# Why Kern County needs a Science Center

By Nick Strobel, Professor of Astronomy at Bakersfield College

More specifically, why does Kern County need a science center that focuses on the earth and space sciences? What follows is an excerpt from a document on the science center components that some faculty at Bakersfield College were planning a few years ago. The reasons are still valid today.

## *Executive Summary*

The Science Center should focus on the earth and space sciences such as astronomy, geology, meteorology, oceanography, chemistry, and physics. No other center or facility in Kern County covers these areas.

The United States' economy is becoming ever-more dependent on science and technology-based industries and agriculture. Scientific discoveries lead to advances in technology. The demand for highly-skilled, science-literate workers in Kern County and in our country is great and will only continue to increase.

Because of the dependence on agriculture and oil, our local economy suffers from larger swings in employment rates and productivity than other parts of California. Vision 2020 and various economic development studies for Kern County and the City of Bakersfield have noted the need to attract new types of businesses to diversify our local economy, smooth out the economic fluctuations and improve the air quality. Five of seven "business clusters" identified in the Natelson report to be key to Kern County's future prosperity require workers with college-level science education. The Natelson report and other reports such as the recent State of the Workforce Report for 2002 clearly show that a significant gap exists between the product of our local education system and the brain-intensive, science-savvy needs of our local economy in the future. This creates a significant gap in the wage earning power between Kern County workers and the state and nation.

The national study "On the Origins of Scientists and Engineers" found that over 84% of the PhD scientists in the physical sciences and mathematics chose to go into a science or engineering career before going to college (almost a third chose even before high school). Teachers in elementary and secondary education are key to developing the passion in the physical sciences and mathematics and to getting children to choose science or other technical careers. However, teachers in our area (particularly, the K-8 teachers) are poorly prepared to teach science in ways that will spark their students. Teachers in California, especially elementary teachers, are experts at avoiding science and math classes in their pre-service education---many even have an active dislike for science subjects. They bring that dislike for science to their students.

Now teachers are being forced to teach more science to their students because of improvements in the state standards. Our teachers do need help and now the "big stick" of the state standards is giving them extra incentive to improve their effectiveness and the

effectiveness of their students in the workplace. The Science Center will address the deficiencies in teacher training and support in the sciences and math and it will provide the stimulating shows and exhibits needed to "light the fire" in the children who visit the center.

Planetariums and science centers/natural history museums expand the horizons of children by showing them possibilities beyond their own limited experience. A significant fraction of the PhD physicists, astronomers, and earth scientists in the "Origin of Scientists and Engineers" study said that planetariums and science centers had a very influential impact on their choice of careers.

## *Excerpts from lengthier white paper on the Science Center*

The Science Center should focus on the earth and space sciences such as astronomy, geology, meteorology, oceanography, chemistry, and physics. This is because

- (a) the biological (life) sciences are already covered in Kern County at places like CALM (present life) and the Buena Vista Museum (past life);
- (b) engineering and industrial applications are already covered with such things as Hands-On Science Teaching (HOST) program at East High School and the "Black Gold" Oil Museum at the Kern County Museum;
- (c) the center will "fill in the gap" of science offerings in Kern County.

One of the primary missions of a California community college is "to advance California's economic growth and global competitiveness through education, training, and services that contribute to continuous work force improvement." The next few paragraphs will address economic growth, global competitiveness, and work force improvement.

The earth and space sciences have a significant impact on our way of life. The United States' economy is becoming ever-more dependent on science and technology-based industries and agriculture. Scientific discoveries lead to advances in technology. In order to maintain our competitive edge in innovation and economic influence in the world, our workers and industries will need more knowledge and skills in science to prosper in the 21$^{st}$ century. Therefore, the demand for highly-skilled, science-literate workers in our country is great and will only continue to increase. Furthermore, these science-literate workers will need to be "home-grown" in the United States as our country reduces its reliance on the highly-skilled workers coming from other nations as a matter of national security.

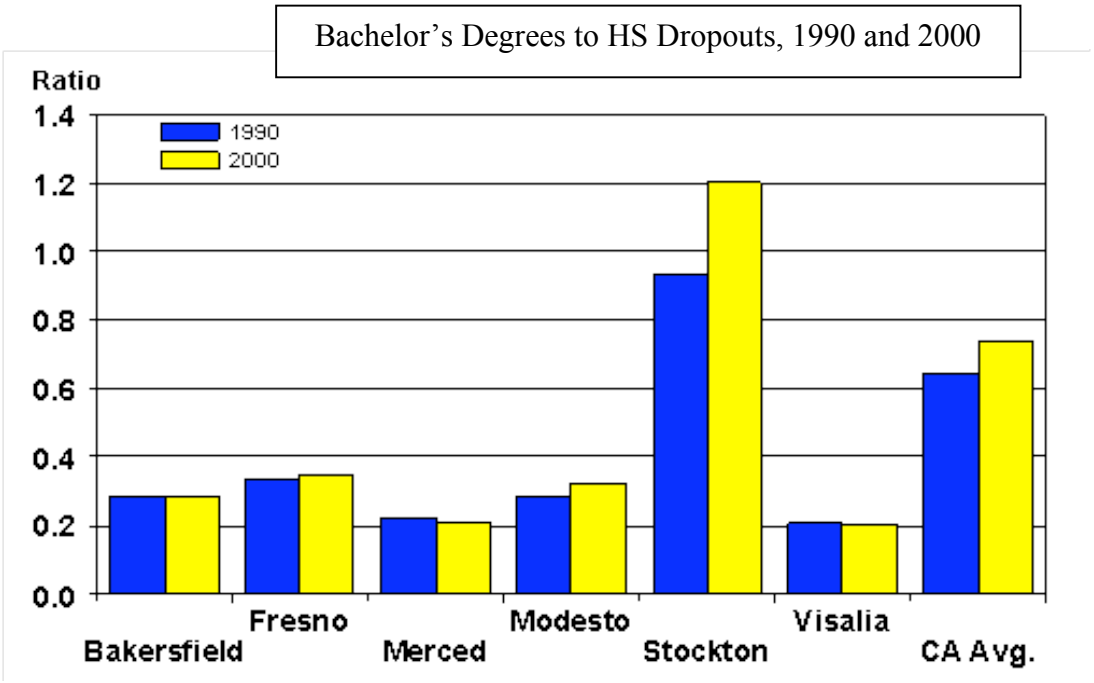
This national trend is also found at the local level here in the southern San Joaquin Valley. Our local economy is based on agriculture, food processing, and oil extraction and refinement. Local workers will need to be able to apply more scientific reasoning and concepts where they work and at home in the future. In order to compete with other areas of the country, local workers will need to improve their knowledge of and skills in science and technology.

Because of the dependence on agriculture and oil, our local economy suffers from larger swings in employment rates and productivity than other parts of California and the nation (Natelson Company report to KEDC, city of Bakersfield). These industries are also responsible for the number one problem facing the Bakersfield area as cited most

frequently by surveyed groups in the Vision 2020 study: air pollution. The Vision 2020 study also found the need to attract new types of businesses to diversify our local economy and smooth out the fluctuations and to have alternatives when the oil runs out (a non-renewable resource).

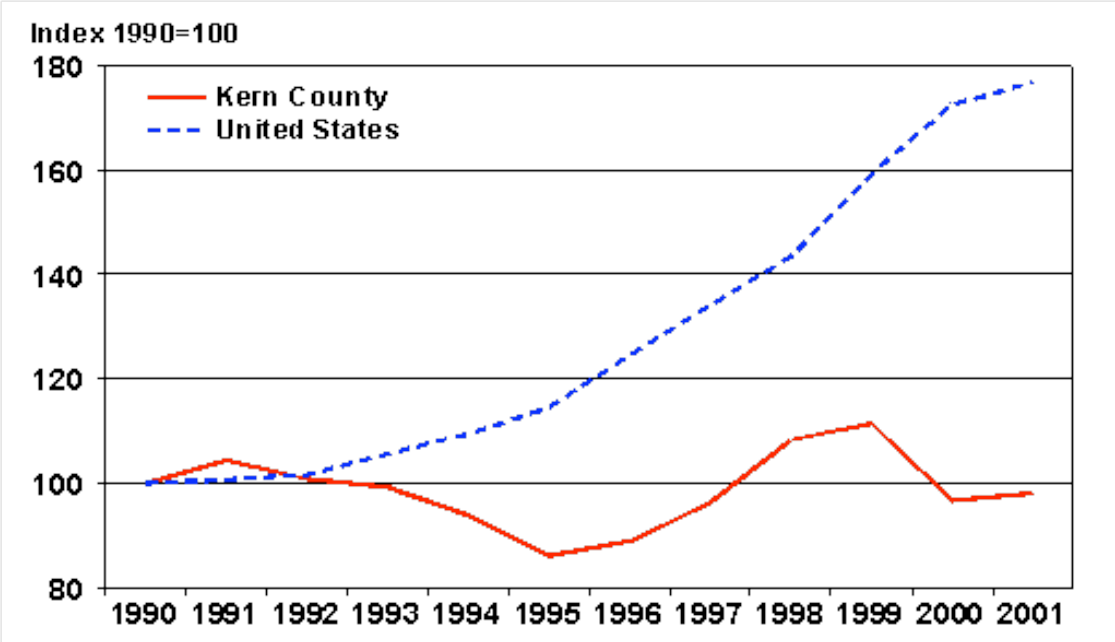
New businesses "that meet clear air requirements, and create sustainable employment in jobs paying higher wages" (Vision 2020) will be looking at the scientific and technical training of our population. Of the seven "business clusters" identified in a study by the Natelson Company for the Kern Economic Development Corporation and the city of Bakersfield, five (aerospace, chemicals and plastics, high-tech, and to a lesser extent: textiles/apparel, and value-added agriculture) require college-level science education. The Natelson report noted that educational levels lag in Kern County and that especially the high-tech and aerospace business clusters dictate a need for increased skills in our local workers.

Of the 11 comparable, competing counties identified in the Natelson report, Kern County is among 4 counties with the lowest level of working-age persons with at least a Bachelor's degree. The Workforce Investment Board's 2002 State of the Workforce Report says that only 13.6% of the population 25 years or older in Kern County has at least a Bachelor's degree. This is only slightly more than *half* the statewide level. At the same time Kern County is faced with 31.5% of the 25+ years olds who did not even finish high school. The figure below from Ross DeVol's presentation at the Workforce Summit in Bakersfield in October 2002 compares our ratio of Bachelor's degrees to High School dropouts to other San Joaquin Valley cities and the state.

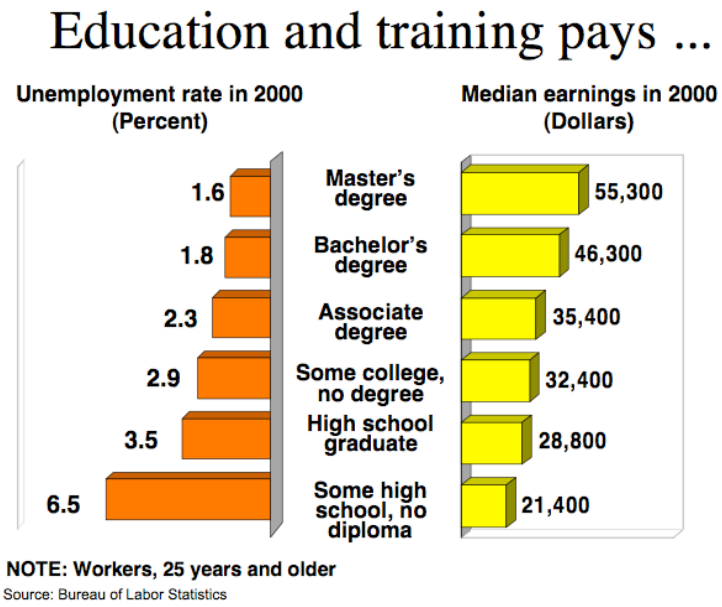



We do share the same problem with other counties in the valley. Stockton stands out because of the presence (at least in part) of the high technology component in its economy. Jobs in high technology companies require college-level training. Stockton is one of the top 50 fastest growing metro areas in high tech output in the nation. The figure also hints at a stagnation of the ratio over the decade. This is made a bit clearer in another

figure DeVol presented at the Workforce Summit. The figure below contrasts the high tech output growth in Kern County with the nation.




The Workforce Report states that over 8,477 jobs per year will open up between 1998 and 2008. Almost 30% of those will require college degrees. When considering just the *higher-wage* jobs, the percentage increases significantly. The figure below from the U.S. Bureau of Labor Statistics makes very clear the connection between education level and the wage level.



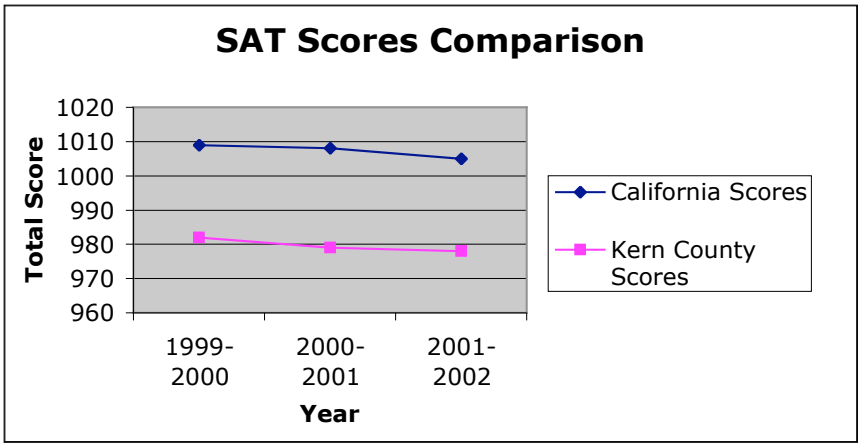

Kern County has consistently been about 15 percentage points behind the statewide average in high school graduates who have taken the required courses for UC/CSU enrollment since at least 1997.

The Workforce Report and other studies (such as the New Valley Connexions report), note a clear switch from manufacturing to service, retail, and government industry in Kern County. Agriculture is also adapting to the new economy by using advanced technology. The manual labor jobs are being replaced by machines. Also, young people can no longer expect to remain in a single career. They will have to have a firm science foundation and intellectual skills to adapt and prosper in the future. Muscle power is being replaced by brain power!

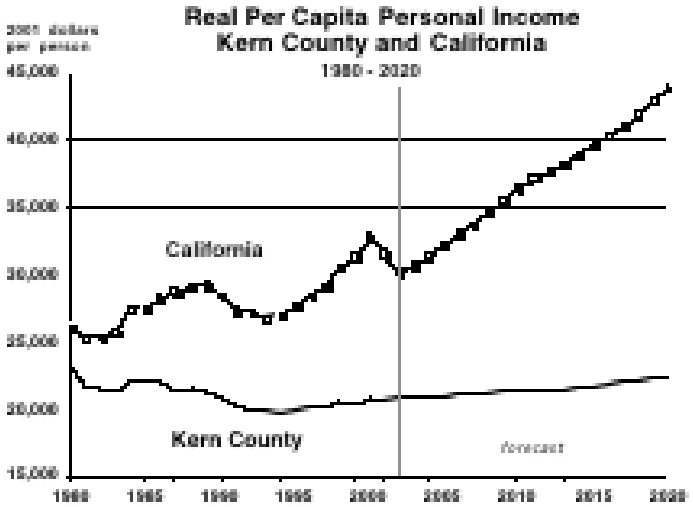
The science center will be an important part of Bakersfield College's response to help Bakersfield move into the 21st century outlined in Vision 2020 and the state community colleges mission. The national study "On the Origins of Scientists and Engineers" by Dietz, Lund, and Rosendhal, found that over 84% of the PhD scientists in the physical sciences and mathematics chose to go into a science or engineering career before going to college (almost a third chose even before high school). Their college education merely fine-tuned the career choice (schools light the fire while colleges refine it). Teachers were ranked equivalent to family members or greater in the influence of choice of career area. Clearly, teachers in elementary and secondary education are key to developing the passion in the physical sciences and mathematics and to getting children to choose science or other technical careers.

However, teachers in our area (particularly, the K-8 teachers) are poorly prepared to teach science in ways that will spark their students. For a great majority of the K-8 teachers, the only science class they had in their college education was a course like our Physical Science 11 class. (Our community needs assessment work will be able to quantify the minimal amount of science and math training of our teachers.) The problem of minimal science and math education training has been known for a long time and it is not isolated to our area alone. Michael Rich, the director of the Challenger Learning Center at Atwater, was an elementary classroom teacher. He had also received the advanced training, certification, and state recognition to be a "Master Teacher" in elementary science and math education. Michael told us teachers in California (the realm of his direct experience), especially elementary teachers, are experts at avoiding science and math classes in their pre-service education---many even have an active dislike for science subjects. They bring that dislike for science to their students.

Now teachers are being forced to teach more science to their students because of improvements in the state standards. To a large extent, their jobs depend on meeting those state standards. One of the major weaknesses of Bakersfield as noted by participants in the Vision 2020 study, was the underperforming of our K-12 students compared to statewide averages. Of the students who *have* taken the college-prep classes in high school, a gap still exists between our students and the statewide averages. One illustration of that is seen in a comparison of the SAT scores in the figure on the next page.




The California Transportation Department has taken the connections between education, earning power, skill levels needed for various job types, and the job offerings in our area to show the challenge facing Kern County in stark terms of the pocketbook:




One of the key findings of the Workforce Report is "that if the local economy is to be transformed into an economy which produces a significantly higher per capita income, lower unemployment rates, and a highly-skilled workforce, the general product of our educational system is not suited to meet all these needs." Our teachers do need help and now the "big stick" of the state standards is giving them extra incentive to improve their effectiveness and the effectiveness of their students in the workplace. The Science Center will address these deficiencies in teacher training and support in the sciences and math and it will provide the stimulating shows and exhibits needed to "light the fire" in the children who visit the center. Not only will the Science Center fill in the gap of science offerings in Kern County, the Science Center will enable Kern County to bridge the economic/pocketbook gap between us and the rest of the state and nation.

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Planetariums and science centers/natural history museums expand the horizons of children by showing them possibilities beyond their own limited experience. This is especially true for those who will become physicists, astronomers, and earth scientists. A significant fraction of the physicists, astronomers, and earth scientists in the Dietz, Lund,

Rosendhal "Origin of Scientists and Engineers" study said that planetariums and science centers had a very influential impact on their choice of careers. At the science centers/museums, they were introduced to career possibilities they and their family had never imagined before and to the aesthetic beauty of science and math that continues to drive them today.

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Every year, Bakersfield College serves about 4,500 K-12 students and teachers with planetarium shows. Teachers rely on the planetarium for their astronomy curriculum. It enhances what they teach in the classroom and shows the children things that cannot be shown in the classroom. In some cases, the planetarium is the sole exposure of astronomy to the students. There is a waiting list for the planetarium. Furthermore, the demand will increase as Bakersfield grows and especially when the state budget situation improves in a few years. I am frequently asked by parent chaperones of the elementary school classes and teachers if they can bring their families to evening or weekend shows. Unfortunately, staffing limitations prevent regular shows for the general public.

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The greatest impact of science education for people in the community happens before students are in college. The "Origins of Scientists and Engineers" study (discussed above) shows that in order to increase the number of people in science or science-related careers, effective science education must happen at the elementary and secondary education level. For a vast majority of the scientists and engineers, the passion for science and math was developed before college. Their college training merely fine-tuned their desire into a particular field of science or engineering.

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