

**THE U.S. SCIENCE, ENGINEERING & TECHNOLOGY  
WORKFORCE OF THE FUTURE**  
*National Strategy, National Portfolio,  
National Resource Base*

**Proceedings of  
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**NATIONAL SCIENCE AND TECHNOLOGY COUNCIL  
COMMITTEE ON SCIENCE**

This document reflects the proceedings of a workshop organized by the Interagency Working Group on the U.S. Science and Technology Workforce of the Future, of the National Science and Technology Council, Committee on Science. This workshop, which included several panels totaling more than 60 national experts in science, mathematics, engineering and technology research, education and human resource development, was organized to provide advice to the Interagency Working Group. This document is not intended to reflect government policy.

A third and unavoidable recommendation consists of the needed revisions or updates of incentive structures to promote and sustain change in the right direction. Incentives are not limited to funding. They are found in a family, at school, in a university, and at public and private agencies and organizations. We do what is checked, valued, and rewarded. Southern University-Baton Rouge used this fact to establish formally systemic mentoring in all its science, mathematics and engineering departments in January 1997.

By some chance, some months ago I wrote a publication that seems to respond to much of the talk which happened yesterday, this morning and today at the lunch. This little publication states that earlier guidance pays off.

Having made that point, I would like to remake the statement that we have embarked on a journey. This is an exhilarating and challenging journey whose moving destination is to be reached continually. Hence, do I need to try to say everything here this afternoon? No, this is a journey just beginning.

There are few words more that I will say before I sit down. They have to do with the recommendations.

After we build partnerships for mentoring a single student or for a national program, let's be very careful to always remember to share the credit. Very often the ones who do the work do not create the problem.

It is some other who tries to talk about the beautiful job that this organization has done and forget the beautiful contribution this other actor also made.

The word incentive is my last recommendation. If you look at biological processes or evolution, you will see that changes have always been provoked and maintained by incentive structures, whether of a natural, social, or financial measure. For the contributions that we are trying to make, incentives are one item to which we must pay special attention. Thank you very much.

**DR. HRABOWSKI:** Next is William Velez, Professor of mathematics, University of Arizona.

**DR. VELEZ:** Good afternoon. I would like to talk about the role that faculty should be playing in encouraging our children to pursue scientific careers.

I am going to make my comments based on my experience as a mathematician at a research university.

I have been truly fortunate to be part of this community. The mathematics that have been developed over the last 20, 30, 40 years have been phenomenal, and we have made fundamental contributions to science. I am proud to be part of this community.

About these mathematicians who are hard working and deep in thought, I would like to ask you the following question: Do you think these researchers should take time out from their

busy schedules of research to actually mentor students? Yes.

When I received the Presidential Award for Mentoring, my department head thought this would be a wonderful excuse to address the faculty on the importance of mentoring, to show them some of the things that I had done in working with minority students. So, we organized a colloquium. We invited our 65 faculty members. Two people showed up.

Do you think that our busy faculty should really take time out from all the things they have to do to mentor our students?

It is not like we are doing so well. As I go around the country, I think it is embarrassing that I have more minority advisees than many departments have total math majors. We graduate more minority bachelor's degrees in mathematics than many departments graduate bachelor's degrees in mathematics.

I think we are in a crisis and we are having some problems, so we are here talking about mentoring and the importance of mentoring. I think that before we design mentoring workshops and programs and brochures and conferences, perhaps we should think a little bit about the culture of being a researcher at a university.

That is what I want to do first of all, and please forgive me for simply talking about myself. I want to emphasize the nature of this culture.

During my second or third year in graduate school, I had a

person ask me if I would work for them. This person suggested various problems to me. I felt completely independent in choosing one thing or another. I finally settled on a problem that I found fascinating. Within a year, I had thought of other problems. By the time I got my Ph.D., my thesis advisor and other faculty were working on my problems and publishing.

When I arrived at a university, I arrived with a research program. I had problems to work on, I had problems for my students to work on, and I had problems that interested other faculty. I was an independent researcher. This independence was not obtained because someone mentored me. In fact, I like to say that the only advice I got in college was bad advice.

Now, I don't think that I am that great. I pale in comparison to the accomplishments of my colleagues. But there is this sense of independence, which I think is tremendously important. I don't think our research faculty sees themselves as having gotten where they are today because someone mentored them. Now we are asking them to mentor students.

I think the belief system is that if a student needs mentoring, the student doesn't have enough independence and isn't going to make it in academia. There is a culture there, and this independence is tremendously important.

For example, when you apply for a research project at NSF,

these awards are called Individual Investigator Awards. You are free to do whatever you like. But, when we make an award, we are not making it to an individual. We are making it to the institution. We provide overhead. An award is not just to carry out research. It is actually to enhance the infrastructure of that university and to encourage students there to pursue scientific careers. But this is not the way it is viewed.

NSF talks about departments of the future, universities of the future, and institutions involved in the integration of research and education.

Maybe a research department in the future should have a varied portfolio of activities. Yes, it should be involved in research and scholarly activities. It should also be involved in innovative teaching practices, in mentoring, in outreach, and in service to the community.

I think that a research department should have this portfolio. So, this is my suggestion. We have to change the culture.

It is the federal agencies who have the power to urge our communities to change. I think when an investigator sends an application to a federal agency to support his or her research, the portfolio of the department should be part of that application. That application should indicate how the activities of that individual are going to dovetail with the activities of the department.

If we find the department is simply not interested in educating our children, well...

**DR. HRABOWSKI:**

Powerful suggestion and powerful presentation. I must say. Now Karan Watson, Associate Dean of Engineering, from Texas A&M.

**DR. WATSON:** I, too, am glad to be here.

I have a definition of mentoring I found. It says, "The art of mentoring begins when your imagination can fall in love with the fantasy of another. Then you provide the specialized knowledge as well as the lore and atmosphere of a tradition to help someone move toward their fantasy." It is very important to recognize that it is toward their fantasy and not our own.

Let me give two quick examples. I love to tell stories. I will do this very briefly. Both of these stories are by Jamie Sams.

One story is about a woman called Walks Tall Woman. Walks Tall Woman was a woman who lived with the people for a while, the water clan. They just accepted her and thought she was one of the normal women doing her daily tasks.

This tribe, this clan, often had a race. It was a foot race. Only men entered the race. One year Walks Tall Woman went to them and said she, too, would enter the race.

They scoffed at her. She entered that race and she won.

They asked her, "How did you do that?" She said, "I

learned every day in my daily tasks how I could run this race better. In every climate and every environment, I thought about how I could run this race better. Therefore, I knew, on the day of the race, that I could handle any environment that came to me."

The important thing about that story is that then the clanspeople, men and women, said, "Can you teach us this same lesson?" She did and they began to win more and more races in a lot of different ways.

Another story is a story about a woman called Sees Far Woman. This story is about an elderly woman who could take in and see the very life, the very soul, the essential flame in people.

One day a young man brought his sister to her. This young woman had been violated, had been raped. Sees Far Woman took this woman in and nurtured her to health physically, but her fire was still not there. However, Sees Far Woman could find the splinters of people's souls around in everyday places. As she walked around, she would help this woman to regain her soul, her very essence, her fire, back into her life. Not only would she find these pieces and give them back to the young woman, she taught the woman how to find the pieces herself. Soon, this young woman had constructed her life back together so well that they called her Star Fire, because her eternal flame was so bright.

I think both of these themes in these stories have to do with mentoring. Sometimes, as a mentor, what we are supposed to do is take somebody who has been crushed and doesn't even have the fantasy that they need to have, and help them find those splinters, and teach them how to find them themselves, until their flame is burning brightly again.

Sometimes our task is to take people who think they run pretty well in this race and teach them that they could even be better in this race.

I want to tell you that this cadre — represented here by a few, but there are more — could help in showing people how they can mentor students.

I think when we look at the culture, especially the culture in academia that we want to change, that we can mentor the people that we want to change. Systems don't change. Individuals do. There are processes and there are ways to take people through that very difficult process of changing their very culture; what they have come to believe in and understand.

Whether it is because they have so crushed their interest in seeing other people and other interests in society, or whether it is because they think they are doing all right and they just need to improve on it, I think we could provide a cadre that could help show people how to move through those changes.

**DR. HRABOWSKI:** I am going to be selfish and invite all these people to my campus to help me. Our next speaker is Guy Vickers, Executive Director of SECME.

**MR. VICKERS:** Good afternoon. It is a pleasure to be here. It is my pleasure to talk about something very dear to my heart, and that is the teachers, K-12 teachers with whom we work.

As mentioned, I am the Executive Director of SECME. I must mention that we just finished a wonderful 12-day summer institute at the University of Miami, where we had 253 K-12 teachers from around the country.

We also had 77 superintendents, math and science supervisors, for four days. We invited 200 middle school and high school winners of the Mouse Trap Car competition and Egg Drop and other mathematics and science competitions.

We also had approximately 80 industrial representatives, government agency representatives. Annie Whatley from the Department of Energy and others brought the numbers to about 700 people stressing the importance of K-12 education.

My emphasis in this short period of time will be to talk about mentoring teachers. We feel that by working with teachers, we can impact greater numbers of students. Working with teachers, I think we all agree, is one excellent way of impacting all children.