New Mexico Tribal Coalition
CENAC Regional Science Fair Report

Prepared for:
CENAC and NMTC

April 8, 2005

Authors:
Kirk F. Minnick and Rachel A. McCormick

Minnick & Associates, Inc.
2403 San Mateo NE, Suite P-4 Albuquerque, New Mexico 87110
505-889-9358 Fax: 505-889-9374

This document is supported by federal funds from the National Science Foundation (NSF), Office of Educational Systemic Reform, contract number (ESR-0100324). Its contents do not necessarily reflect the views or policies of NSF, and no official endorsement of material should be inferred.

Introduction

The NMTC has collaborated with CENAC to create a regional science fair that brings together students, teachers, and parents from all 12 CENAC schools in January for a science competition. The fair provides all attendees with an opportunity to compete in a science competition that encourages mastery of Western Science while emphasizing Native science through the incorporation of a unique judging category, the Native Scientist Award.

Students first participate in a science fair at their school; this local fair is utilized to select students to participate in the CENAC science fair. The fair is separated into two days of events, one for students in Kindergarten through 4th grade competing by grade level and one for students in 5th to 8th grade competing by their project's topic. Involvement in the CENAC science fair necessitates creating a poster and writing a report; students in 5th to 8th grade are required to complete additional paperwork. Science fair judges are drawn from NMTC professional contacts as well as CENAC schools' tribal communities. Examples of judges include National Laboratory personnel, UNM professors, Native scientists, and high school teachers.

During both the 2004 and 2005 CENAC science fairs, a similar schedule was followed. Judges arrived in the morning for an hour and a half orientation. The judging of student projects ensued after the orientation, followed by the determination of awards. An awards ceremony concluded the science fairs in the late afternoon. Student projects were rated and scored based on their use of a scientific approach, skills, creativity, clarity, thoroughness and teamwork (where applicable). Additionally, students in 5th to 8th grade were judged on their project abstract, research, journal/documentation and bibliography.

One primary emphasis of the CENAC science fairs is introducing and encouraging student participation in culturally-based projects. A separate award category in both 2004 and 2005, the Native Scientist Award, was judged based upon three criteria: integration of cultural traditions and western science and technology, traditions (adherence to cultural heritage, knowledge gained in traditional ways/through cultural teachings), and self-reflection.

Background

In 2004, the K - 4th grade (K-4) event was held at T'siya Elementary School on January 13 while the 5th – 8th grade (5-8) event was at Santa Fe Indian School (SFIS) on January 15. During the following year, 2005, the science fair was held at the Isleta Recreational Facility, with the K-4 event on January 11th and the 5-8 event on January 13th. More than 350 students in Kindergarten to 8th grade participated in the 2004 science fair with a total of more than 250 science projects; while in 2005, approximately 225 projects were entered in the science fair by more than 275 students in Kindergarten to 8th grade.

Figure 1 presents the number of projects and the percent of projects that were culturally-based by CENAC school in 2004 and 2005.

Figure 1
K-8 Student Projects - 2004 and 2005
CENAC School, Number of Projects & Percent of Projects that were Culturally-Based Projects

School	Number of Projects		Percent Culturally-based?	
	2004	2005	2004	2005
Isleta Elementary School	19	31	21%	19%
Jemez Day School	22	15	18%	20%
Laguna Elementary School	17	7	12%	43%
Ohkay Owingeh Community School*	21	18	5%	6%
San Felipe Pueblo Elementary School*	32	20	9%	10%
San Ildefonso Day School	8	9	25%	0%
Santa Clara Day School	35	25	37%	32%
Sky City Community School*	44	43	7%	9%
Taos Day School*	23	28	9%	11%
Te Tsu Geh Oweenge Day School	15	12	0%	17%
T'siya Day School*	30	16	10%	31%
Santa Fe Indian School	0	0	---	---

*K-7 or K-8 schools

During both 2004 and 2005, all CENAC schools except SFIS participated in the science fair and entered nearly 10 or more projects each year. The number of projects entered by Laguna (2004: 17; 2005: 7) and T'siya (2004: 30; 2005: 16) declined by 45% or more from 2004 to 2005. While the number of projects submitted by these two schools decreased, the percentage of projects that were culturally-based increased dramatically (Laguna: 2004: 12%; 2005: 43%; T'siya: 2004: 10%; 2005: 31%). Between 2004 and 2005, the percent of projects that were culturally based increased by 5 percentage points or more at Laguna, T'siya, and Te Tsu Geh Oweenge (2004: 0%; 2005: 17%) while decreasing by 5 percentage points or more at San Ildefonso (2004: 25%; 2005: 0%) and Santa Clara (2004: 37%; 2005: 32%). During both 2004 and 2005, SFIS students did not participate in the CENAC science fairs. In 2004, the 7th and 8th grade science teachers did not assist their students in preparing for the science fair, citing numerous demands on their schedules. In 2005, testing schedules at SFIS interfered with students' attendance.

At the K-4 event in 2004, the least number of schools (6 of the 11 schools with a Kindergarten) participated at the Kindergarten grade level while in 2005, the number of schools participating at the Kindergarten level rose to 8. In 2004, 11 schools (100% of possible schools) participated in 3rd and 4th Grade representing all eligible schools. In 2005, T'siya did not participate at the K-4 event.

At the 5-8 event in 2004, the most schools participated in Chemistry/Bio-Chemistry, Behavioral/Social Science, Environmental Science, Medical/Health, and Physics projects. During the following year, 2005, the most schools entered projects in Botany, Chemistry/Bio-Chemistry, Medical/Health, and Physics/Space Science.

K-4th Grade Science Fair Projects

The K-4 events' projects were classified and judged by grade level. Figure 2 reports the number of projects and percent of projects that were culturally-based projects by grade level in 2004 and 2005.

Figure 2
K-4 Student Projects - 2004 and 2005
Grade Level, Number of Projects, & Percent of Projects that were Culturally-Based Projects

Grade	Number of Projects		Percent Culturally-based?	
	2004	**2005**	**2004**	**2005**
Kindergarten	12	20	8%	25%
1st Grade	31	19	10%	5%
2nd Grade	31	25	7%	12%
3rd Grade	35	27	9%	15%
4th Grade	31	26	7%	8%
OVERALL	***140***	***117***	***8%***	***13%***

In 2004, the least projects were submitted by Kindergarteners (12), as one would expect while there were more than 30 projects submitted for each of the remaining grades. From 2004 to 2005, the number of Kindergarten projects rose from 12 to 20, while the number of projects entered by students in 1st Grade to 4th Grade fell across each grade level from 2004 to 2005. The most notable decline in the number of projects submitted occurred in 1st grade where the number of projects fell from 31 in 2004 to 19 in 2005, which was most likely the result of T'siya not participating at the K-4 event.

It is important to note that data collection challenges prevented the recording of whether or not many projects were culturally-based, hence data on the percent of projects that are culturally-based should be interpreted cautiously. In 2004, 8% of all projects at the K-4 event were culturally-based, compared to 13% in 2005. It is very likely that the actual percentages of projects that were culturally based are even higher than the reported percentages.

Examples of project titles for Kindergarteners included "The Floating Egg", "Hot Colors" and "Native American Kinders Fight Against Diabetes" (culturally-based). Science Fair titles for 1st grade included: "How does Bread Mold", "Traditional Pottery" (culturally-based) and "Which Hand soap is the Best". Second Graders used titles such as "An Egg Without a Shell", "The Use of Yucca Plants" (culturally-based) and "How to Make Playdough". Some 3rd Grade titles were "The Heart as a Pump", "Natural or Not" (culturally-based), and "Ground Contamination". Lastly, topics among 4th Graders included "What Cleans Silver Best" (culturally-based), "Free Energy From the Sun", and "Construct a Circuit".

5th – 8th Grade Science Fair Projects

The 5th to 8th grade Science Fair projects were classified and judged by subject area. Figure 3 reports number of projects and percent of projects that were culturally-based projects by subject area in 2004 and 2005.

Figure 3
5-8 Student Projects 2004 and 2005
Subject Area, Number of Projects, & Percent of Projects that were Culturally-Based Projects

Subject	Number of Projects		Percent Culturally-based?	
	2004	**2005**	**2004**	**2005**
Behavioral/Social Science	16	6	13%	17%
Botany	12	10	33%	20%
Chemistry/Bio-Chemistry	21	15	10%	13%
Computer Science	1	1	0%	0%
Earth Science	16	4	31%	25%
Engineering	6	10	33%	20%
Environmental Science	13	8	23%	38%
Mathematics	0	1	--	0%
Medical/Health	13	12	15%	25%
Microbiology	2	9	0%	22%
Physics/Space Science*	16	18	0%	28%
Zoology	6	3	17%	33%
Overall	***135***	***107***	***19%***	***21%***

*Space Science was a new category in 2005.
**Overall includes Team Projects, which were not classified by Subject.

The 4 subjects with the most 5th – 8th grade projects in 2004 were Chemistry/Bio-Chemistry (21), Behavioral/Social Science (16), Earth Science (16) and Physics (16); while in 2005, the most projects were entered in Physics/Space Science (18), Chemistry/Bio-Chemistry (15), and Medical Health (12). The number of projects entered in Behavioral/Social Science (2004: 16; 2005: 6), Earth Science (2004: 16; 2005: 4), and Zoology (2004: 6; 2005: 3) declined by 50% or more from 2004 to 2005. On the other hand, in 2004 no projects were entered in Mathematics, while 1 was entered in 2005; additionally 2 projects were entered in Microbiology in 2004 compared to 9 in 2005.

As with K-4 projects, it is important to note that data collection challenges prevented the recording of whether or not many projects were culturally-based, hence data on the percent of projects that are culturally-based should be interpreted cautiously. In 2004, one-third (33%) of Botany projects and one-third (33%) of Engineering projects were culturally-based along with nearly one-third (31%) of Earth Science projects. In 2005, one-quarter (25%) or more of projects in the following categories were culturally-based: Earth Science (25%); Environmental Science (38%), Medical/Heath (25%); Physics/Space Science (28%); and Zoology (33%). Overall, 19% of 2004 5-8 projects were culturally based, compared to 21% of 2005 projects. Furthermore, it is very likely that the actual percentages of projects that are culturally-based are even higher given the missing data**.**

Examples of some project titles by 5th to 8th grade students were: "What Wood Makes the Strongest Bow" (culturally-based), "Caffeine's Effect on Memory", "How Does Piki Derive Its Color" (culturally-based), "Thermal Currents", "Acid Rain", "Curing Eczema Using Modern or Traditional Medicine" (culturally-based), "How to Make Your Own Flashlight", and "Cabbage Chemistry".

Judging and Awards - 2005

The judging process, criteria established for awards, and the determination of awards is a critical aspect of any science fair. The CENAC Regional Science Fair has established standards for judges to rely upon when analyzing student projects so that awards may be determined as fairly as possible.

Judging Scoring Card and Questions

In 2005, the same judging forms and questions were utilized at the K-4 and 5-8 events. Judging questions included things like "Was there a procedural plan for obtaining a solution?"; "Does the student(s) have the skills required to do all the work necessary to obtain the data exhibited in the project?"; "Does the project show creative ability and originality in the question asked?"; "Is she/he/they able to explain its purpose, procedure, and conclusion in a clear and concise manner?"; and "Does the project carry out its purpose to completion within the scope of the original aims?". These questions were meant to be interpreted by judges in a manner appropriate to student's expected capabilities at each grade level. Between 2 and 5 questions were asked regarding each participant/team project in each of the following categories:

- Scientific Approach (25 points)
- Skills (10 points)
- Creativity (20 points)
- Clarity (10 points)
- Thoroughness (15 points)
- Teamwork - *Team Projects only* (10 points)
- Abstract, Research, Journal/Documentation, Bibliography - *5-8 only* (5 points each)

Judges rated students' on the above categories from 1 to 5. At the K-4 level, a total of 80 points (individual) or 90 points (Teams) were available while at the 5-8 level, a total of 100 points (individual) or 110 points (Teams) were available.

Native Scientist Projects Judging Scoring Card and Questions

Native Scientist projects were rated using the same 3 criteria at the K-4 and 5-8 events in 2005. Examples of questions included, "Will the project have an impact on the community or individuals in that community?"; "Was the project done with respect and maintaining the integrity of the natural world?"; and "Has the student gained cultural knowledge?". Two or three questions were asked regarding each participant/team in the following categories, with a total of 50 points available:

- Integration of Cultural Traditions & Western Science (10 points)
- Traditions (30 points)
- Self-Reflection (10 points)

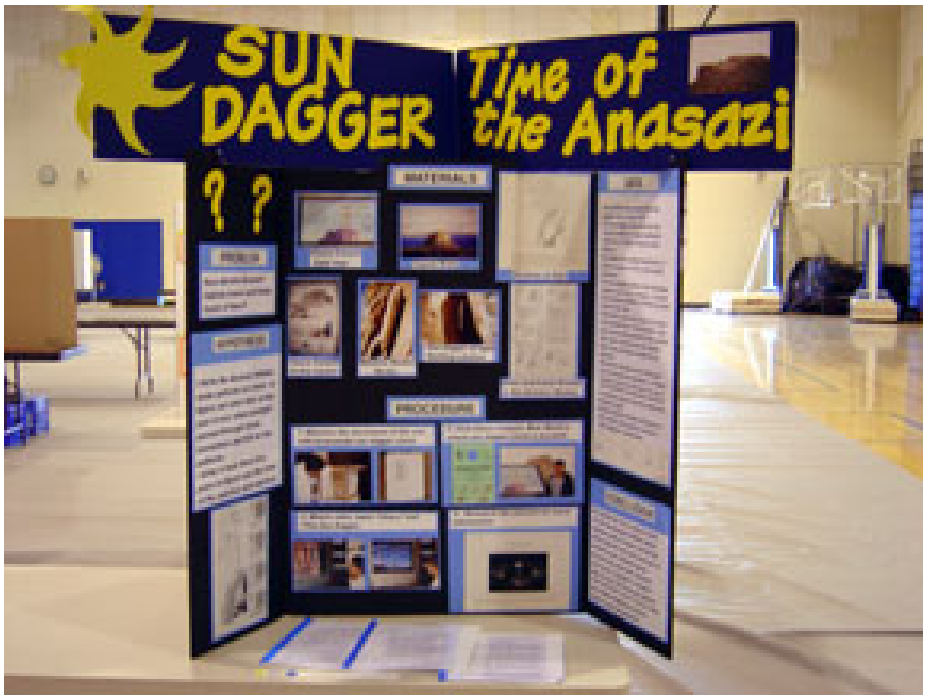
Awards and Certificates

At the K-4 event in 2005, 6 awards were given at each grade level including 1st, 2nd, and 3rd place for individual projects as well as 1st, 2nd, and 3rd place for Team projects. Additionally, Native scientists awards were given to 3 students (including a 1st, 2nd, and 3rd grader), a Museum of Natural History Certificates of Recognition was awarded to one student at each grade level, and one Explora Science Center winner was selected. Lastly, two Superintendent's Awards were given.

At the 5-8 event in 2005, 1st, 2nd, and 3rd place awards were given for each of 12 subjects (Behavioral & Social Sciences, Biochemistry, Botany, Chemistry, Earth Science, Engineering, Environmental, Medicine/Health, Microbiology, Physics, Space Sciences and Zoology). Awards were also given for 1st, 2nd, and 3rd place Team projects as well as for 1st, 2nd,and 3rd place Native Scientists. Additional awards at

the 5-8 event included: a Museum of Natural History Certificate of Recognition awarded to one student at each grade level, one Explora Science Center winner and two Superintendent's Awards. Figure 4 is a photograph of a project entitled "Sun Daggers – The Time of The Anasazi" by Jeramiah D., an Isleta Elementary School student who won 1st place for Space Sciences and won the Superintendent's Award.

Figure 4
"Sun Daggers – The Time of The Anasazi"
1st place in Space Sciences and Superintendent's Award

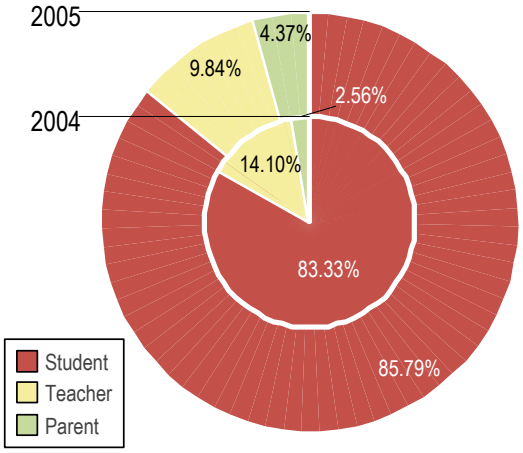


Science Fair Evaluation Forms (Students, Teachers, and Parents)

In order to evaluate the successes of the Science Fairs as well as areas that could be improved upon for the following year, Evaluation Forms were distributed each year to students and teachers who attended the science fairs. This section documents the findings from these Evaluation Forms completed by students, teachers and parents.

Respondents' Role

Figure 5
CENAC Science Fair Evaluation Form
What best describes your role in the science fair?
(2004: N=78; 2005: N=183)



Respondents were asked "What best describes your role in the science fair?" In 2004, 83% of the 78 respondents were students and 14% were teachers while in 2005, 86% of the 183 respondents who reported their role were students and 10% were teachers. During both 2004 (3%) and 2005 (4%), less than 5% of respondents reported being parents. In 2004, all respondents reported their role while in 2005, 10 of the 193 respondents' roles were not reported.

Responding Students' Grade Level

Figure 6 presents the grade level of students who completed the Science Fair Evaluation Forms.

Figure 6
CENAC Science Fair Evaluation Form
Percent of Students Responding by Grade Level
(2004: N=65; and 2005 N=157)

Grade Level		2004	2005
Kindergarten	K-4 Event	0.0%	8.7%
1st Grade		0.0%	8.1%
2nd Grade		1.5%	9.4%
3rd Grade		3.1%	8.7%
4th Grade		7.7%	12.8%
5th Grade	5-8 Event	15.4%	14.1%
6th Grade		44.6%	16.8%
7th Grade		21.5%	10.1%
8th Grade		6.2%	10.7%
TOTAL # of Students		64	154

*In 2005, 1 student reported their grade level as 9th and 8 students did not report their grade level.

In 2004, only 12% of responding students attended the K-4 event while in 2005, nearly half (48%) of responding students attended the K-4 event. During both years, the most respondents were in the 6th grade.

School Attended by Responding Students

Figure 7 presents the number of students completing Science Fair Evaluation Forms by CENAC school attended in 2004 and 2005.

Figure 7
CENAC Science Fair Evaluation Form
Number of Responding Students Attending each CENAC School

School	2004	2005
Isleta	7	0
Jemez	0	0
Laguna	0	14
Ohkay Owingeh	0	13
San Felipe	14	15
San Ildefonso	0	1
Santa Clara	15	9
SFIS	0	0
Sky City	0	41
Taos	6	28
Tesuque	7	5
T'siya	16	28
TOTAL	65	154

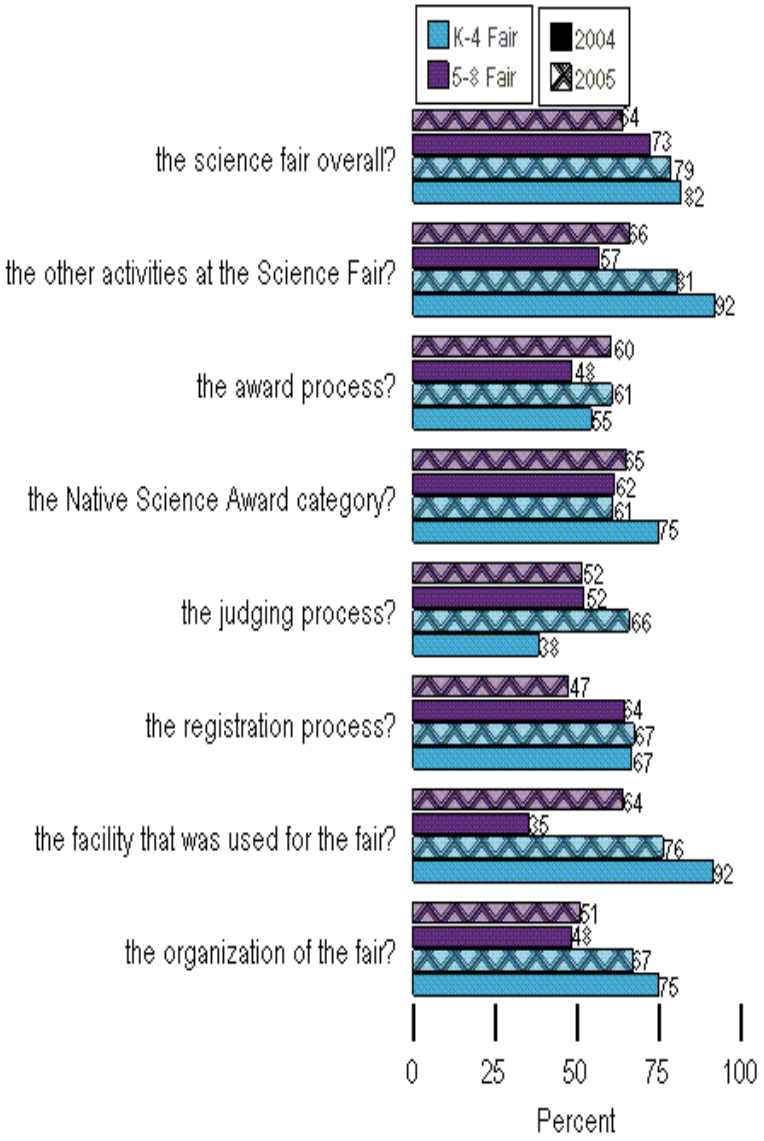
In both 2004 and 2005, there were no responding students from Jemez or SFIS (no students attended from SFIS). In 2004, respondents were from 6 CENAC schools. The number of schools represented increased from 6 in 2004 to 9 in 2005 while the number of students responding who reported their school increased from 65 to 154. Students not completing Evaluation Forms, especially in 2004, may have been the result of some schools transporting their students back to school prior to the award ceremony (an appropriate time for the completion of the forms).

Evaluation of Science Fairs

Figure 8 reports the percent of Science Fair Evaluation Form respondents (students, teachers and parents) who rated the fair components as 4 or 5 where 1 equals "Needs Improvement", 3 equals "Okay" and 5 equals "Excellent" by year for the K-4 and 5-8 events.

Figure 8
CENAC Science Fair Evaluation Form
Percent of Attendees Giving a 4 or 5 by Grade Level and Year
Where 1= "Needs Improvement" 3= "Okay" and 4="Excellent"
(K-4: 2004: N=12, 2005: N=95; 5-8: 2005: N=65, 2005 N=98)

"How would you Rate…"



There were mixed results between 2004 and 2005 in attendees' ratings of fair components. An increase of 10 percentage points or more in the percent of attendees rating fair components as a 4 or 5 where 5 equals "excellent" occurred for the K-4 event in 'the judging process' (2004: 38%; 2005: 66%) and for the 5-8 event in 'the award process' (2004: 48%; 2005: 60%) and 'the facility that was used for the fair' (2004: 35%; 2005: 64%). On the other hand, a decrease of 10 percentage points or more in the percent of attendees rating fair components as a 4 or 5 where 5 equals "excellent" occurred for the K-4 event in 'the other activities at the Science Fair' (2004: 92%; 2005: 81%), 'the Native Scientist Award category' (2004:

75%; 2005: 61%), and 'the facility that was used for the fair' (2004: 92%; 2005: 76%) and for the 5-8 event in 'the registration process' (2004: 64%; 2005: 46%). While K-4 respondents' rating of the 'science fair overall' (2004: 82%; 2005: 79%) remained relatively level, 5-8 respondents' ratings fell by 9 percentage points from 73% in 2004 to 64% in 2005.

Open-ended Responses

Science Fair attendees who completed Evaluation Forms were asked in an open-ended question, "What are your feelings about the 'Native Scientist Award' category?" Responses were overwhelmingly positive. In 2004, student responses included:

"I think the Native Science Award was great because I got to see what Science Fair projects were related to Native American ways."

"It was good because it gives us a chance to express our Native culture."

"I didn't know about the different types of clay and now I know."

While in 2005, some student responses were:

"I think it is good that they are taking time to recognize Native projects."

"You should do it every year."

"I think its really cool that kids get Native Science Awards."

Respondents were also asked to comment on their feeling about the use of categories and grade levels in the judging process. Many of the responses to this question were positive. However, a number of recommendations were included. The two most common recommendations from students, parents, and teachers in 2004 were:

"I think they could get more judges and that way it would be faster."

"I feel that you should have had us compete with only 6th with 6th and 7th with 7th and so forth."

In 2005, all but 1 of the 42 responses from K-4 attendees were positive. The 78 responses from 5-8 attendees were also mostly positive, though 7 respondents said things like:

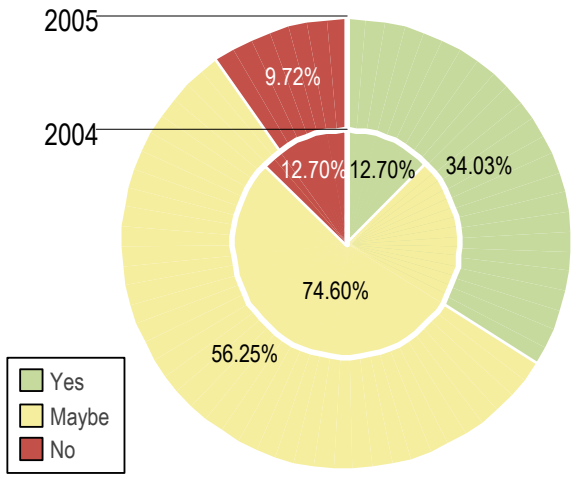
"I think the fair could try to get more judges to stay on schedule."

Lastly, attendees who completed Evaluation Forms were asked "What suggestions can you give to improve the Science Fair for next year?" In 2004, student, teacher, and parent respondents from the K-4 event most often recommended increasing the number of judges and having refreshments for sale. In 2005, the recommendation to increase the number of judges was still given, but less frequently than in 2004. However, in 2005, many respondents recommended having a concession stand, increasing the number of activities for students when they are not being judged, and making the evaluation form more student-friendly.

In 2004, 5-8 respondents recommended letting students have time to look at one another's projects, increasing the number of judges, and having more chairs as well as a snack bar. Some people suggested that the Science Fair be held at another location as they felt the overall space at the SFIS was too small to accommodate the event. The following year, common recommendations at the 5-8 event included simplifying the registration process, providing refreshments, decreasing the time for judging projects, and having more judges.

Student Interest in Native Scientist Category

Figure 9
"Do you plan on entering a traditional Native Science project next year?"
2004 and 2005)



The question, "Do you plan on entering a traditional Native Science project next year?", was used to measure student interest in the Native Science projects. In 2004, 13% of students replied "yes", that percent increased by 21 percentage points to 34% in 2005.

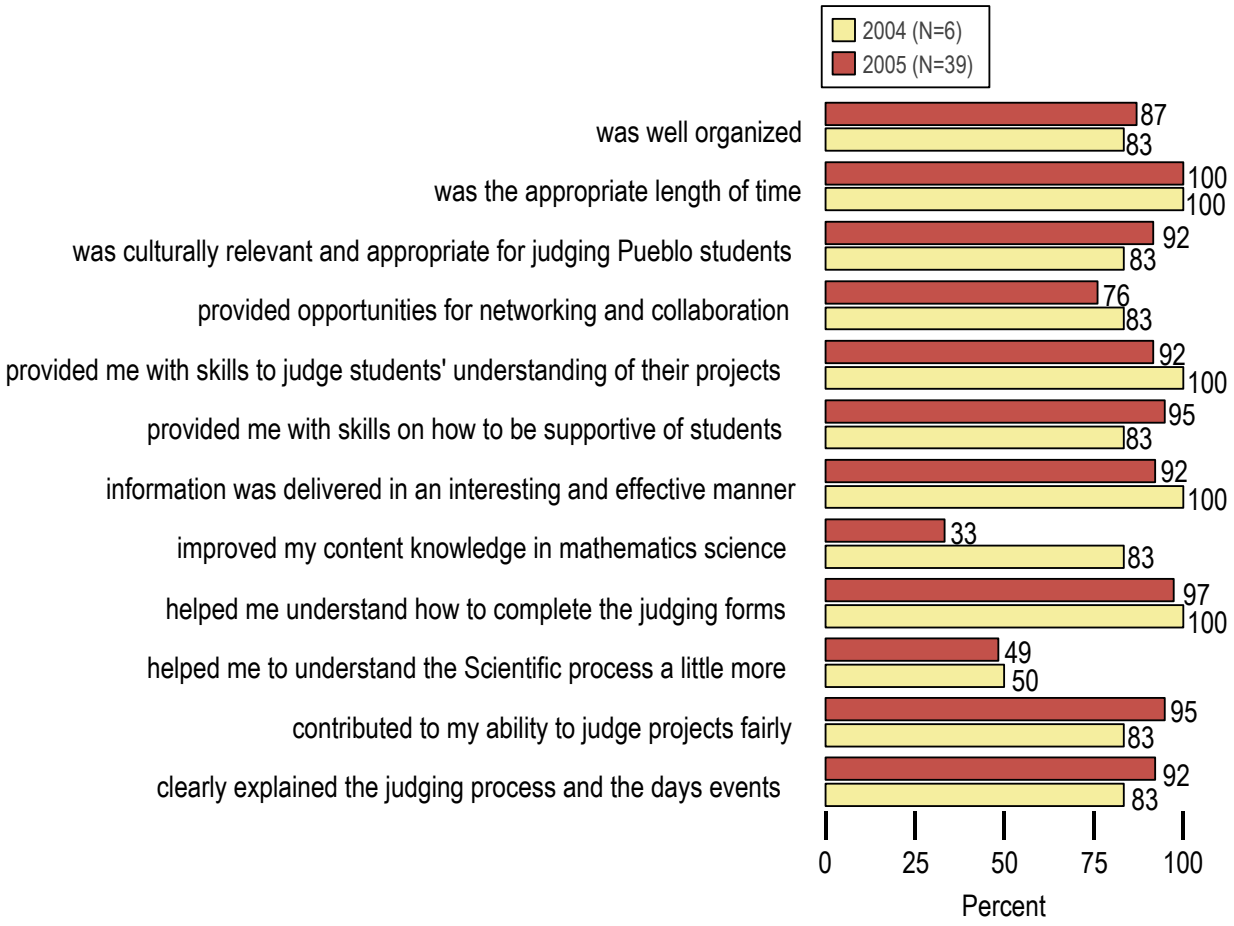
Surveys of Science Fair Judges

In both 2004 and 2005, participating judges were asked to complete a survey following the completion of their duties as CENAC science fair judges. In 2004, 6 judges completed this form while in 2005 compared to 39 judges in 2005.

Figure 10 presents the percent of responding judges who "agree" or "strong agree" that the judges orientation was successful in the following 12 areas.

Figure 10
CENAC Science Fair Judges' Survey
Percent of Respondents who "Agree" or "Strongly Agree"
(2004 and 2005)

The Judge's Orientation…



It is important to note that in 2004, only 6 judges completed surveys compared to 39 in 2005. Overall, there was an increase in the percent of respondents who positively rated the 12 areas of the judge's orientation. Between 2004 and 2005, the percent of respondents' who "agree" or "strong agree" with the following items regarding the judge's orientation increased by 10 percentage points or more: 'provide me with skills on how to be supportive of students' (2004: 83%; 2005: 95%) and 'contributed to my ability to judge projects fairly' (2004: 83%; 2005: 95%). Based on responses from 2004 judges on open-ended questions (reported in the following section of this document), it appears that the dramatic decrease in the percent of judges who "agree" or "strongly agree" that the orientation 'improved my content knowledge in mathematics and science' (2004: 83%; 2005: 33%) reveals that judges in 2005 had notably more mathematics and science content knowledge than judges in 2004.

Open-ended Responses

Judges surveyed were asked to respond to a number of open-ended questions regarding the Science Fair. When asked, "What did you find most useful about the judges' orientation?", judges in 2004 gave the following replies:

"I thought it was very well presented; especially for judges who were new to the process."

"Gave insight on how to treat students and (provide) encouragement."

In 2005, common responses regarding what was most useful about the judges' orientation included responses such as:

"Provided me with an increased list and increased specificity of content with which to judge"

"How to use the judging forms efficiently"

"Suggestions about what to ask and how to act"

Surveyed judges also provided recommendations regarding the Native categories. Judges in 2004 mentioned:

"Criterion established for native categories, constructs. This process will help the teachers guide students at the local level. Can we help you in the process?"

"Most children prepared their exhibit for a Western Science category and were unprepared to articulate their experience as a native person. They could use some guidance from their teachers."

"With the Native Science category I thought the questions and basis for criteria were too broad. It was very difficult to judge and rate the native projects based on the judges' form."

The most common responses regarding recommendations for the Native categories in 2005 were comments rather than recommendations. Examples include:

"Native Science was a welcome relief from the run of the mill science fair projects. Helps keep old traditions alive."

"It gave me a chance to see how Indian kids are relating their culture to that of the Dominant Society."

Judges were also asked for suggestions as to how to improve the judges' orientation. Two judges in 2004 recommended that a "cheat sheet" be preprinted for all judges. One of those two judges noted that this was done at the 5-8 event after being suggested at the K-4 event. Another recommendation in 2004 was:

"Make sure judges have background in the sciences, stress the importance of competition for these students to go further in the science fair process."

In 2005, common recommendations included:

"Better signage for judges new to the Pueblo schools."

"Outline the process in paper format prior to the event."

"A less noisy room."

Judges were also invited to list any other comments; responses to this question in 2004 included:

"I enjoyed judging – each child taught me something new. There are several kids that touched my heart."

"I really think it is important to make sure judges have some knowledge of basic science concepts. It makes a difference during the interview process, so students get full benefits of interactions."

In 2005, judges' comments in the section provided for other comments included things like:

"I really enjoyed this experience and would like to volunteer for next year."

"I enjoy talking with students about science and think it's very beneficial to them to have scientists mentor, critique and comment on their work".

Conclusions and Recommendations

The NMTC has made a great deal of progress between 2004 and 2005. In 2004, respondents to the Evaluation Form and the judge's survey reported a shortage in the number of judges and their familiarity with science content. NMTC was cognizant of this concern in planning for the 2005 science fair; hence the number of judges participating in the science fair increased along with the number of judges who have strong science backgrounds. Additionally the number of Native judges participating also rose notably. The presence of a greater number of Native judges will have a positive impact on students; as poignantly stated by the NMTC's co-Principal Investigator, Anya Enos, "the fact that so many of this year's judges were Native was in itself a positive message for the kids – Native people are Western scientists".

NMTC was also able to more than double the number of respondents to the Science Fair Evaluation Form from 78 in 2004 to 193 in 2005. Furthermore, the number of judges completing surveys rose from only 6 in 2004 to 39 in 2005. This high response rate is indicative of NMTC's efforts to encourage participation in these surveys. Another, notable achievement at the 2005 science fair was increasing the number of student respondents interested in culturally-based projects; in 2004, 13% of students compared to 34% in 2005 responded "yes" when asked if they intended to enter a Native Scientist project the following year.

A few recommendations for future CENAC science fairs that the science fair committee should review include the following:

1. Incorporate student-friendly language in survey.

A number of teachers and parents indicated that younger students struggled to comprehend the evaluation form. NMTC personnel are responding to this suggestion by working in cooperation with Minnick & Associates to produce a child-friendly evaluation form to be completed by students in K-4 event. This survey, currently in a draft form, incorporates simple language, a reduced number of questions, and symbols to increase younger students' comprehension of the questions.

2. Provide more activities for students.

NMTC has provided a number of mandatory activities for students to participate in while they are not directly involved in the presentation and judging on their projects. At the K-4 event in 2005, these activities included computer lab, Explora activities, playground activities, and math activities; while at the 5-8 event activities included computer lab, Explora activities, and playground activities. Though these activities have provided students with enrichment and entertainment during the science fair, many students quickly complete the activities and then "hang out" the remainder of the time. It may benefit NMTC and CENAC schools to explore more options in order to provide students with other activities throughout the day. Some suggestion are:

A. Hold the science fair at or near a science museum.
B. Co-host the science fair with another event, such as Exploring Science Careers.
C. Have volunteers run activities throughout the day and require all students to attend sessions.

While the above activities would provide enrichment and excitement for students, they also require a very large amount of additional work and support and may not be possible until the CENAC science fair is more well-established.

3. Speed up the judging process.

Due to the large distance between CENAC schools, many attendees travel for more than 2 hours to attend the CENAC science fair. Hence, especially for those teachers traveling with younger children, limiting the time spent at the science fair is critical in order for them to be able to return to their school. This noteworthy travel time, in combination with repeated recommendations to "speed up the judging process"

on evaluation forms, leads to the recommendation that NMTC evaluate possible methods of reducing the length of the CENAC science fairs. One judge suggested having a sheet for judges to initial after reviewing a project as he/she found students' forms were sometimes depleted even though 3 judges hadn't reviewed the projects. It may also be helpful to (1) have judges travel in groups to each project in a certain grade/category (this method may not be consistent with national competitions), (2) address timing and rotating in the judge's orientation and/or (3) establish a method to ensure judges rotate in a timely and efficient method. However, it is most important that quality of judging is not sacrificed in any way.

4. Assist schools and teachers with ensuring highest quality projects.

In 2005, one judge wrote in the comments section, "So many projects, particularly younger students, were beyond students' comprehension abilities. Many had no idea of a scientific, fact based experiment or valid results". This judge's comment and the Evaluation Team's observations reveal that not all projects at the science fair were of high quality.

The NMTC had provided extensive mathematics and science professional development for many struggling teachers. Increasing mathematics and science content knowledge is arguably the most important step in assisting teachers by giving them an information foundation, however many teachers also require further training regarding the process of experimentation in science. NMTC may wish to further implement trainings related to conducting and interpreting science experiments in their professional development as a means of better supporting teachers in helping their students prepare for the science fair. These trainings could focus on things like utilizing the scientific method, identifying facts and inferences, designing sound experiments and analyzing data.

Additionally, NMTC personnel report that at the 5th to 8th grade level, if a project is the only entry in a category at the local fair, it automatically qualifies for the CENAC fair. While this is an appropriate policy given the small size of many CENAC schools and the desire to encourage participation, the quality of projects may be addressed by standardizing school judging. It would be helpful to ensure that local science fairs utilize the same processes, criteria, and scoring methodology for judging that is employed at the CENAC fair. This would familiarize students with judging methodologies prior to the CENAC fair and ideally provide students with feedback that could be used to refine projects prior to the regional fair.

5. Have refreshments for sale.

Depending on the location of the science fair, it is challenging for parents and other guests to leave the event for lunch. Additionally, evaluation forms from teachers, students, and parents at both the 2004 and 2005 science fairs often recommended having refreshments for sale. NMTC may wish to consider soliciting the assistance of student groups at the SFIS or parent volunteers in order to organize and run a refreshments stand at the 2006 events.

6. Ensure SFIS students are able to participate.

It is unfortunate that during both the 2004 and 2005 CENAC science fairs, SFIS students were unable to attend. SFIS students and their peers at the remaining CENAC schools would greatly benefit from the participation of these students in the science fair. NMTC has made it a priority to work with SFIS personnel in order to ensure that SFIS students are able to attend the science fair. Unfortunately, scheduling challenges (both testing and teacher participation) have resulted in SFIS students not being able to participate. One science teacher at SFIS, who was unable to assist students in preparing for the science fair during the school day, recommended providing a stipend for a teacher to assist students during after school hours. The Evaluation Team suggests that NMTC continue to explore this teacher recommendation and other methods of ensuring SFIS students are able to participate.

The CENAC science fairs have been effective and exciting collaborations between NMTC and the 12 CENAC schools it serves. Students, parents, teachers, and other attendees have come together to participate in this endeavor which has brought together CENAC schools in the spirit of celebrating their science successes and improving science education through competition and sharing of student projects.