true reform. They must be sustainable so that quality initiatives can grow and replicate and they must have viable assessments in place to assure that these results effectively are forming the future that we have in the progress model.
I thank you very much for the opportunity to address you today.

DR. BEERING: Thank ‘Ou, Dr. Wheeler;’

We’ll ask Dr. Colletetto go next.

DR. COLLETTET: Good morning or good afternoon, whichever it is. Thank you for the opportunity to testify to this Commission which is on a vitally important subject.

I speak today as a senior consultant for the Delaware Foundation for Science’ and Math education, which is a non-profit, which is

supported and aimed at implementing the Delaware Math and Science standards. And, also, as a member of the American Chemical Society and a cutR0it me’mber of the Societies Committee on Education.

My views are those of a person who has spent a career in DuPont R&D working on advanced materials, but it’s also combines the fact that I got into, science education reform late “in my báreer and spent seven years in the trenches as a co-
principal investigator for the local systemic’ Ohange initiative of the Delaware Science Coalition.
Based on these experiences, I believe the National Science Board should move promptly forward in creating a commission on K-1G STEM education. I further believe that the National Science Foundation should play the strong leadership role in strengthening our nation’s STEM education. NSF is already engaged in this—the whole process of improving the STEM education pipeline at ‘every’ level—and also by the work they do through the EHR directorate in linking research funding to educational outcomes.

The Math/Science partnerships and the local systemic change initiatives, which preceded them provided basically a process to support large scale, innovative and collaborative efforts among businesses, universities and state and local education officials. They served their purposes. The LSC5 certainly served their purpose. The NSF has a unique role in strengthening STEM education and by unique it is because NSF is the only federal entity that has both a well-established infrastructure for reaching education K-16 and also has well-established connections with the scientific community.

When the Delaware science standards were

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it as we move from what was then a K-12 focus to a
now new K-16 focus.

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When the Delaware science standards
were
This opinion a’nd my influenced by the experience i systemic change initiative. I states and localities have had In Delaware we made significant science education through this think we should celebrate that respect for NSF is had with the local believe many other a
similar experience. progress in improving through their help.
progress and build on

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the elementary schools. lacked the background to lots about
that, especial no real access to either professional development
it. The Delaware Science every year every child. Coalition began
a pilot p inquiry-based cu-rculum
taught in Most elementary teachers teach
Science. You heard ly hands on Science and had the materials or
the that they needed to teach Standards said Science To meet
this~ challenge the rogram to explore an’ in a limited number of

adopted in June 1995, little Science was

106
elementary schools. This program was so successful.

let me just say something about the program~ The program, provided the curriculum to the elementary teachers and the professional development and ensured they had the classroom supplies to teach it to every student. It was so successful that there was an immediate demand to expand it to more schools, to more teachers. It automatically overwhelmed the small staff that was available. The grant that we got from NSF was therefore a God sent. It allowed the Coalition to form to take the program forward and to systematically expand. First, to every elementary school in the state and many of the charter schools, then to all middle schools in the state with a K- technology-based support. So I’m dealing with one issues Jerry brought up, namely scale. These programs are scalable.

Through ‘this program we were also able to leverage NSF’s $6 million investment in Delaware, it is an investment, it’s not just the funds, to
than, $23 million through support from the state, from individual school districts and the business community. The result is that today most public schools, and I would almost be willing to say all public school students—Delaware’s students are learning more science than ever. They’re experiencing a curriculum that is significantly more demanding than it was 10 years ago. They are also being taught by better prepared teachers who have great access to computer-based technology in their classroom.

I’m also pleased to report that the Science Coalition was sustained. I want to deal with Jerry’s second point. It continued on after the grant was finished and is now expanding to high school. We are seeing this year for the first time some encouraging improvement at the high school side.

NSF gave us more than money. It gave us access to experts in science education research and helped us share experiences and learn from many of their reform programs. That’s why I cannot emphasize too strongly my view that research in education should be thought of as equal ‘contributors’ to NSF’s overall goal of promoting scientific progress.

Let me just close by stating again the urgency of this issue. We’ve all heard about the flurry of recent publications. These reports ‘cry out’
for a coordinated research to tile ‘education challenge. Dealing with this challenge will require a national consensus, but it will also require national leadership. NSF is uniquely qualified to take such a leadership role. A formal commission on improving K-16 STEM education could settle this question and provide a definitive road map for NSF to follow. I think this needs to be an action agenda as others have said.

As a member of the scientific community, as a citizen concerned about our technological future, I urge you to move forward promptly on this task.

DR. BEERING: Than you very much, indeed.

Last, but not least, Dr. Robert Tinker, President of the Concord Consortium.

DR. TINKER: Thank you for the opportunity to address the Board. I promise that, I will ‘~not take more than my time if you promise’ to read my eight’ pages of testimony.

(Laughter.)

DR. TINKER: I realize we’re running a little behind. Let me say a little bit about ‘the Concord Consortium. It’s a non-profit that I
started 17 12 years ago. It has about 50 professional educators 18 focused on creating just the sort of thing Jerry was talking about. We combine groups of scientists, psychologists, programmers, educators, and financial people into large-scale groups to really attack fundamental educational problems. We do focus on scalability. We work almost exclusively on large-scale projects that can have national impact. We have had sustained projects, that is our projects have been sustained.

Ten years ago we started the virtual high school which was really the first online courses -- really high quality courses for high school students. That is now an independent, non-profit organization that exists on its income. Similarly, our early work with probes and sensors and our current work with sophisticated models all have sustained capability or history.

I want to focus on one particular aspect of the National Science Foundation: and its role and urge the Board to include this strongly in its charge to the commission. If you look at the various aspects of education at the National Science
Foundation you could divide it into four categories: public understanding of Science, human resource development, what is essentially dissemination and innovation. Of those four I argue that innovation is under-funded and under-appreciated. Of course, innovation is a difficult topic to pin down. What I’m talking about is the kind of innovations that can have national impact that can be sustained on their own once they’ve been developed. The sort of high risk/high gains kinds of things that we could be doing. I took a look at the currently funded projects at the EHR and NSF and tried to look at those, which I felt had the potential of major innovation. I came to the conclusion that roughly to 3 percent of the total budget of the NSF education directorate is devoted toward this kind of fundamental innovation. This is exactly the kind of under-investment that David was talking about. I feel of those we should be investing very heavily in the use of technology. Technology is one of the few areas that hasn’t been thoroughly explored in education. There are many things that you could do in education that would be improved through the use of technology in various forms. And, again, I won’t go into the details. I’m already
down 22 to my last minute. But I list in my remarks a
whole

1 range of interesting things that technology could be
doing. If you take my estimates, I see

\[ \text{roughly} \]

3 half a percent of the education investment at the
4 National Science Foundation is on innovative uses'

\[ \text{of} \]

5 technology. I think that needs to be changed. I
6 think the unique role of the National Science
7 Foundation is doing things that could have

\[ \text{national} \]

8 impact.

9 I think Innovation is one area that has

\[ \text{of fashion} \]

10 been under-funded recently. It’s gone out

\[ \text{of many} \]

11 to develop new curriculum materials because so

\[ \text{of innovations} \]

12 people feel everything has been done that could be
done. But, as Jerry said, there is much more to be
13 -dane and we could be doing much better. We are
15 essentially resting on technologies and

\[ \text{in general that are one and two decades} \]

16 investments of one and two decades ago.

18 Thank you.

19 DR. BEERING: Thank you very much.

20 We need to learn how to download it
21 all on
22 us.

22 We now have time for our members to pose
I’ll start with Dr. Washington.

DR. WASHINGTON: I have a question. I think it was something that Congressman Ehiers brought up. It had to do on the uni’formity - the need for uniformity and standardization in between sort of one school district or one state or another.

I wonder if you could sort of talk about that issue a little bit us in terms of how can’ that be addressed.

How important is it?

DR. SELBY: In New York City, my friend Julia Rankin has for the first time every instituted a scoping sequence in the elementary schools. We’re all tremendous impressed and very, very supportive.

It’s the first time, in the elementary schools that there is to be some coordination across all grades.

All those I know are very much in favor of this.

DR. BEERING: Other questions for the panel?

DR. COLLETTE; Let me just comment on’ the uniformity. I think it’s been positive in Delaware.

It evolved because the districts started out with basically the curriculum is our responsibility and
everybody did the different things. It evolved to a common curriculum. It has facilitated professional development of teachers. It’s improved communications. It gives you better measures. I think it’s a valuable thing.

DR. WHEELER: A quick comment, I’m not as worried about it as Congressman Ehlers is. I think there’s an issue there, but we’re never going to have a national science standard. We just aren’t. We’re not Japan or France or whatever. But I think if we get assessment and accountability done correctly that will become less and less important an issue. I can’t resist but saying the content is very uniform all the way. Newton’s second law still works in California.

DR. BEERING: Dan?

DR. ARVIZU: I’m always impressed with how ‘many great examples of things there are that work well and how much value we get out of sothe of these programs at various levels in various regions of the country. The question I have regards how can we, perhaps, replicate those more effectively and more
1 efficiently in other areas in other locales?
2 Specifically, is it just a matter of resource
3 there other, perhaps, higher efficiency things we
4 can do that allow us to get to that scalability that
5 I think is really the basic underlying question.
6 Whoever wants to respond to that.

7 DR. SELBY: It gives me a chance to
8 make a
9 suggestion that I didn’t have until this morning.
10 And that is, if you could develop -we have model
11 schools why not model teacher education schools?
12 Maybe through that if you could set up a model
13 as a base from which to move. A suggestion like
14 yours.

14 DR. WHEELER: I think in the context of
15 your charge or your search for the commission I
16 would worry more about NSF’s philosophy of let many
17 thousand flowers bloom -my concern’s earlier
18 about a lack of a progress model. I think that we
19 would resolve some of the issues. Human nature is
20 always going to have a little bit of variation,
21 but we’ll solve some of the issues if NSF stepped more
22 to plate about insisting on future grants
that they’re jumping off the successes and to some extent even the failures of previous grants and not reinventing the wheel or the flat tire.

I think that’s where some of it comes in. Some of it’s human nature. It’s almost like the opposite of where do you want to put ‘nuclear waste? Not in my backyard. If it wasn’t done here, then we want to do something different. But Delaware has shown a fantastic example of a group getting toget’her and ying this is the way we’re goin’ to do it. That’s a progress model. Admittedly on a ‘state-based level, but in the context of your charge today that’s something NSF has to worry about.

DR. BEERING: ‘Good point.’ Betsy?

DR. HOFFMAN: I’d like to address to you the same kind of question I addressed to the congressional members, but phrase it a little bit differently.

We heard from the congressional members sort of uniformly don’t do another a commission or don’t do another study. We know what the issues are.

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DR. TINKER: If I may, there’s really two kinds of research—allied and basic research. I think it’s important that there be healthy, basic research in education, but the gains that we’re going to see are in applied research, which is expensive, large scale. Some’people use the medical trials model. That is not being funded adequately“erother

National Science Foundation right now. We need much more large scale implementation studies that can tell us what works, what doesn’t work and allows us to make mistakes and learn from those mistakes.

DR. SHAW: If I may also, one of the recommendations of the PCAST report is that that be a multi-agency efforts Right now a lot of the burden of that has shifted from NSF into the Department of Education. I think that’s a wonderful thing if for no other reason that I think it’s very posiEive to see the Department of Education start to get use to those paradigms and make real progress. But I do” think that input from the National Science Foundation has a major role to play based large1~r on the fact that that’s a community that understands the

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methodologies well, the ways of evaluating
evidence'
and so forth.

DR. BEERING~ Ray?

DR. BOWEN: I need to sort of put this
in
context. It’s going to sound a little crazy. I
think we all understand the problem. There have
been
nice descriptions of that this morning ‘and we
‘keep up
with those kinds of things~ In your commentary
you’ve indicated some characteristics of the
solution
to the problem. In some cases you’ve had good
ideas
about how you might structure. the solution. My
question is what’s the source of the problem? If
I’m
a science teacher, what are the barriers to my
ability to produce within my cohort of students a
well prepared group of young people prepared to
pursue careers in Science and Engineering? What
are

the barriers? Why do we have this problem in our
nation right now?

DR. WHEELER:, I’d like totak-e‘the
first
stab at that. Coincidentally, when the national
science standards were, released by the Academy in
January of ‘96, NTA polled it’s members about 10
percent of its members and we said exactly that
question. What are the barriers that you feel to
being successful reform? It wasn’t really a big
double-blind experiment, et cetera. ..But we
about a dozen factors we thought they might react to. It was sort of an online survey. All but three got less than 3 or 4 percent of the votes. Three of them were above 96 percent. Imbu-, isolation and meaningful professional development were the three that teachers said that they had for the barriers to success.

I would add, and this is really non-scientific. This is Jerry Wheeler. I would parental influence is an important one. When I went off to that Sputnik thing, my dad—I won’t tell you what he said because it was a little bit too colorful for

Capitol Hill, but he basically had me by the neck and said this is important and would claim that one of the major shifts between 1958 and 2005 is parental attitude toward their child’s getting a good Science/Math education. It even goes to what their whole image of what their school, should be. I don’t know how to solve that problem, but I would claim that’s one of the biggest issues.

DR. SELBY: I support everything Jerry said. But I would add, of course, something that the teachers themselves wouldn’t be in a position to "add, is. The scientific method is taught in an anonymous universal abstract mathematical application of
something. That it doesn’t matter who you~ are you
just have to have brains and that is what you come
out with if you look at most of the stuff.’

Changing
the attitude about that it’s a very human inquiry
and
that who you are matters .I mean that desperately
seriously for the diversity issue.

If we could understand -if women have
a
different cultural upbringing than men, then we

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some different we’ll ask our questions maybe
differently. If southern ‘Afro American have a
different perspective than Boston Kfro Americans,
they’ll answer the question ‘different and science
will win out. Paleni said science is an
interrogation of nature, but nature can also
respond
in the way the question is asked. What I would
like
students to know the way they ask their question
and
everything they bring to it wrings the person in.
We’ve made science education so unattractive in
high
do
school and college I don’t know how we managed to

When I went to college it was the two
worlds. I was the only Physics major in
the class~

It’s almost still the same way because of the
perception of what Physics ‘is or the “perception that
it’s only brains that” count. I want to have it
understood that the whole person counts and that
The issue of time and professional development that is particularly true as you go to more hands on introducing these computer probes, and that is not an easy task, the individual teachers would be taking on a major effort in order to do that. They need help. They need support and they need time, but it can be done and it is being done.

DR. BEERING: Thank you.

Other comments from the panel?

DR. BOWEN: May I sort of follow-up. I appreciate your comments. I think there are real barriers there. Now the dilemma is how a’ commission could be tasked to sort of identify mechanisms which would somehow addresses those barriers and supersede those barriers for the benefit of the teachers and we need good ideas.

DR. WHEELER: If I could quickly comment, I think one example I gave was the post-Sputnik
summer institutes. I think the commission is going to have to say those did something, but now this is 200's and as a nation we can't afford to send all the

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1 science teachers back to the 'different universities
2 for summer programs. We didn't even do it then. We
3 sent the junkies. I was one of the junkies who
4 eventually went back for a number of things, but we
5 need to say, all right, this is what we want to have
6 happen. That's why I tried to pick out the
7 strategies. But now we have to get very creative on
8 how we do that. We can't revert back to 1959
9 solutions for the 2005 problem.

DR. SELBY: Can we ask why we can't afford it?

DR. BEERING: We can afford it. We make
up our minds to do it we can do it.

-DR. WHEELER: We can afford to solve the
problem, but there are different ways of solving
the

DR. BEERING: Thank you very much indeed.

We will now invite another 'group of five
panelists to take your seats up front.

(Pause.)

DR. BEERING: Let me thank you for coming forward so quickly. I think we're all set. I'd like

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to ask Mary Vermeer Andringa to kick us off.

MS. ANDRINGA: Thank you very much.

It's indeed an honor to be able to share a little
perspective from the heartland, 'from the State of
Iowa from an employer of a workforce..

Our company, Vermeer was started 57
7 years ago. We’re still privately held. We have 2000 employees. We have been able to bring many firsts to the marketplace,’ such as mechanical stump grinder to grin up a stump instead of burning it or pulling it out with a chain, a one-person hay bail system. My father invented the first round hay bailer and we have lead the country in bringing horizontal 2.4 directional drills as a mechanism to put in fiber cable, water, sewer lines without disturbing the surface. You can go from the street to a house without any open cut. You can also go a mile out using these machines. So there’s quite a bit of technology involved.

Through the years, we have always emphasized looking for new, innovative, safe, productive kinds of equipment. So this past year – we just finished our fiscal year – 4% percent of our volume was related to products which were developed within the last four years. Some of those were new modifications, but some were entirely new lines. So our need for good engineering and good manufacturing skills is very, very important.

A recent report called “The Skills Gap” which was released by the National Association of Manufacturers stated a few things and I’d like to just relate some of these key findings with ‘what’s a reality in our company in Iowa. – One is that we
are all experiencing an overall shortage of qualified worker, design engineers and CNC or Computer Numeric

 Controlled operators are our hardest people to ‘f-i-

 Design engineers .we have about 200 people in Engineering, but about 100 people who are design or

 product engineers. We will have those openings often .

 for at least an average of four months compared a marketing person whom we can usually ‘find in about

 two months. So it shows that there’s a defini’te skill shortage.

 Also, on CNC type machine operators

 1 anywhere from six’ to seven weeks to find good people

 2 even though we hire every graduate that ‘comes out of

 3 the community colleges that we can find. ‘That’s a

 4 little bit to the skill shortage. What about the

 5 level of people coming in as current employees? ‘We’

 6 find that we have to do quite a bit of math teaching

 7 on our premise because the people who come into

 8 production often don’t have the necessary skills,

 9 even just decimals, fractions, metrics. For

 10 instance, many years ago we could not find enough

 11 welders. We established our own two-week lab that
put over 150 people through in a year with a 6 to 1 ratio of instructor and student. With that, we found that we really had to put a three-hour math module into that because, again, these people are just not understanding enough about Math even though we really a very good educational system in the State of Iowa.

We also have found that in trying to attract and retain people one of the things which we’ve tried to emphasize a lot is to offer internships for high school and college students. They may be children of our employees, but they may

be just area young people. What is good I think it’s this last summer we had 25 interns. Fifteen of them were either engineers, working engineering or the finance or accounting area. We believe that really helps them look more to Engineering or Math as a career going forward. So we really try to support that.

Another opportunity, and—maybe this is just an example of something we tried to do on a very small scale, but would be great if it could be upscaled is that through our foundation we have hosted for many years multiple scholarships for students. But maybe even a little bit more to speak to this idea ‘workshops for teachers K through 12 and week-long workshops focusing on Math and Science’
to help, them go back into the classroom arid be’
more effective and have more energy.
A recent project that has just been
established in the State of Iowa in an 11-county
area is called “Project Semi.” It’s really a large
science lab which moves from school to school in
the 11 counties for week-long opportunities, for
young people to get into a lab which has the latest
technology and the teachers have been previously been
trained in order to be able to use the lab most
effectively. Again, a way to help both the teachers,
who many in the State of Iowa teaching Science at
best have a minor in Science -they do not have a
major to help them be more energized in their
professional development as was mentioned earlier;
but also to really inspire the students for the
careers that can happen in Science, Math and
Engineering. ‘Those were just a few of the ideas.

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1 people to get into a lab which has the latest.
2 technology and the teachers have been previously been
3 trained in order to be able to use the lab most
4 effectively. Again, a way to help both the teachers,
5 who many in the State of Iowa teaching Science at
6 best have a minor in Science -they do not have a
7 major to help them be more energized in their
8 professional development as was mentioned earlier;
9 but also to really inspire the students for the
careers that can happen in Science, Math and
10 Engineering. ‘Those were just a few of the ideas.
11 A couple of your questions early on were,
12 first of all, why hasn’t more been done since 1983?
13 I really believe that the fact that you need a crisis
14 often to make something happen and the crisis of
15 Sputnik was part of my generation growing up in the
16 late ‘60s. But today, and I know this maybe overly
17 dramatic, but as Thomas Friedman in “The World is
18 Flat” said when he grew up his mother said to him eat
19 your dinner because there are children in India
20 starving. I remember hearing that when I grew up.
21 Today he said I need to tell my daughters do your

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homework because children in India and China are
starving for your jobs.

I think we just need to wake up and say, even though we may be helping the countries around the world raise their level of quality of life, which I think is very important, we still want to stay as the leader in innovation in this country and we can do it if we put the emphasis back in the schools and the leader in innovation in this country and we can do it if we put the emphasis back in the schools and industries, universities, community colleges, local governments in really focusing on things like scholarships for Math and Science, workshops for teachers, other kinds of opportunities that we can work together with.

I really think there’s a lot of funding out there that’s in the corporations who would love to be able to collaborate with the local schools, with the universities in focusing on the things that matter most for our country and for our businesses and for our young people.

Another thing which I think we can never lose sight of is we who are employers, I think 1 million people, are employed and many of us in manufacturing. We have a group of employees who do listen to us and would help focus on this message. They have children in the K through 12 school system. In a lot of ways we have some great opportunities for communication. I don’t think I’m enough of ‘an
at all to say what should happen with the National Science Foundation and if there should be another commission, but I do totally agree with all the statements that there need to be actual plans; I believe any plan that’s effective is well communicated. Mostly, I think we need a good communication plan on this to then get things rolling.

A plan needs to be updated regularly and then that needs to be communicated. And I think if we do that we can be successful. Thank you.

DR. PEERING: Thank you very much. Do you have room to hire some of those interns you have every summer?

MS. ANDRINGA: “Absolutely. We hire almost every one we can.”

DR. PEERING: Do you really? Congratulations.

Next is Albert Berkeley. Albert?

MR. BERKELEY: Than you very much for having me. I need to say at the beginning of this that these views are my own, not the views of any federal agency.

I got involved in this education issue quite by accident. I’m not an educators—I have enormous respect for the educators I’ve been working with in the last 10 years. But I got involved when Andy Grove at Intel called me up while I was president of the NASDAQ stock market ‘and said we have
to do something about H1(b) visas. Being totally
naive I said why? Why don’t we grow our own? He
proceeded to educate me on the supply and demand
they were facing in the semi-conductor business.
what I would like to do, reflectin~ the
fact that I’m not an educator, is talk- about this
problem from the vocabulary of business. Each
industry has its own business. My wife, who is an
educator, hates it when I talk-about’ the
education industry, but I’m going to intentionally do that.
I want to change the paradigm a little bit and
change the vocabulary because I think the caidron of
competition which the business community is
engaged in and has ‘been engaged in for a longtime
includes an awful lot of training. We trained a lot of
people at NASDAQ. We ran a huge educational program at
the National Association of Securities’ Dealers
training and licensing 700,000 stock brokers,, for example.
We learned a lot about the education process and the
quality of instruction that we needed to delivery
and we didn’t use much of the vocabulary of education.
So bear with me, if’ you ~will, and l’et me talk
about this issue in a slightly differentdimension.
We talk about what’s the unit of
output.
What are we trying to produce? I view education as
an input to our other industries where the
products that has to hold-up in a globally competitive
What are the inputs? What are the conversions processes? Where’s the value added? What are, the best practices? Is there a bill of materials? What sequence should be done on the manufacturing line very similar to the sequencing issue that Vern Ehlers developed. What parts ne’ed to be assembled as sub assemblies, which is another part of the sequencing issue? How do errors enter the system and how much rework should be done and where ‘is it done? What’s the quality control process? Where are the economies of scale? What is the role of specialized labor? Where do you put specialization of labor into this process? One of my observations from my wife’s efforts in inner-city Baltimore is that most of the teachers are expected to be generalists. That’s exactly opposite what you see happening in business where people are more and more specialized. I’ll talk a little bit more about that in a second. I think unless these issues are dealt with in education we’re not going to move the ball forward. I think that education is going to become a scapegoat for the impending problem on the door now that was so conveniently packe,d away and ignored for the last 20 or 30 years.
The question you all asked us in your e-mail inviting us to come I think was exactly the right one. Why haven’t the previous recommendations work? I think they didn’t work because of the very human reaction was I don’t see that elephant here right now. I’ll just keep on doing what I was doing.

Well, the elephant’s here with the General Motors financial situation, the Delphi bankruptcy, the airline industry problems. We can, in fact, innovate our way out of this.

I met with the head of the Education Ministry in Singapore a while back and was impressed with all the things they’ve done, but most impressed with the fact that they started out 50 years ago with 250,000 people and they raised the standard of living from a rock in a swamp to one of the highest standards of living in the world basically on the back of education.

As painful as it is to talk about education in these tough terms, let me continue that for a moment. Let me give you a series of analogies. The first analogy I want to talk about is focus. I notice in my wife’s school—she manages three schools in inner-city Baltimore—that have been basically been the bottom of the barrel schools.
are allowed' to in a crisis remedial situation in schools that have failed to focus on a few things that count like' reading, writing, adding and subtracting and they don't let a child move forward into other courses until they have mastered those few things that matter in the focus.

I think one of the things that the National Science Foundation could do would be to address the issue -of scope. Why do we have this deep, mild wide attitude of what a child should know? We’re actually not expecting them to know’ ‘this broad, liberal education which would be wonderful at the end of college. We’re trying to train them how to think and educate themselves, so why are we giving them a smattering of this and a smattering of that instead of driving deep and narrow into a topic where they come out of it with real mastery and with the confidence that they can know how to think and learn through that mastery? The second issue or analogy that I’d like to bring about is how we organize the work flow in education. In business the way’you organize the process of getting your work done is the essence’of your business model. We organize around grade
and ages in schools, but when we train people in
the
NASD or businesses that I’m associated with we
train
them according to how much they already know; We
and
group them around what they’ve already mastered
and
we move them forward in those groups. I think the
way we segment the market to be educated is wrong
in
our educational system. It has “great” potential
Changing
the outcome quite a lot.
control
The third analogy is the quality
control
mentioned a moment ago. The Japanese taught us to
end
stop examining a product when it filled off the
control
process back into the individual worker. I’m sure
in
you’ve all read articles where individual workers
1 many factories are empowered to stop the assembly
2 line if there’s something wrong with a part that’s
3 coming through their station. That’s where you take
4 a child who’s falling behind and make them master
5 that topic before they go ahead to the next.
topic.
6 Let’s don’t let the flaws compound until the end
of
the year or the end of 12 years. Let’s work the
flaw
at the moment it occurs and put that part again,
9 I’m using tough language here - put ‘that part back
10 in the factory to get fixed and up to 100 percent
11 presentable before' it goes to 'the next body of
knowledge that it needs to learn.

13 In business there are all sorts of step
14 functions. You have' to bake a loaf of bread for a
15 certain number of minutes at a certain temperature,
16 otherwise you get goo. I don’t know how many of
17 you’ve been in a bakery, but it’s really interesting
18 to see how precisely they control the length of time.

19. Well, what’s the analogy in education? I had the
20 privilege of sitting with Commissioner Hannay when
21 she was running the Food and Drug Administration. We
22 sat and talked about how many repetitions does it

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1 take for a, human being to build in short-term
memoty
2 and long-term memory, and she’s a neuro-
bicologist,, :l
3 think, and she told me, well, it takes 30 to 300
4 repetitions to build long-term memory ‘physically into
5 your brain.
6 One of the comments that we made :this
7 was the session at Georgetown University :one of
8 the comments which came up in the course of that
9 session was’ that we have a lot of cu/ti’culum and
10 a
11 lot of education that will give a student€ 15 or
12 not repetitions and think they’Ve done it. T’hey have

baked the bread. There hasn’t been enough heat. ..
13 There hasn’t been enough time and you’re not
14 goi9g-t6

14’,~ get the product you want. -You ha’ie to
15 recognize the
16 physics, the physiology, the neuro--bioiogy under
17 their learning process to get enough repetitions

in
17 there to make that work. So there’s this’ issue of
18 minimum levels of work to get the product done.
Next, I want to talk a little bit about the standards. Standards are all about who you compare yourself to. We are idiots to compare ourselves to each other unless one of us is the best in the world in that particular topic. We must stop this, and this is a great opportunity ‘for the NSF to stop this feel-good comparisons to ‘the school down the street. We have to compare ourselves to the relevant international competitor who’s taking the job off the General Motors workers table.

The next analogy is the issue of whether business is fundamentally a science or fundamentally an art. I will say to you in conversations, ‘there’s always this interest in making it ‘into a creative art, but I happen to have friends in Hollywood who are working hard to make their creative business into a predictable reproductable science and I’m impressed with what they’ve learned about human psychology and what it takes to entertain a person and how you make that happen and there is an underlying science to it. This is the research issue. I think we’ve-paid lip service to research, but we haven’t actually engaged research in the education industry to the extent we should.
The seventh analogy I want to talk about

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is the one I referred to first, which is the specialization of labor. It makes no sense to ask each teacher to write their own lesson plans and present it each year. You do not benefit from any of the business concepts of experienced curves. You don’t develop economies of scale and you don’t develop the benefits of specialization of labor.

In Hollywood we honor a playwright and we honor the actor and actress who delivers that script extremely well; We don’t hold either one of them as being above the other. Why do we require our teachers to be actors and actresses to deliver the script they write? They’re never going to get that script as good as somebody who can focus on what pieces of information should be learned and in what order.

The next to the last area I want to go into concerns the way we govern education. We look at education as a political process, sort of a democratic corporation with a school ‘board. What we’re finding through the corporate side is that really makes governance improve and makes the
1 operation improve from governance is transparency.

2 We are blessed in this country by the series of laws that were passed in the 1930s which bring enormous transparency to corporations in the United States a lot more than the managers would like some times, but to the overall benefit of the corporation and country.

8 I believe that substantially more transparency would help in education and the National Science Foundation is uniquely positioned to do that.

11 There are three specific issues I rebónithend. One i~

12 that we make the bodies of knowledge that students are expected to know and the sequence in which they’re expected to learn them are readily transparent to students and teachers using the technology of the web.

17. Secondly, having told students what they’re expected to know, give them easy access to low-risk, self-testing mechanisms. -John Engler, former governor of Michigan, is running the National Association of Manufacturers. They have the GEMS test, which you all paid for, up and running on the
Bill Schmidt from Michigan helped get that up.
Dick Atkinson, when he was president of the University of California System loaned statisticians and programmers to put coefficient engines in some of those random questions to make an infinite number of random questions available of the same difficulty. That is low-risk, self-testing.

We've had two million or more students come in and test themselves against what they actually know against students their age in 40 countries...

Powerful, powerful concept.

The third transparency the National Science Foundation could undertake is to show the standards, state-by-state, comparatively and show this incredible variation in what one state thinks is an A and another state thinks is an A. ‘What one state thinks is necessary and what another state thinks is necessary. Parents would not put up with it if they understood what the states with the poor standards think. This requires trusting the citizenry, but I do. And I think we would get the same kind of improvements in education that we’ve had in corporate governance if we had more transparency in education.

The last area I want to talk about, ‘the’ last analogy I want to make is to automation. There’s a lot of effort in business to understand what should be automated, when it should be automated, how it should be automated. Everyone goes in education to automating the core function of the teacher. Business did not automate that way. Business automated all of the ancillary back office functions ‘first. It’s only lately that’ We’ve begun automating the core business of the markets, for
example. We first automated all the accounting functions in the brokerage firms long before we did the core automation. I would suggest to you that we aggressively automate, but that we do these ancillary things like transparency before we try to get to those core functions.

Thank you very much.

DR. BEERING: Thank you very much.

When we print our science and education indicators in a few months, you will enjoy reading the comparison of the 50 states of the United States. Then you’ll be depressed about how bad things really are. But we have a ‘lot of information there which ought to help policy makers.

Next, Ray Cline, Vice President of Innovation and Integration at EDS.

DR. CLIME: Thank you, Mr. Chairman. We would like to thank the Board for this opportunity to provide input into the reconstitution of the commission. I have prepared statement which I’ll forward to the Board, but in this period of time I’ll try and tailor those to the time available.

As the father of three children attending middle school, high school and college, I have a personal interest in the topic of K through 16
As a member of the Dean’s Leadership Board for the Cullen College of Engineering at the University of Houston and a formerly trained scientist, I have responsibility to improve the excellence of our U.S. technology community. And as an executive with EDS, a technology company who’s built its business based on a team of deeply knowledgeable and skilled scientists, mathematicians and engineers, we are keenly interested in and have a professional responsibility to nourish and groom our students to ensure the best workforce for the future;

We’re not here today to provide any detailed data. As mentioned earlier, I think you have a lot of that. But rather offer a few insights for your consideration and we begin with three—simply ideas. The practice of Science and Engineering is not a multiple choice test. The practice of Science and Engineering is fundamentally an interdisciplinary approach to solving problems. The practice of Science and Engineering in the commercial world is a social team-oriented process. These points taken at face value may appear obvious. Let’s look at each one of them in slightly more detail.

In problem-solving, the statement of the problem may suggest methods for its solution, but it seldom prescribes the method used to find the solution. In practice, we are seldom given a problem
and simultaneously told how to solve it. Contrast this to the way that science is primarily taught in our schools. The Board’s on Scierice ‘and’ Engineering Indicators 2004 report points out that only abOut 20 percent of math students were asked to work on problems -with no obvious method -of solution on a regular basis.

My own interest-in science wa-s greatly enhanced by the inventive teaching approach of my high school Chemistry and Physics teache-r, Mr. Larry Scheer. Mr. Scheer would often dedicate ciassrodm discussions to truly unsolvable problems, such as if you had just discovered the cure to all ai’sea-se, what would you do with it? ‘During’the discussion he.-would challenge students to explore consequence~ and ‘the’ viabilities of the alternatives that we proposed. This often allowed discussion to wander; taking us into areas not immediately evident’, creating an environment where the path to Solving th~ problem was as important as the’ outcome. The result was- a” hunger for learning and an appreciation for thinking beyond the tests.

In solving problems, assembling a team with diverse experiences and disc±~l~ne can’ -bring unconventional- solutions to the table’; In the “Ten Face,s of Innovation” Tom Kelly explores the di’~erse roles involved in problem-solvin~ based on .

In solving problems, assembling a team with diverse experiences and disc±~l~ne can’ -bring unconventional- solutions to the table’; In the “Ten Face,s of Innovation” Tom Kelly explores the di’~erse roles involved in problem-solvin~ based on experience from the commercial innovation work thEse diverse roles include not just the experimenter but the anthropologist, cross-pollinator hurdler, collaborator, director, experienced architect, set designer, story teller and caregiver. These different -viewpoints of a problem help to provide a more complete de~inition and.
extensive exploration that usually results in a better solution. Mr. Scheer would often challenge his students with unstructured problems such as design an experiment to measure the speed of sound.

Our lab team accomplished this by measuring the difference between the sight of cymbals crashing and the arrival of, the sound across the length of three football fields. The solution was inspired by the fact that one member of our lab team as a percussionist in the high school band.

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Now to the social nature of Science and Engineering, a focus on learning and practicing prescribed methods for solving science and engineering problems as is often the case in our schools can result in less team-oriented activities and more individual drill as evidenced by the often, dreaded math homework ritual that transpires between parents and their teenagers.

As a technology executive I always hoped to be on the forefront of change. Needless to say, I was a little surprised when I saw a recent headline reading “E-mail is for old people.” I guess I’m old people, but that headline points out a ‘broader trend. The use of text-messaging and chat rooms as a trend evidenced for the Board’s 2004 indicators. The use of internet chat rooms dramatically increases in the pre-teen and teenage groups, perhaps not coincidentally the same age as when our STEM performance begins to fall behind the rest of the world. ...

We do not suggest that there is a cause and effect relationship between increases-in the use
of text messaging and chat rooms with lower relative performance in STEM, merely that the increased -use--of

the internet for chat rooms is a manifestation of the

fact that pre-teens and teenagers -are very social beings. This social behavior is consistent- with the way that we expect scientists and engineers-to work,

in the commercial environment. -If STEM education

does not provide a social environment for young people, their interest will turn to other subjeb’ts, topics and activities, which include social interaction.

EDS is a national corporate’ sporsar of -the Jason Project, an effort to enroll ‘virtual communities, middl-e_gr-ade student-- afld real time disciplinary scientific expeditions directed by leading scientists. Students not only get to participate in the scientific expedition, but they become part of a social network o-f the virtual community that’s participating in the expedition. Perhaps we can better use teen problem-solving and exploration approaches to leverage the natural social nature of teenagers in ways that keep them actively engaged in the STEM learning process.

We hope these rather simple points ‘might suggest some alternatives that could be explored -by a reconstituted commission. At EDS’ ‘we recognize the need to create opportunities for ‘an unstructured problem-solving through teams that bring unique ski-il pets to the discussion. .. In addition to the Jason Project, we are a regional and national project of the future city.
competition, a middle school educational outreach program designed to foster interest in Technology and Engineering by challenging teams of students to design, simulate, model and defend their proposals for novel cities. Students have the benefit of working with new simulation and working with new simulation technologies under the advisement of personal and team mentors throughout the program to solve the complex, open-ended challenge of designing complete cities from scratch. Teams must explore the design challenge from diverse perspectives while investing a level of effort that provides a strong social interaction within the team.

EDS also sponsors technology grant

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DR. BEERING: Thank you very much indeed.

Next, we have William Archey, president and CEO of American Electronics Association.
MR. ARCHEY: Thank you, Mr-- Chairman.

I represent the American Electronics Association, actually known as AEA. We’ve gone to our acronym. We’re the--largest high-tech trade association in the country with about 3000-member companies started by David Packard in 1943. The legend was that David Packard founded us because of the fact that he felt that the- incipient high-tech industry needed to have civic responsibilities that would, be played out through this organization.

The reality is that David Packard and of his suppliers got together because’ they thought they were getting the short end of the stick on government c--nts in 1943. That was the reason why AEA was originally organLzed. To some degree, I have a feeling of a famous comment by George Gobel “Did you ever stop to think the wold is a tuxedo and you’re a pair of brown shoes?” I have a feeling with all of these experts on education I don’t pretend to be an expert on education.

What we have done is nine month ago we issued a report called “Losing the Competitive Advantage -- the Challenge for Science and Technology in the United States.” We think -it had a rather significant contribution to the debate here in Washington about what those challenges are. I ~Ould
also note to you that although I think to some degree they are correct. Terry Boehiert and Vern Ehiers were talking about the fact that they've had enough reports. I think that's probably about right, but nine months ago if you were to raise the issue of competitiveness as a major challenge fading this country you weren't going to get an awful lot of listeners or an awful lot of takers.

It's amazing what has happened in the nine-month period of time. I think we've got ways to go, even within official Washington. It's ter'ri're's of driving home what those challenges are before real action is going to get taken.

The second thing I would just note to you is that we're a little different organization in that we're organized actually 'from the local 'level up. While we're in Washington, we're not of Washington. We have 17 local councils throughout the United

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States of local, high-tech executives with full-time staffs. One of the things we're embarking on, in fact, embarking on it next week and proceeds from a couple of calls I had this morning without San Diego Council and our Dallas Council. We're going to take our paper on "Losing the Competitive Advantage" and we're going to translate that or already have translated it into a PowerPoint presentation for local high-tech executives to go out to local school committees, to parent groups and teacher groups, not to talk about what the changes in the curriculum should be because I don't think we can pretend to be able to say what that should be, but rather to present the larger context - of what's going-on in the rest of the world and why you should be concerned about that as a parent or a teacher in terms of the kids, in terms of the grandkids.

It could have a profound effect of their standard of living and all other aspects.
So we’re going to start this in three of our councils. We’re going to do it in about 9 or 10 between now and the Christmas holiday.

1 interesting thing that we find, and these request to do this have come from our companies, a lot of our companies are doing a lot of work locally in terms of particularly the emphasis on why is a high-tech job exciting, conveying that and conveying what you need to know in your class to have one of those jobs. We do an annual study called “Cyberstates” that takes a look at all 50 states in terms of high-tech jobs. It includes the number of jobs, salaries and the difference between those salaries and those of the rest of the private sector. This is not survey data. Our report that came out a few months ago noted that nationwide the high-tech industry pays 84 percent higher than the rest of the private sector” combined in terms of all those jobs. Most kids are not aware of that. What our executives have said to me is we need to take those challenges and convey those to people at the local level because they still don’t get it. There is not a sense of urgency about why Math and Science education reform, but rather to be driven by what is going on in India.- What is going on in China? I’ve always contended - most of my professional background is in the international area - there is no more insular country in the developed world than the U-nited States, and I’ve said
6 this in front of another panel about a week ago.

7 I grew up in Pittsfield, Massachusetts

8 where the school committee was possibly interested in

9 what was going on in Lanesboro, which was the

10 contiguous town. But the idea of -being interested- ‘in

11 what was going in Springfield was too farfetchEd. I

12 think one of the things we’re going to try to do.

13 it’s not a panacea. It’s not a big magic bullet.

14, .But what we’-re going to try to do —i-s convey and

15 express urgency about what the challengE is, not per

16 say in the United States but in the rest of the world

17 with the hope that- i-n some instances; nOt in all,

18 people might wake up to the fact that idea of

19 educational reform, quad-educational reform has to go

20 out the -window. There’s a real series of reasons why

21 educational reform and it’s impact on, indeed, their

22 progeny.
On that note, thank you very much.

DR. BEERING: Thank you indeed.

I had an aunt in Boston who lived in Maiden and she took a trip abroad and was asked by her neighbor how she went and she said via Melrose.

(Laughter.)

DR. BEERING: Same problem.

Ron Bullock will complete our panel.

MR. BULLOCK: Thanks. Ron Bullock, CEO of Bison Gear and Engineering, a manufacturer employing 200 and we make electric motors and gear motors incorporated into a wide variety of applications, commercial restaurant equipment, medical equipment, packaging machines, and machine tools to name a few.

One in seven of our associates has an engineering diploma. We run a customer centric model of operational excellence with a strong emphasis on innovation.
In looking at the questions posed by this panel, it seems we’ve had many Paul Reveres warning about the importance of K through 16 Science, Technology, Engineering and Mathematics education to the competitiveness and security of our country.

The quantity and quality of the output of our educational system in STEM needs to be dramatically improved or we risk losing our standard of living and ultimately our national security. It’s not something that’s developed in the past few years, but has been decades in the making. It’s complicated by poor changing demographics.

The modern day Paul Revere would probably be shouting the Chinese are coming and the boomers are going. I’ll focus on that and K through 16 to support the STEM gap-in the workplace with the suggestion we incorporate our community college system as part of the solution:

Some key trends we see in business community are the worker gap. It’s been growing that. That growth is over. The native-born workforce grew 44 percent over the last 20 years. It’ll grow by zero percent over the next 20 years. Stagnation of educational achievement “has been documented. The demand for skill workers outpaces supply.

My colleague, Maty Anne Andringa described...
that eloquently. We’ve got the global race and our international competitors are gaining significant ground. We have the adult workforce challenge. Even if efforts to improve K through ’12 are fully successful, our competitiveness is going to be crippled by the low education levels in the workforce 18 to 34 years old in the Year 2005. Our competitive weakness is concentrated in the population age 25 through 34. The OECD survey of 30 industrialized nations report that the U.S. ranks No. 1 in adults 45 through 65 with a high school diploma percentage-wise. We rank No. 5 for adults 35 to 44 and we are dropping off to No. 10 in adults 25 to 34, an indictment of our educational system if I ever heard one.

The bedrock grades, K-through 12, is largely controlled by parents, local communities and state boards of education. I think we need to win this war state by state but under a unified game plan.

Let me relate some personal experience we’ve had in hiring high school graduates. After-I bought my company in 1987, via an LBO, We used a Sharp math test to access candidate’s minimum proficiency in Mathematics to work in our manufacturing operations. Fifty percent of kids with a high school diploma could not get a passing score on math basics that should have been mastered by the time they were out of eighth grade.

I contacted the superintendent of the Downers Grove School System. Together we arranged for a meeting with his department heads for Science Technology and Mathematics and began a collaborative
effort that started with three-week paid summer internships for teachers in our high-tech manufacturing facility, with reports to me on how I spent my summer vacation at Bison Gear. Those three weeks consisted of two weeks rotated through our functional areas and a week focused on problem-solving initiatives such as statistical process controls.

In their reports one theme was recurrent. We garnered some great experiences on how to teach Math, Science and Technology by how it’s applied in industry and we became more effective in the classroom. This resulted in a program that we developed called ITAPS, Integrated Technology Algebra and Physical Science, targeted at non-college prep students at the freshman and sophomore levels. We enrolled two classes of 60 students each taught by teams of teachers from the three departments. We donated 60 sets of parts, drawings and mike’s, had our engineers assist in curriculum development with an emphasis on applications, made classroom visits and
helped them plan tours for both classes. The net result test scores for these students of Applied Science and Mathematics improved to the level of their college-bound peers and, they gained knowledge of attractive careers in manufacturing.

We’ve seen the same sort of thing in our Returning to Learning program that we initiated at our company. We pay for any of our associates work related two-year degree and we have loan programs for bachelor and advanced degrees. We see people as a result of making this investment in education and we make sure that we treat our people right and our retention rates benchmark well against anyone.

As far as key transition points, I feel we need to start with students developing Science and Algebra skills in the sixth grade, make a special effort to expose them to change-the-world career tracks using their STEM education early in high school.
7 school. Both Mary and I are directors with the

8 National Association of Manufacturers and the

9 Manufacturing Institute. Our 501(c) (3) has

10 prototyped an approach with their Dream It, Do-It.
11 program in Kansas City and is read~r to roll it out to
12 other major metropolitan areas.

13 Parental education is also a key here and
14 I’d strongly recommend we -do some research to develop
15 the best approach in marketing the message

16 communication .how we communicate. This is very
17 important. I graduated from Wright State University
18 and I’d like to point out a couple of innovative .
19 programs they have done. The Wright Step program has
20 a mission to enhance the development and education of
21 youth under-represented in the fields of Engineering,

22 Science and Math. Forty student-s are ‘enrolled .
annually, starting in the seventh grade, out-of the

Dayton Public’ Schools. They continue on as a sumther

program, which they complete in the tenth grade.

Upon successful completion, they are awarded a full four-year scholarship to WSU. During

the first eight years out 320 students, 162 enrolled.

We’re seeing a graduation rate of about 60 percent

and about half of those receive degrees’ in

Engineering or science-related fields. It’s a great

program that provides engineers and scientists ‘from a

slice of the population not often -contributing young

people to this type of career path.

We also have a program once students get

into college called -E~R 101 and we attack the

freshman Calculus sink, which flushes out about 58

percent of the perspective students and I’ll get to

that later. We’ve improved our success rate in

retaining Engineering students to 74 percent.
19 Another innovative program that we can learn from

20 that I’d recommend we take a look at.

21 There are some policy recommendations that

22 I’ve added that are appended here, just looking at

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1 time. But I’d like to encourage us to look at

2 community colleges, set up accountability standards,

3 financial aide policies in support of adult learners

4 and working students. Look at making community

5 college more affordable and improving the quality of

6 it and we have to address remedial education as the

7 first step in skills development. In the United

8 States today 90 million adults over ‘25 have’ no post-

9 secondary education, 36 million did not graduate ‘from

10 high school, 52 million have only high’school

11 credentials So we need to do some things here.

12 These are policy recommendations that the National

13 Association of Manufacturers is fully committed to

14 supporting and we’d like to work with the National

15 Science Foundation and the National Science Board in

16 implementing them. We have 15 million workers here

17 in the United States that make things in America and

18 we work hard on making sure they’re registered voters

19 as well.

20 Finally, as leaders we need to mount the

21 bully pulpit and articulate some audacious, goals to

22 get our nations behind these efforts ala John F.

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1 Kennedy and his chall’~i–ge to put a man on the moon by

2 the end of the decade in the ‘EOs. ‘Let’s dream it
3 and let's do it.

DR. BEERING: Thank you very much indeed.

We'll now turn to our Board members for questions. Warren?

DR. WASHINGTON: I have a question for you. I noticed that some of you have attended this innovation conference. That was yesterday. I'm impressed with many of the individual programs that you're doing. I think industry is stepping up to helping out in this problem.

The question I have is why is it so difficult to sort of get the federal government to start to step up to making this a national imperative? I heard the congressmen this morning talking about that we need to do a lot more, but we can't seem to really break through at this point.

For example, substantially increasing the education budget in the National Science Foundation, trying to put more national federal funding into trying to address some of these problems, helping out the
1 states and helping out school districts.

2 MR. ARCHEY: I think some of the problems-

3 with that is that contrary to what some people are

4 talking about everybody knows what the problem is.

5 don’t share, quite frankly, that belief. Certainly,

6 if they know what the problem is, they don’t sense

7 the urgency of the problem.

8 The second issue is I think that we go

9 against something else that goes on. There really- i-

10 an attitude in, this, country, and I- would argue in.

11 official Washington, that America being No. 1.

12 economically and technologically is a God-given right

13 and we don’t have to worry about anything else; it’s

14 a given. Therefore, paying-attention to what’s going

15 on in the rest of the world isn’t so necessary. The-

16 idea that increasing the NSF budget or increasing R&D

17 generally and things like that, well, it’s a nice
thing to do but how important is that really?

That’s, where I disagree with some people

in the Congress because I’ve briefed 86 members of

the Congress in the last six months. You’d be amazed

at how few of them have any idea of what the hell is

going on in the rest of the world. That’s what I

think is still lacking. There’s been a lot of

reports, including ours, that talk about we need Son

of Sputnik even if we have to create it. I still

think that’s the case.

DR. BEERING: Other comments?

MR. BULLOCK: We did have five cabinet

secretaries in the breakout sessions yesterday.

There’s reluctance, I think, overall to invest in

things that have long-term payback. We have a short-term mentality here in the
United States that tends
12 to get supported by our publicly-traded companies.
13 The most important thing is how they make their
14 latest quarter, but we are committed. We ‘had 50
15 business leaders there along with 20 heads of-
16 ‘universities. We’re committed to -communicate this~
17 I met with the chief of sta’ff of my
18 congressman, Dennis Hastert this morning to get the
19 dialogue started. We’ve invited him to come into our
20 plant to talk about-this. We need to communicate. A
21 communications plan about this is very important.
22 DR. BEERING:-: Yes, sir?.

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1 MR. BERKELEY: I completely agree with
2 what Mr. Bullock said, but I think-there’s a
3 different path that you could’take that would help a
4 lot. That is -to stop looking at the existing
5' hierarchial authorities to change.’ They have many
6 vested interests for not changing. I have enormous
7 faith in the common sense of parents and students of
8 local people when they have access to information and
9 it’s accurate and it is telling and there is a path
10 for change. I ‘don’t believe that this large set- of’
11 interlocking interest that we have now is attackable’
12 from the top or the side. I think it I’ns’to come up
13 from the bottom.
14 , I think that t,heNAM ‘self-testing ¿oftware”
15 that they have that John Engler has called .
16 called “Get Smarter!’ which took your $100 million
17 investment in the third national Math and Science
18 survey and simply put it on the web to allow students
19 to know what they know versus their peers in ‘those
20 countries. That model, the’ National Sciende
21 Foundation could put up -self-testing modules in every
subject that matters. You could avoid the

interpretation, the averaging, the excluding of
certain types of people -all- the-overly
-sophisticated academic, purity that goes into judging
us versus us and let individual students and -families
know where they’re standing on an international ‘scale’
or on a national scale, and they would not put ‘up’
with the problems we’ve been talking about today. So...
I invite you to bring real democracy to this proceed~.

DR. BEERING: Other-comment~?

- (No response.) -
DR. BEERING: We’ve kept within the...

particularLy Dr. Selby mentioned that. Let me remind
you of something that happened 2400 years ago. Two...
parents were talking about the future of their...
children. One was the king of Macedonia. One was a
doctor named Nichomachus. The two youngster we have
Aristotle and Alexander and they decided that they...
would bring these two youngsters in the attention of
some ~ Socrates and Plato.

You know what those two youngsters did. They

collected books. They founded scientific specimens.

They founded the first university in the Western
world, also the first library, which still exists~
an Alexandrian library and they gave us the term “academy” for what we today
consider to be a

6 distinguished institution of learning.

7 It started with a conversation between two

8 dads and they encouragement of two sons to go out and

9 make something of themselves. They all did well.

10 Our charge is to get our -kids to go out and make

11 something out of themselves, but we have to prepare

12 the groundwork for that. Our companion piece to our

13 Science and Engineering Indicators about to be

14 published speaks in nine short pages about the

15 challenge to America that we consider the most

16 pressing and we see that this most pressing challenge

17 is building a new foundation. We’re talking about K-

18 14, K-16. We very much appreciate your insights,

19 your personal examples, your personal testimony, your

20 practical experience that you’ve shared with us and I

21 guarantee you they will instruct our deliberations in
22 the future.

With that, I want to thank you for taking
2 time to be with us today. We’re adjourned.

(Whereupon, at 1:35 p.m., the above-
entitled matter was concluded.)