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ABSTRACT

The Alaska Rural Systemic Initiative (AKRSI) implements initiatives to document the indigenous knowledge systems of Alaska Natives and develop pedagogical practices and school curricula that appropriately incorporate indigenous knowledge and ways of knowing into the formal education system. These initiatives foster interconnectivity between two interdependent but historically disconnected and alienated educational systems--the indigenous knowledge systems rooted in Native cultures, and the formal education system that has been imported. These systems have complementary scientific and mathematical knowledge and skills that can strengthen the quality of education for students throughout rural Alaska. AKRSI has positively influenced student performance. In its first 5 years, the AKRSI strategy has produced increases in student achievement scores; the number of rural students attending college; and the number of Native students choosing to pursue studies in the fields of science, math, and engineering; and a decrease in Alaska dropout rates. AKRSI-sponsored initiatives are briefly described, along with the evaluations currently underway that provide evidence of progress related to these systemic-reform change indicators: resource changes, policy changes, management changes, data utilization, implementation of standards-based curriculum, partnerships, and research. (TD)

AKRSI Final Report: Phase I, 1995-2000

Submitted by Frank Hill, Oscar Kawagley, and Ray Barnhardt

ALASKA RURAL SYSTEMIC INITIATIVE

Alaska Federation of Natives • University of Alaska • National Science Foundation

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Introduction: Bringing Schools and Communities Together in Rural Alaska

The following Final Report will begin with a brief introduction to the educational reform strategy of the Alaska Rural Systemic Initiative, followed by an overview of the context in which the AKRSI operates and a summary of the data documenting the impact of the project over the first five years, particularly as it relates to student achievement. This will then lead into a synopsis of what has been accomplished during Phase I under each of the NSF "systemic reform driver" change indicators.

The underlying purpose of the Alaska Rural Systemic Initiative has been to implement a set of initiatives to systematically document the indigenous knowledge systems of Alaska Native people and develop pedagogical practices and school curricula that appropriately incorporate indigenous knowledge and ways of knowing into the formal education system. The central systemic reform focus of the AKRSI reform strategy has beeb the fostering of interconnectivity and complementarity between two functionally interdependent but historically disconnected and alienated complex systems — the indigenous knowledge systems rooted in the Native cultures that inhabit rural Alaska, and the formal education systems that have been imported to serve the educational needs of rural Native communities. Within each of these evolving systems is a rich body of complementary scientific and mathematical knowledge and skills that, if properly explicated and leveraged, can serve to strengthen the quality of educational experiences and improve the academic performance of students throughout rural Alaska.

The key elements of change around which the AKRSI educational reform strategy has been constructed are: 1) the Alaska Native professional educators working in the formal education system coupled with the Native Elders who are the culture-bearers for the indigenous knowledge system; and 2) the rural teachers/schools implementing math/science performance standards and assessments associated with the Quality Schools Initiative administered by the Alaska Department of Education. Together, these elements function as a powerful set of "attractors" that are serving to reconstitute the way people think about and do education in rural schools throughout Alaska. The role of the Alaska Rural Systemic Initiative has been to guide these agents through an on-going array of locally-generated, self-organizing activities that produce the "organizational learning" needed to move toward a new form of emergent and convergent system of education for rural Alaska. The overall configuration of this emergent system may be characterized as two interdependent though previously separate systems being nudged together through a series of initiatives maintained by a larger system of which they are constituent parts (a more detailed description and illustrations of the theory of complex adaptive systems on which the AKRSI reform strategy and initiatives are based is included in the Supplementary Documents section).

The overall structure of the Alaska Rural Systemic Initiative has been organized around the following five major initiatives, each of which has been implemented in one of the five major Alaska Native cultural regions each year on an annual rotational scale-up schedule over the five-year cycle. In this way, we have been able to adapt the initiatives to the cultural and geographic variability of each of the regions, while at the same time engaging the necessary state-level support structures throughout the five-year cycle.

YEARLY CYCLE OF AKRSI INITIATIVES BY CULTURAL REGION

Initiative/Year	1995-96	1996-97	1997-98	1998-99	1999-2000
Native Ways of Knowing and Teaching	Yup'ik Region	Inupiaq Region	Athabascan Region	Aleut Region	Tlingit-Haida Region
Culturally Aligned Curriculum Adaptations	Tlingit-Haida Region	Yup'ik Region	Inupiaq Region	Athabascan Region	Aleut Region
Indigenous Science Knowledge Base	Aleut Region	Tlingit-Haida Region	Yup'ik Region	Inupiaq Region	Athabascan Region
Elders and Cultural Camps	Athabascan Region	Aleut Region	Tlingit-Haida Region	Yup'ik Region	Inupiaq Region
Village Science Applications and Careers	Inupiaq Region	Athabascan Region	Aleut Region	Tlingit-Haida Region	Yup'ik Region

Along with the rotational schedule of regional initiatives, there have also been a series of cross-cutting themes that integrated the initiatives within and across regions each year. While the regional initiatives have focused on particular domains of activity through which specialized resources have been brought to bear in each region each year (culturally aligned curriculum, indigenous science knowledge base, etc.), the following themes have cut across all initiatives and regions each year:

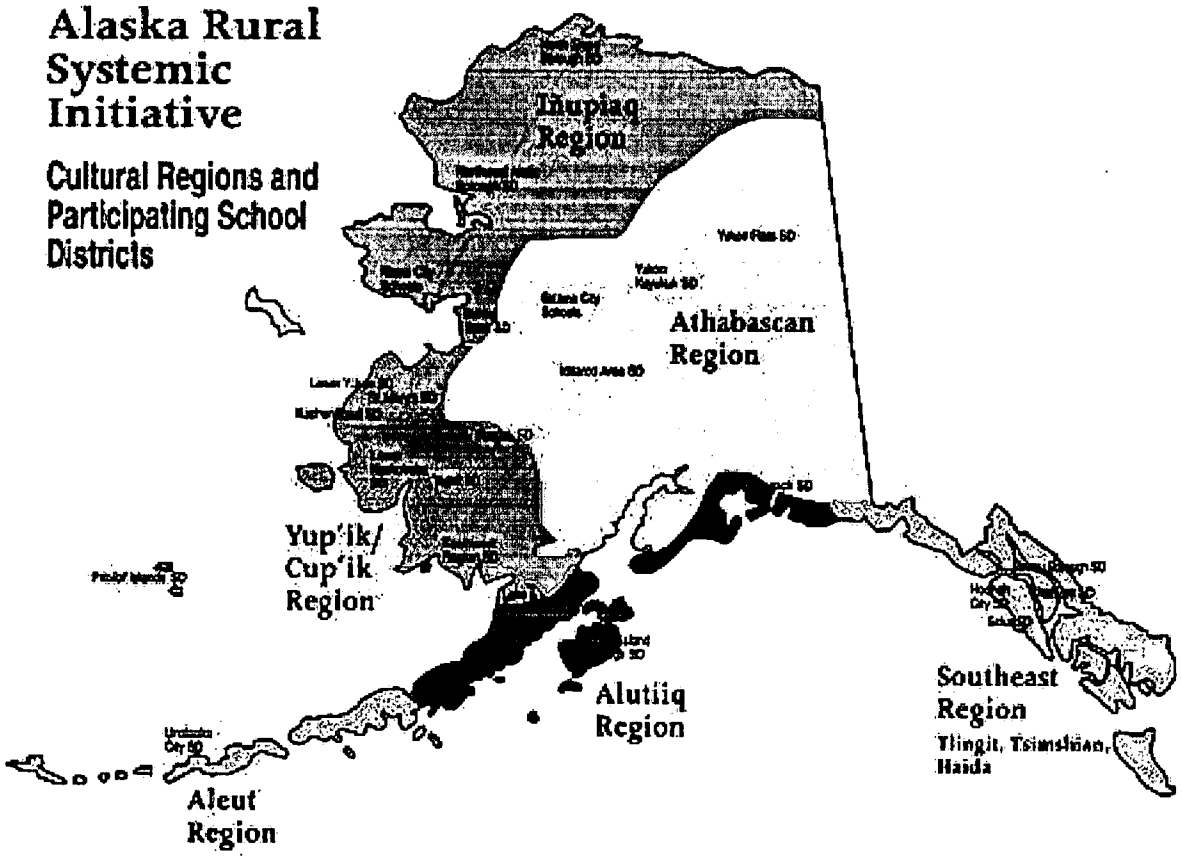
1. Documenting cultural/scientific knowledge
2. Indigenous science teaching practices
3. Standards-based math and science curriculum
4. Teacher support systems
5. Appropriate math and science assessment practices

In this way, rural schools across the state have been engaged in common/shared endeavors that unite them, at the same time that they have been concentrating on particular initiatives in ways that are especially adapted to their respective regions. Together, these initiatives have sought to generate a strengthened complex adaptive system of education for rural Alaska that can effectively integrate the strengths of the two constituent emergent systems. A summary of the activities that link the regions together through the five integrating themes and the responsible organizations is provided in the Supplementary Documents section.

Section I: Overview of the System Undergoing Reform

Demographics

The following map outlines the five major cultural regions around which the AKRSI initiatives have been organized. The twenty participating rural school districts (including the five focal districts) are evenly distributed across the five regions.



In the initial year of implementation, nine rural school districts (with a total of 102 schools) joined the AKRSI to implement the various initiatives. That number was scaled up to 20 school districts in year two and those districts have continued as the focus of the AKRSI through year five, currently involving a total of 176 rural schools serving 18,942 predominately Alaska Native students (see detailed list of schools and demographics in the Supplementary Documents). These schools/districts will continue to serve as the primary partners throughout the Phase II (along with the 30 associated Native organizations, state agencies, rural campuses, professional organizations, etc. with which we have subcontracted for various purposes), though the remaining 103 rural schools (mostly serving non-Native communities) will also be engaged to implement the applicable initiatives in varying degrees as they rotate through the respective regions. By the end of Phase II the Alaska Rural Systemic Initiative will have implemented activities associated with each of the initiatives that will have directly or indirectly impacted all the 279 rural schools in the state, serving a total of 33,666 students with a professional staff of 2988.

SUMMARY OF DEMOGRAPHIC DATA FOR AKRSI SCHOOLS/DISTRICTS, 1995 - 2000

	# Sch. Dist.	# K-12 Sch.	# M/S Teach	# Students	% Ethnic/rac
1995	9	102	35	11,854	92
1996	20	176	98	18,308	80
1997	20	176	115	18,808	80
1998	20	176	118	18,965	80
1999	20	176	118	18,982	80

Balancing breadth and depth in the change process

During the first year of implementation of the intervention strategy outlined above, the locus of activity was concentrated in one or two key school districts in each of the five regions, so that sufficient time and effort could be put into identifying appropriate staff and working through the details of each initiative to determine its efficacy and manageability. In the second year, the number of school districts was doubled to include most of the rural districts with a 50% or more Alaska Native student population, and additional funding ($3,000,000) was obtained from the Annenberg Rural Challenge to integrate comparable systemic reform initiatives in the areas of social studies, language arts and fine arts. One school district in each region from the original target districts was also identified as the "focal district" for purposes of intensive implementation of the initiatives, and for more detailed tracking of the impact of the systemic reform strategy at the school/district level (i.e., core data elements). These included the Lower Kuskokwim School District (Yup'ik), Northwest Arctic Borough School District (Inupiaq), Yukon-Koyukuk School District (Athabascan), Chatham School District (Tlingit-Haida) and Kodiak Island Borough School District (Alutiiq/Aleut).

As we shifted the initiative emphases from one cultural region to the next, continuity has been provided through the efforts and guidance of an AKRSI Regional Coordinator in each region, who insure that the activities from each initiative continue to be emphasized in the original region, and are built upon as they are extended to the new region. Thus, the scale-up process for each initiative has been cumulative within each region as well as across regions. The data gathering for purposes of assessing impact has concentrated on the 20 participating rural school districts and most intensively (especially for CDE purposes) on one focal district in each of the five regions. To gauge overall impact of the AKRSI on the participating schools/districts, we have drawn comparisons in performance between the 20 AKRSI districts and the 28 non-AKRSI rural districts on measures such as student achievement scores in math, drop-out rates, university attendance and choice of math/science majors.

Current Status

1. Schools and students reached:

The Alaska Rural Systemic Initiative is currently concentrated most directly on 20 rural school districts containing 176 schools that serve predominantly Alaska Native communities throughout the state. Together these districts serve a total of 18,982 students, constituting nearly 60% of all rural students in Alaska. However, these school districts contain approximately 90% of the Alaska Native student population in rural Alaska, and have historically produced the lowest achievement scores in the state (and nation). Likewise, Native people have been the most under-represented group in all aspects of math and science education and practice in Alaska (as well as in the country as a whole). The five rural districts that serve as the AKRSI "focal districts" contain a total of 8,351 students in 61 schools served by 791 certificated staff. The remaining rural school districts and students throughout the state have also been impacted, however, through participation in AKRSI-sponsored activities such as professional development workshops (e.g., the Alaska Science and Math Consortia), Native science fairs, Alaska Native Science Education Coalition activities, science camps, Leadership Institutes, etc., as well as changes in state policies and the utilization of culturally-aligned curriculum resources generated by AKRSI and made available through the Alaska Native Knowledge Network.

2. Teachers reached/involved:

A wide array of Alaska RSI-sponsored professional development opportunities have been offered at both the district and statewide levels in the State. These include statewide conferences for math/science educators, regional and statewide curriculum workshops, a regional Scientist-in-Residence program, the Alaska Native Science Education Coalition, Native science and cultural camps for teachers, a regional Academy of Elders for Native educators, and various district-level workshops around specific initiatives. School districts have readily provided release time for individual teachers and devoted district inservice time and travel funds to these efforts.

The 20 rural school districts directly involved with AKRSI initiatives employ a total of 1806 certified personnel, which constitutes 60% of the certified personnel serving in rural schools. However, only 6% of those personnel are Alaska Native (even though one district has reached over 30%). Given the 30+% turnover rate for teachers in many rural schools, as well as a growing teacher shortage in general, the emphasis of AKRSI has been on those changes that can bring about a higher degree of stability and continuity in the professional personnel in those schools, and particularly on the preparation of more highly qualified Alaska Native teachers and administrators (especially in the areas of math and science). While non-Native teachers are directly involved in many of the AKRSI professional development initiatives, the metrics and demographics associated with the annual turnover of rural educators makes it clear that even a concentrated effort at upgrading the capacity of those teachers would have little lasting impact on the quality of math and science instruction in rural schools, because we would have to repeat the process every three years on the average to sustain a minimum level of impact. All rural teachers have been impacted by the work of the AKRSI, however, as the licensing requirements, professional development initiatives and the curriculum and policy changes that have been implemented at the state level extend out to the hiring and retention practices of rural school districts.

Based on a successful AKRSI initiative in the Interior Athabascan region during Year One, we have sponsored in each of the five regions a process we call an "Academy of Elders." An Academy is made up of Native teachers, Elders and practicing scientists and science teachers, all of whom gather for a week or more at a camp or village site where the Elders and scientists pass on their knowledge in reference to some aspect of the local environment to the teachers. The teachers are then responsible for developing curricular applications for what they have learned, checking with the Elders and scientists for its accuracy, and then pilot testing it in the classroom to determine how effective it is with students. These refined curriculum units are then compiled and put onto the AKRSI web site and into publication form for distribution to other teachers and schools. In July, 2000, the

Association of Interior Native Educators received approval of a $1.3 million federal grant to assemble the curriculum materials that have been generated from the five Interior Academy's for distribution to all eight rural school districts in the Interior, and to provide on-site professional development for the teachers.

This process is now coupled with the AKRSI sponsorship of a series of regional Native Educator Associations, one function of which has been to host the regional Academy as well as an annual meeting in which the work of the teachers is shared with school board members, superintendents, teachers, teacher aides and students. In Feb., 2000, the fourth statewide Native Educator's Conference was held in Anchorage, hosted by the Native Educator Associations under AKRSI sponsorship. In addition to the presentations and sharing of the products of the previous years work among the 200+ attendees, work sessions were convened to address issues of general concern. Three years ago, the Native educators produced the Alaska Standards for Culturally Responsive Schools, which have since been adopted by the State Board of Education and are now in use in schools throughout the state. The Cultural Standards embody the reform strategy of the AKRSI and are having ripple effects in urban as well as rural schools. The focus of last years NEC work session was on the development of "Guidelines for the Preparation of Culturally Responsive Teachers," which are now being put to use in preservice and inservice programs around the state. The most recent NEC produced a set of "Guidelines for Respecting Cultural Knowledge," which is now under preparation for distribution throughout the state. These guidelines are designed to assist teachers in the appropriate integration of indigenous knowledge in their teaching.

Section II: AKRSI Influences on Student Performance and Participation – Phase I

Given the need for in-depth data to be able to adequately examine the issues associated with systemic reform and the labor-intensive nature of gathering such data from widely diverse and geographically dispersed schools, we have concentrated our efforts on selected schools, districts and initiatives in each region, focusing on those which represent the range of characteristics exhibited by all schools in rural Alaska (the five focal districts). In this way, we have sought to achieve a greater depth of impact on the most needy schools and communities in rural Alaska, as well as a deeper understanding of what does or does not make a difference in rural school reform efforts. The data accumulated for the first five years of the AKRSI on which the following summaries are based are included in are included in the Supplementary Documents (along with the AKRSI partner school districts identified with an asterisk). In addition, the core data elements submitted to QRC/NSF have been a source of in-depth data for longitudinal comparison of the impact of the AKRSI initiatives.

The first challenge of the AKRSI in this area was to encourage and assist school districts in the establishment of higher level math and science courses, so that students would have the option to enroll in them. For many rural students, the highest level of math and science courses offered in their school has been algebra and general science respectively. As students see greater relevance for linking the study of math and science to the needs of their communities, their level of expressed interest has increased, and several districts are now putting together higher level courses that will be offered in a variety of forms. One district is taking the approach of offering the basic science disciplines of physical, biological and earth sciences on a three-year rotational schedule, so students across three grade-levels can make up a sufficient enrollment to justify full-blown courses, and all students have an opportunity to take all three courses, though in different sequences. Other districts have established positions of "itinerant specialists," so that qualified science and math teachers move from school to school on a rotational basis to make advanced courses available to students. A third approach has been to adopt courses in interdisciplinary areas that integrate standards-based science and math subject matter in applied fields of relevance to the local area (ecology, fisheries, bio-chemistry, computer science, and variations on applied technology). A fourth approach being pursued by two districts involves investing in two-way video technology, so that teachers with expertise in certain subject areas can teach students throughout the respective region, with tutorial

support from the teacher on site in each village school. As these new opportunities have been made available, the level of interest has been high on the part of students and teachers.

Another initiative aimed at making available advanced math and science courses is coming from the University of Alaska, which has established a partnership between the rural campuses and adjacent rural school districts to offer entry-level university courses (focusing on calculus, chemistry and physics) in such a way that they can also be taken as "advance placement" courses by interested high school students. The most promising avenue for achieving increased interest in advanced level courses has been the establishment of local chapters of the American Indian Science and Engineering Society, which is now in its fifth year. Three high school chapters of AISES have been established in the school districts serving the Inupiaq Eskimo region, four in the Athabascan region, three in the Aleut/Alutiiq region, and now four in the Yup'ik/Cup'ik region. Each chapter has sponsored an Alaska Native Science Fair in their region. Students begin to prepare for the fairs while participating in the various AISES Science Camps held in the summer and fall. These high school chapters are being mentored and supported by members of the nearby college and professional chapters of AISES.

Data on student performance and participation

The performance indicators of the effects of the first five years of implementation of the AKRSI initiatives show a net gain between AKRSI partner schools over non-AKRSI rural schools in the mean of the percentage of students who are in the upper quartile on 8th grade standardized achievement tests in mathematics, and a corresponding greater decrease in the percentage of students who are performing in the bottom quartile for AKRSI partner schools over non-AKRSI rural schools. At the 11th grade level, AKRSI students are moving out of the lower quartile in math performance at a significantly greater rate than non-AKRSI students, but non-AKRSI students are entering the top quartile at a faster pace than AKRSI students, though both groups are showing a substantial increase on the upper end. In addition, the student dropout rate for grades 7-12 in AKRSI partner schools has declined from a mean of 4.4 in 1995 to 3.5 in 1998, whereas the dropout rate decreased from 2.7 to 2.4 in non-AKRSI rural schools in the same time period. Most noteworthy from a long-term standpoint has been the increased enrollment of Alaska Native students from the AKRSI districts into the University of Alaska, along with the dramatic increase in the enrollments of Native students in majors in math and science fields, especially in the life sciences. The details and significance of these and other related data are included below.

A major step toward linking learning of math and science to the local environment has been the sponsorship of several regional science camps focusing on helping students (and teachers) recognize the many facets of science that are practiced in the everyday activities of the people in their communities, including the scientific knowledge imbedded in many of the traditional activities of the local Native people. These camps show a consistent benefit in helping students develop interest and achieve success in the study of science, and they have attracted widespread attention, including several statewide radio and newspaper reports. The intent of the camps is to stimulate interest in science through success in a familiar setting, which will carry over to greater success in the classroom and laboratory setting.

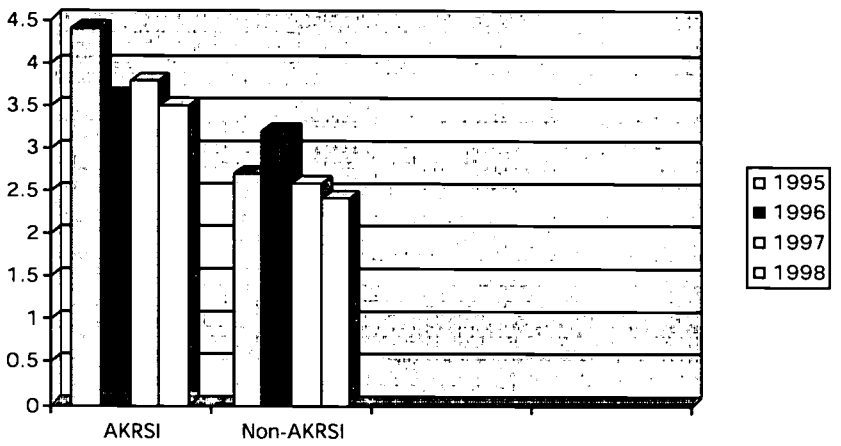
A comparative analysis of student academic performance following one such NSF-funded science camp sponsored by the Juneau School District in the Southeast region provides strong evidence of the beneficial effects of student participation in such activities. In a comparison of the subsequent grade point averages of the 36 middle school students who participated in the camp and a matched control group of students who did not attend the camp, the overall GPA's of the camp group remained stable from the preceding year, while those of the control group declined in a pattern typical of students at those grade levels in that district (and many others). However, when the data was disaggregated by gender and ethnicity, the Alaska Native students who attended the Camp showed a significant gain over the previous years academic performance, while those who did not attend showed a typical decrease. Furthermore, the Native students from the Camp group who produced the greatest increase

were the male students from the lower quartiles the previous year, whereas the Native males were the students with the greatest decrease in the control group.

The beneficial academic effects of putting students in touch with their own physical environment and cultural traditions through a guided experience have not gone unnoticed by school districts and other Native organizations around the state, which have sponsored a minimum of twelve such camps of various kinds, in addition to the eight camps/academies/institutes that we have co-sponsored through the AKRSI. One AKRSI school district has urged all of its schools to start the school year with a minimum of one week in a camp setting, combining cultural and academic learning with parents, Elders and teachers all serving in instructional roles. One school in the district has built up to a full month of camp for the middle school students, with a well-crafted curriculum addressing both the state Content Standards as well as the newly adopted Cultural Standards.

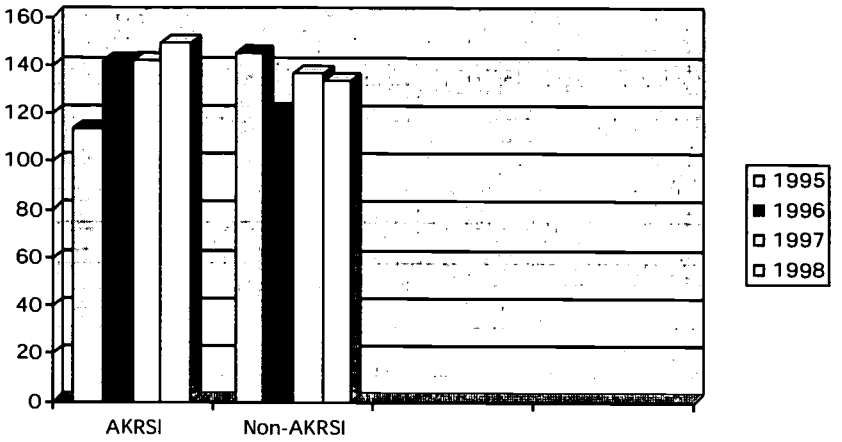
The measure that we have been using to track the impact of the AKRSI on high school completion is the school district dropout rates for grades 7-12, as reported to the Alaska DOE by all districts each year. In comparing the dropout rates after the first four years of AKRSI with those of the baseline year, between the partner schools and those of non-AKRSI rural schools, those districts associated with the AKRSI reported an overall decline in dropout rates of .9%, while the non-AKRSI districts reported an overall decrease of .3%. The following chart illustrates the difference, and the district-by-district breakdown is provided in the Supplementary Documents section. In general, the dropout rate has decreased more in the AKRSI districts than in the non-AKRSI districts, though the overall rate continues to be higher in the AKRSI districts.

GRADE 7-12 DROPOUT RATE - 1995, 1996, 1997, 1998



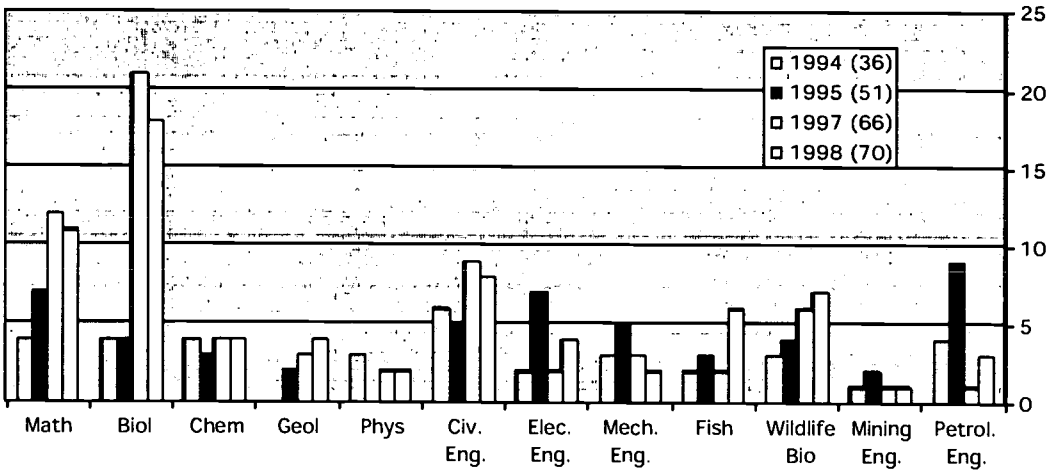
A comparison of the enrollments of first-time freshmen rural students at the University of Alaska indicates that the number of students from rural districts involved with the AKRSI (20 districts, 133 communities) increased from 114 in 1995 to 149 in 1998, while the enrollment of new rural students from non-AKRSI rural districts in Alaska (28 districts, 120 communities) decreased from 145 in 1995 to 134 in 1998. While these are significant differences, it should be noted that many of the non-AKRSI rural communities tend to be made up of a majority non-Native population who are more likely to attend college outside of Alaska than the students from the primarily Native AKRSI communities. It has been encouraging to see the continuation of increased enrollments of rural/Native students at the university, and with the recent adoption by the UA Board of Regents of a full scholarship for the top 10% of each high school graduating class in the state, we expect to see this trend continue.

UA Rural Student First-Time Enrollments – 1995, 1996, 1997, 1998



Since the University of Alaska Fairbanks is the primary higher education institution in Alaska emphasizing the sciences, and since it is the institution that has historically been responsible for serving rural Alaska, we have been using the level of Alaska Native enrollment in UAF math, science and engineering majors as the primary indicator of shifts in rural student choices in pursuing careers in those fields. The following chart indicates that, of the 12 major fields available at UAF, the percent of Alaska Native student enrollment increased over Year One in seven fields (math, biology, geology, civil engineering, electrical engineering, fisheries, and wildlife biology), stayed the same in two (chemistry and mining engineering), and decreased in three (physics, mechanical engineering and petroleum engineering). It is especially encouraging to see the significant and steady increase in overall enrollments of Native students in math, science and engineering fields, from 36 in 1994 to 70 in 1998.

% Alaska Native Student Enrollments at UAF in Math/Science Majors 1994, 1995, 1997, 1998



It is noteworthy to point out the substantial increase in the enrollment of Alaska Native students in the life/biological science fields (including fisheries and wildlife biology), since that is consistent with the

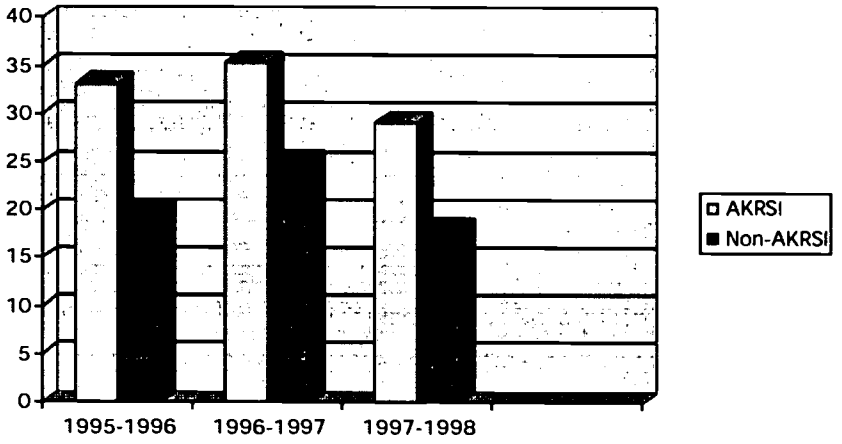
interests shown by younger students as they select topics for developing a project to enter into a science fair. It also reflects strong practical considerations, since the increases in Native enrollments are in those fields for which job opportunities are most likely to be available in rural communities. In addition, these are the majors that are most consistent with the areas of expertise that have been at the heart of the survival of indigenous cultures and traditional knowledge systems.

One of the additional factors that has had an impact on increasing the level of interest of Alaska Native students in careers in math, science and engineering is the increased interest in the establishment of AISES chapters in the AKRSI schools, along with the presence of a strong active chapter of the American Indian Science and Engineering Society on campus at UAF (it has been selected as "National AISES Chapter of the Year" or runner-up for the last four years). AKRSI has been working to assist in the establishment of high school chapters in the cultural region involved in the "Village Science Applications and Careers" initiative each year, so we anticipate that the level of interest in math, science and engineering careers will increase accordingly. As those high school students attend the university, we will be able to track them by region to determine if there has been any differential impact as a result of the AISES chapters and the associated Science Camps and Native Science Fairs.

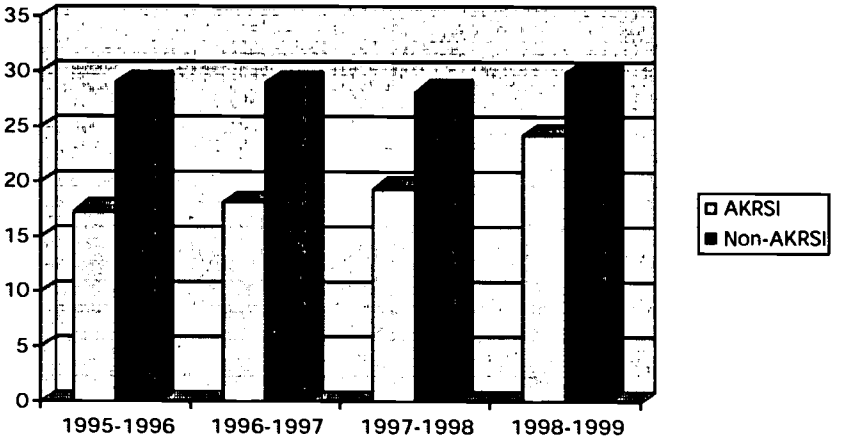
While we are working with the Alaska Department of Education to develop and implement a broader array of appropriate measures to track the performance of Alaska students in the areas of math and science, the measures that we have adopted as the primary indicator of the impact of the AKRSI initiatives on student academic performance are the percentage of students who score in the upper and lower quartiles on the standardized achievement tests administered in all schools in the state (mainly because these are the only ones with reliable data available across the timeframe we have been working in). However, to add validity, we have also included a comparison of student performance on these measures between AKRSI and non-AKRSI rural schools, in part because between 1994 and 1995, the state shifted from administering the Iowa Test of Basic Skills in reading, language arts and mathematics to grades 4,6 and 8, to administering the California Achievement Test, 5th Edition in the same subject areas, but to grades 4, 8 and 11. Since the same conditions apply to all schools in Alaska, it is a valid exercise to compare the performance of students across districts, though there are problems with comparison across the two transition years. Starting in Year Four, we have been able to make more extensive comparisons, including between the 1996 and 1997 grade 11 performance levels. These comparisons will be further complicated in the future as the State moves from the CAT-5 to a newly developed qualifying exam in the areas of math, reading and writing, which has been mandated by the legislature to go in effect for the class graduating in 2002. We should, however, be able to continue to make comparisons between AKRSI and non-AKRSI schools/districts.

The initial indicators of the effects of the first four years of implementation of the school reform initiatives in the 20 AKRSI school districts (which have historically had the lowest student achievement levels in the state and nation) point to a differential gain between AKRSI partner schools and non-AKRSI rural schools of 5.9 percentage points between 1995 and 1999 in the mean of the percentage of students who are in the top quartile on 8th grade standardized achievement tests in mathematics. A corresponding differential decrease of 2.2 percentage points between 1995 and 1998 indicates a greater decrease in the percentage of students who are performing in the bottom quartile for AKRSI partner schools over non-AKRSI rural schools. The raw data for this analysis are included in the Supplementat Documents section.

EIGHTH GRADE MATHEMATICS PERFORMANCE – 1995/96, 1996/97, 1997/98
% Rural Students in **Bottom Quartile** on CAT-5

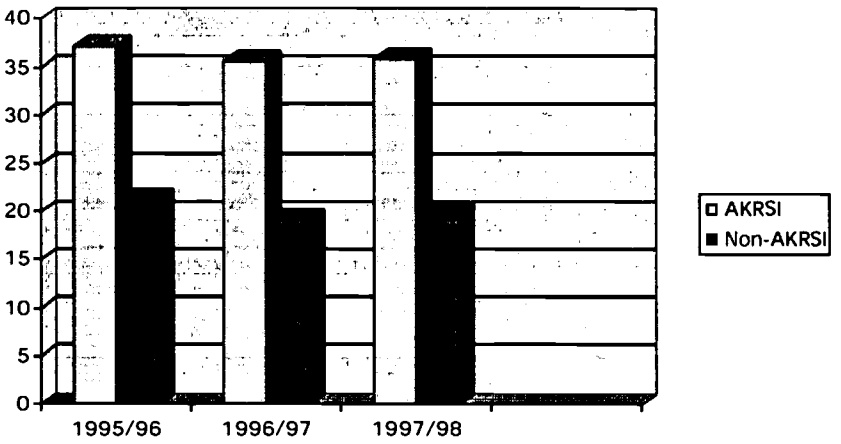


EIGHTH GRADE MATHEMATICS PERFORMANCE – 1995/96, 1996/97, 1997/98, 1998/99
% Rural Students in **Top Quartile** on CAT-5

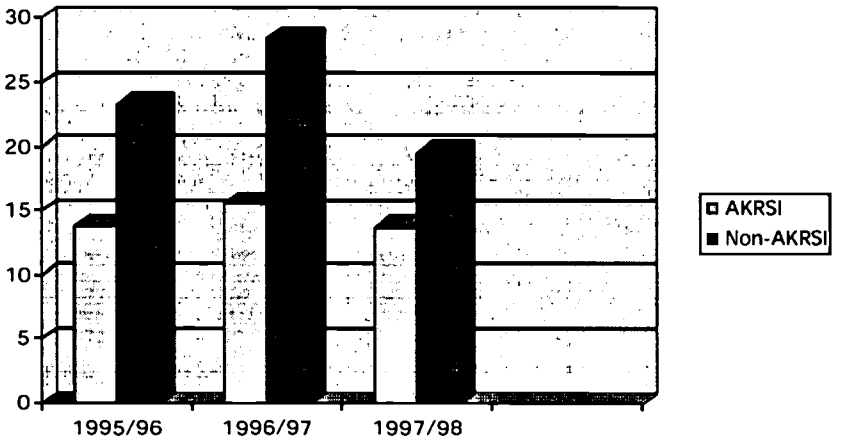


At the 11th grade level, the data indicates that AKRSI 11th grade students are moving out of the lower quartile in math performance at a significant rate while non-AKRSI students are changing very little, but non-AKRSI students are entering the top quartile at a faster pace than AKRSI students, though both groups are showing a substantial increase on the upper end.

ELEVENTH GRADE MATHEMATICS PERFORMANCE – 1995/96, 1996/97, 1997/98
% Rural Students in **Bottom Quartile** on CAT-5



ELEVENTH GRADE MATHEMATICS PERFORMANCE – 1995/96, 1996/97, 1997/98
% Rural Students in **Top Quartile** on CAT-5



While this data indicates significant increases in the percentage of students who have performed in the upper quartile on standardized math tests in both AKRSI and non-AKRSI schools (with a significantly greater decrease in the percentage of AKRSI students in the lower quartile), it is apparent that the cumulative effect of increasing the connections between what students experience in school and what they experience outside school appears to have a significant impact on their academic performance (at least in one subject area at two grade levels).

Summary of progress during Phase I

The Alaska Rural Systemic Initiative completed its fifth year with a full complement of rural school reform initiatives in place stimulating a reconstruction of the role and substance of schooling in rural Alaska. The educational reform strategy we have chosen — to foster connectivity and complementarity between the formal education system and the indigenous communities being served in rural Alaska based on current concepts, principles and theories associated with the study of complex adaptive systems — continues to produce an increase in student achievement scores, a decrease in the dropout rate, an increase in the number of rural students attending college, and an increase in the number of Native students choosing to pursue studies in fields of science, math and engineering. The initiatives

outlined above have demonstrated the viability of introducing strategically placed innovations that can serve as "attractors" around which a new, self-organizing, integrated educational system can emerge which shows signs of producing the quality of learning opportunity that has eluded schools in Native communities for over a century. The substantial realignments that are evident in the increased interest and involvement of Native people in education in rural communities throughout Alaska, as reflected in the various indicators/drivers summarized previously, point to the applicability of complexity theory in shaping reform in educational systems. As the environment in which we operate evolves, we have sought to evolve accordingly, refining and adapting our initiatives to fit the conditions that emerge.

While the NSF funding of the Alaska RSI initiative has been the catalyst for the core reform strategy, we have been fortunate to acquire substantial supplementary funding to address areas for which the RSI funds were not suitable, such as indigenous curriculum materials development (from NSF Division of Elementary, Secondary and Informal Education), and implementing comparable initiatives to those of AKRSI in the areas of social studies, fine arts and language arts (from the Annenberg Rural Challenge). All of these funds combined provide an opportunity to address the issues facing schools in Native communities throughout rural Alaska in a truly comprehensive and systemic fashion.

As a means to help document the process of systemic reform in rural schools, we have joined in two related projects that have produced comprehensive case studies of educational practices and reform efforts in nine rural communities/schools in Alaska. Seven of the case studies were funded through the Northwest Regional Educational Laboratory by a field-initiated grant from the National Institute for At-Risk Youth under USDOE, and the other two are being administered by Harvard University through a grant from the Annenberg Foundation. Since all of the communities are in school districts associated with the Alaska Rural Systemic Initiative, we have been able to obtain a good cross-section of in-depth data on the impact of the RSI reform effort over the past few years (see References section for details). Results of the case studies of systemic reform in rural education were presented at the 1999 annual meeting of the American Educational Research Association in Montreal, and one of the AKRSI PI's reported on the lessons learned in a panel on "Research Utilization in School Reform" which was held in conjunction with the 2000 AERA meeting in April in New Orleans. An article summarizing this research has been accepted for publication in the Journal for Research in Rural Education in 2001.

We are mindful of the responsibilities associated with taking on long-standing, intractable problems that have plagued schools in indigenous settings throughout the world for most of this century, and we have made an effort to be cautious about raising community expectations beyond what we can realistically expect to accomplish. We are also mindful of the larger context in which the AKRSI operates and the expectations of the funding agencies with mandates to support initiatives that can contribute to a larger national agenda. Our experience thus far is such that we are confident in the route we have chosen to initiate substantive reforms in rural schools serving Alaska's Native communities, and while we expect to continue to encounter plenty of problems and challenges along the way, we are capitalizing on a broadly supportive climate to produce changes that will benefit not only rural schools serving Native students, but will be instructive for all schools and all students. We welcome the opportunity to continue to explore these ideas and find ways to strengthen and renew the educational systems serving people and communities throughout our society.

Section III: AKRSI Influences on the System

Following is a short description of each of the key AKRSI-sponsored initiatives as they relate to the overall educational reform strategy outlined above.

Native Ways of Knowing/Parent Involvement – Each cultural region has been engaged in an effort to distill core teaching/learning processes from the traditional forms of child-rearing and parenting in the communities to be used in the development of pedagogical practices in the schools that incorporate these processes (e.g., learning by doing/experiential learning, guided practice, detailed observation, intuitive analysis, naturalist intelligence, cooperative/ group learning, listening

skills). Further refinement of these practices for educational purposes took place in May, 2000 with the convening of a conference on "traditional child-rearing and parenting practices" by AKRSI in cooperation with the Alaska Department of Education and Early Development. These practices have been incorporated into the "Guidelines for Nurturing Culturally Healthy Youth," which are now being infused in the preservice and inservice professional development programs of the university's and school districts.

Culturally Aligned Curriculum/Cultural Standards - A set of complementary "Alaska Standards for Culturally Responsive Schools" have been developed for students, teachers, curriculum, schools and communities that provide explicit guidelines for ways to integrate the local culture and environment into the formal education process so that students are able to achieve cultural well-being as a result of their schooling experience. These "cultural standards" are now being used to help schools align standards-based curriculum with the knowledge base that exists in the surrounding community. In addition, the Alaska Native Science Education Coalition, which is made up of representatives from over 20 agencies, professional organizations and other programs that have an interest and role in science and math education in rural Alaska schools has placed an emphasis on integrating the cultural standards into science curricula. Under the coordination of the math specialist with the Alaska DOE, the ANSEC is now focusing its vast array of curriculum and professional development resources around the implementation of culturally responsive math curriculum, including the incorporation of rural/cultural considerations in the Coalition members own materials and practices (e.g., Alaska Math Consortium workshops, Yup'ik Math curriculum materials, Observing Locally/Connecting Globally program, etc.).

Indigenous Science Knowledge Base/Cultural Atlas – Students in rural schools have been interviewing Elders in their communities, researching existing documents related to the documentation of indigenous knowledge, and then assembling the information they have gathered into a multimedia format for publication as a "cultural atlas" on CD-ROM and the Internet (examples may be viewed at http://www.ankn.uaf.edu). Documentation thus far has focused on themes such as weather prediction, edible and medicinal plants, geographic place names, flora and fauna, moon and tides, fisheries, subsistence practices, outdoor survival and the aurora. These documentation efforts will now be expanded and linked together through the development of curriculum templates that can be used to form a statewide database for furthering the application of technology as a tool for the incorporation of cultural knowledge in the implementation of standards-based curriculum. In addition, two volumes of village oriented science curriculum resources have been developed in collaboration with rural teachers and these are now being distributed to all the schools in rural Alaska. They are designed to serve as a supplement to existing curriculum materials, so on-site workshops can be provided to teachers with ideas on how to relate the teaching of basic science and math concepts to the surrounding environment.

Elders and Cultural Camps/Academy of Elders – Experienced Native educators have been convening with Native Elders in a traditional camp setting around an identified science/math theme and engaging in a deliberative process through which the Elders share their traditional knowledge related to the theme and the Native educators seek ways to apply that knowledge to teaching various components of the standards-based curriculum. The educators then field test the curriculum ideas they have developed, bring that experience back to the Elders for verification, and then prepare a final set of curriculum units that are pulled together and shared with other educators (examples of curriculum units are posted on the Alaska Native Knowledge Network web site). In addition, regional associations of Native educators have been formed in each cultural region to provide an avenue for sustaining the initiatives that are being implemented in the schools by the AKRSI. The regional associations sponsor curriculum development work, organize Academies of Elders and host regional and statewide conferences as vehicles for disseminating the information that is accumulated. By focusing AKRSI efforts and resources on the Native educators, whose commitment to education in rural Alaska is lifelong (as opposed to an average stay of three years for non-Native educators) and who are themselves co-members of the cultural community being served, the opportunities for

achieving interconnectivity and complementarity between the indigenous community and the educational system are multiplied many times over, and they are more likely to be sustainable.

ANSES Chapters/Camps/Science Fairs – K-12 chapters of the American Indian Science and Engineering Society have been formed in rural districts serving each of the five cultural regions. These chapters have participated in AISES Science Camps and have sponsored Native Science Fairs in which the students projects were judged for their science content by experienced science teachers and for their cultural content by Native Elders. The winners of the regional science fairs have gone on to compete in the first statewide "Alaska Native Science and Engineering Society" science fair held in February, 2000, and the statewide winners went on to take five ribbons in the national AISES Science Fair in Minnesota in April. The focus of the ANSES initiative in Year Five has been on sponsorship of the statewide science fair as a vehicle for guiding the local and regional ANSES chapters in the sponsorship of science camps and local/regional science fairs. Guidelines and supporting documents for this initiative are in the final stage of publication and distribution to schools throughout the state (drafts are available on the ANKN web site). In addition, under the sponsorship of the Alaska Native Science Education Coalition, small regional teams of science teachers, Native teachers and Elders have been building science and math curriculum units around a locally identified theme that can serve as a focus for meeting state content standards starting from a knowledge base grounded in the local environment (e.g., weather, food preservation, moon/tides, birch trees, berries, measuring systems). These units are then field tested by the participating teachers, refined and made available to teachers throughout the state as models for an on-going process of standards based and culturally grounded curriculum development. These units also provide numerous examples of science projects incorporating traditional and western science knowledge that students can develop for the ANSES science fairs.

The initiatives outlined above have been implemented on a region-by-region basis to integrate the reform process into the everyday workings of the schools and districts to a sustainable level. In addition to the regional initiatives, an array of statewide initiatives have also been implemented to support the activities at the local and regional levels. Following is a summary of the statewide initiatives as they relate to the implementation of the regional initiatives.

Math/Science Performance Standards and Assessments – During Phase I, AKRSI in collaboration with the Alaska DOE, prepared a set of science performance standards and sample assessments that take into account the cultural context in which students are situated. These are now being used by the state as a model for other content areas as assessment materials are being developed for use by schools on a statewide basis. Through AKRSI support, the task force developing the science performance standards included significant representation from rural/Native communities to help incorporate the various cultural and geographic perspectives needed to provide equity in the assessment process. A similar process is now being applied to the math content standards, with the added challenge of impacting the design of the high-stakes mathematics exam that will be required (along with reading and writing) for high school graduation in 2002.

Alaska Standards for Culturally Responsive Schools – An array of professional development activities are have been developed to assist teachers, administrators, curriculum developers and school boards in the integration of the "Alaska Standards for Culturally Responsive Schools" in their work. These activities include the integration of the "Guidelines for Preparing Culturally Responsive Teachers" into teacher pre-service programs, as well as the formation of an Alaska Native Literary Review Board to oversee the application of the recently adopted "Guidelines for Respecting Cultural Knowledge" in the development and selection of curriculum materials and the integration of cultural expertise into pedagogical practices.

Native Educator Associations – The 12 regional Native Educator Associations that have been gradually assuming additional responsibilities, including incorporating the Guidelines for Preparing Culturally Responsive Teachers (which they developed) into teacher preparation programs, and the sponsorship of a statewide Native Educators' Conference in the spring of each year. They will also

draw on their expertise to help increase the number of locally trained teachers in the rural education system.

Cultural Frameworks for Curriculum – The AKRSI Curriculum Clearinghouse has been identifying and cataloging curriculum resources applicable to teaching activities revolving around 12 broad cultural themes organized on a chart that provides a "Spiral Pathway for Integrating Rural Alaska Learning." The themes that make up the S.P.I.R.A.L. framework are family, language/communication, cultural expression, tribe/community, health/wellness, living in place, outdoor survival, subsistence, ANCSA, applied technology, energy/ecology, and exploring horizons. The curriculum resources associated with each of these themes can be accessed through the ANKN website at http://www.ankn.uaf.edu. These materials are now being screened to identify the resources most applicable to the AKRSI reform strategy and then incorporated into a 12-volume CD-ROM collection that will be made available to all schools in Alaska, so that the available materials can be accessed by teachers on an as-needed basis.

Alaska Native Knowledge Network – A web site with over 4000 hits a day, a bi-monthly newsletter (Sharing Our Pathways) with a circulation of over 3000, and a culturally-based curriculum clearinghouse with over 2000 listings, have been established to disseminate the information and materials that are being developed and accumulated as the AKRSI initiatives are implemented throughout rural Alaska.

Consortium for Alaska Native Higher Education – For the past three years, the AKRSI has been working in partnership with five regional initiatives supported by a Kellogg Foundation grant aimed at establishing a network of Tribal Colleges throughout rural Alaska. As these new structures emerge, the AKRSI regional support functions that have been administered directly through the Alaska Federation of Natives will be subcontracted with the regional Native organizations that are spearheading the Tribal College initiatives. In this way, the regional infrastructures best suited to carrying on the work of the AKRSI will be strengthened, and the initiatives of the AKRSI will become an integral part of the development of those infrastructures. The AKRSI PI's have met with the members of the Consortium for Alaska Native Higher Education and they have enthusiastically embraced this strategy for long-term institutionalization of AKRSI initiatives.

Locus and focus of reform process

The following section addresses the actions that are currently underway that provide evidence of progress related to the systemic reform change indicators outlined by NSF, along with a recap of the activities that relate to each of the indicators (taking into consideration the drivers and the cross-cutting variables).

1. Resource changes:

The rural school districts with which we are working have been utilizing their Title I, Migrant Ed, Eisenhower, Johnson-O'Malley and Indian Ed funds to provide supplemental support to the AKRSI initiatives in their regions, including the sponsorship of eight regional science camps during the up-coming summer alone. The cycle of AKRSI initiatives in each region is serving to provide a focal point for the investment of school district resources in enhancing the standard curriculum, including making substantive changes in the curriculum itself (e.g., through the unit-building workshops and the Academy of Elders process).

While changes in school funding formulas adopted by the state legislature are posing a threat to the level of funding for some rural schools and thus are a major preoccupation of those districts at the moment, some significant shifts have taken place in districts associated with the AKRSI, particularly with regard to reallocation of Title I, Indian Education and Johnson-O'Malley funds to support initiatives such as science camps, documentation of cultural resources by students, student projects involving data collection and analysis in their local environment (e.g., fisheries studies, forestry

inventories, water sampling, sanitation studies), increasing involvement of Elders as knowledge resources, use of technology to record and analyze data, etc.. Additional effort are underway to re-direct school district core funding in the areas of staff development and curriculum development toward direct support for the AKRSI school reform initiatives. To assist in this regard, AKRSI has joined a partnership with the Northwest Regional Educational Laboratory for an Eisenhower grant to provide support services to Alaska schools through the Northwest Consortium for Mathematics and Science Teaching. A new grant, "Observing Locally, Connecting Globally," that was developed jointly with the GLOBE program at the University of Alaska Fairbanks was recently funded my NSF to get students involved in bringing local knowledge to bear on the observation of global climate change.

In addition to public resources being brought to bear on the implementation of AKRSI initiatives, we are also collaborating with several organizations in the application of private resources to address education needs in rural Alaska. These include funding support from IBM for computer equipment to support the Cultural Atlas initiative, an additional year of support from the Annenberg Foundation for the Alaska Rural Challenge, a Kellogg Foundation grant to support the Tribal College initiative in Alaska, an AOL grant to assist with a local mapping and place name project in a village school, and a joint project with the Alaska Staff Development Network to the Gates Foundation for upgrading the technological proficiency of school superintendents. Additional private resources are anticipated through the membership of one of the AKRSI PI's on the national board of the Rural School and Community Trust.

2. Policy changes:

In response to the piecemeal approach that had been taken to science and math education policies and practices in the past (most of which omitted consideration of Alaska Native perspectives), the Alaska RSI formed the Alaska Native/Rural Education Consortium, which is made up of representatives of all key players shaping policies impacting Alaska Native students. In its twice-yearly meetings, the Consortium serves to coordinate the efforts of the various players so that related policy initiatives reinforce one another and move science and math education in rural schools in a consistent direction.

The most far-reaching policy agenda impacting all aspects of education in Alaska, including math and science, is the Alaska Quality Schools Initiative, which is being co-sponsored by the Governor's office and the Alaska Department of Education and Early Development, and in which the Alaska RSI is a significant player. It is through the Quality Schools Initiative that the policy changes relating to standards-based curriculum and assessment are being implemented, with support from the Alaska RSI to insure that appropriate consideration is given to Alaska Native issues in the process. The inclusion of science as a content area for developing performance standards and assessment measures is an outgrowth of AKRSI's involvement, since only math was included in the original plan. Also included in the AQSI has been the adoption of "quality schools" standards and designators that will serve as the basis for a state accreditation system for K-12 schools. The special issues associated with rural schools are of particular concern to the AKRSI partner school districts, and we continue to work with them to insure that the standards that emerge are compatible with multi-graded classrooms in small schools with limited resources.

While Alaska has adopted demanding math and science standards, the need now is to support schools in implementing programs that meet those standards. To that end, we are working with various state and professional organizations to strengthen the curricular and instructional base for rural schools. A series of statewide, regional and local conferences, workshops, institutes and meetings have been held to help schools address the question of how they will meet the newly adopted state and national standards for all subjects. However, given legislative efforts to reduce revenues at the state level, rural schools are also taking initiatives of their own, including court action, to obtain the level of funding needed to adequately provide "high quality and rigorous programs." The consequences of various legislative mandates impacting school programs and policies remains to be seen, but they will certainly have an impact of the focus of curriculum policies as the new qualifying exams become a

reality for the class of 2002. With an expanding state population and a fiscally conservative legislature, the policy debates are many and heated, and they are not likely to cool down anytime soon, especially in rural Alaska.

The "Alaska Native Student Learning Action Plan" currently being implemented by the Commissioner and State Board of Education, with support from AKRSI, is intended to provide guidelines and incentives for the alignment of all elements impacting rural/Native students educational experiences throughout Alaska. In summary, the Alaska RSI will continue to work closely with the Alaska Department of Education to help put in place a statewide standards and assessment system that will serve as a guide for identifying areas in need of improvement. The DOE science and math specialists are integral members of the AKRSI staff and will continue to provide on-going support for the coordination of the Alaska Rural Systemic Initiative with the Alaska Quality Schools Initiative.

3. Management changes:

The most significant step in bringing management level attention to the implementation of the AKRSI initiatives throughout rural schools in the state is the arrangement between the Alaska Commissioner of Education and AKRSI for a joint position in the Commissioner's office to help coordinate the two-pronged strategy for rural education reform outlined above. Now that this position has been established, there is a direct linkage between the Quality Schools Initiative/Native Student Learning Action Plan being implemented by ADOE and the initiatives underway through the Alaska Rural Systemic Initiative. This has become all the more important for purposes of maintaining continuity in our rural school reform efforts as personnel changes continue to take place at the highest levels of the state education bureaucracy.

While considerable attention has been given to community engagement and ownership in the implementation of the AKRSI, and to support for teachers to develop curricula and teaching practices consistent with the needs of rural/Native students and communities, little attention has been given to the role of the principal and other administrators and policy-makers in this process. In the meantime, rural schools are grappling with the task of implementing standards-based curricula and performance assessments, meeting legislative mandates for high school graduation qualifying exams, responding to increased demand for community voice in school programs, and accommodating increasing enrollments while at the same time experiencing significant budget constraints, all of which calls for the development of new support systems to assist administrators in making the structural changes that are necessary to respond to this rapidly changing leadership environment.

Two additional ways in which the AKRSI has addressed this indicator are in the establishment of a distance education course on "Leadership for Culturally Responsive Schools," to be offered through the Alaska Staff Development Network as a way to meet state certification requirements, and in the implementation of a technology grant from the Gates Foundation, also in collaboration with the ASDN, to sponsor training aimed at increasing the technological proficiency and awareness of school superintendents. The latter is intended to help administrators develop a more systemic approach to the integration of technology in schools throughout the state.

4. Data utilization:

Both the core data elements and school district data collection and utilization related to the goals of the AKRSI are being coordinated through the staff responsible for math and science assessment at the Alaska DOE, to avoid duplication of effort and to bring AKRSI goals and considerations into the state-level assessment planning and implementation process that impacts all schools in the state. Both the math and science specialists at DOE have participated in the NSF PI/PD meetings, so they are aware of the goals of the NSF/RSI, as well as the challenges in developing data collection and assessment procedures that are meaningful and in support of these goals. The insights gained from these associations, including the importance of being able to disaggregate data for various purposes, have been factored into the planning for a new electronic data entry system that is under development

by the Department of Education. The math/science data specialists also participate in the AN/RE Consortium meetings, as well as various regional meetings in which they share the information obtained through the state data collection process to help shape the planning for the next round of initiatives.

5. Implementation of standards-based curriculum:

5.a. Standards-based curriculum:

The Alaska Rural Systemic Initiative has taken several major initiatives focusing on supporting the implementation of high quality standards-based, culturally aligned science and math curricula at the statewide as well as the regional levels. On the statewide level, we have worked directly with the Alaska Department of Education and Early Development to develop science and math performance standards and assessment measures for ages 5-8, 8-10, 10-14 and 14+, that now serve as benchmarks for student performance on the state content standards. This has been followed with a coordinated year-long effort between AKRSI, the Alaska DOE, the school districts and the University of Alaska, building sample performance assessments/rubrics and developing/field testing in-depth science curriculum units, based on the Alaska Curriculum Frameworks effort from year one.

The second major AKRSI initiative in the area of curricula has been the creation of a curriculum clearinghouse to identify, review and catalog appropriate national and Alaska-based curriculum resources suitable for rural/Native settings and make them available throughout the state via the world wide web. This is now being extended to include a CD-ROM collection of the best materials in various thematic areas most relevant to schools in rural Alaska. A curriculum specialist has been assembling materials from all over the state and has established a searchable database of curriculum resources on the Alaska Native Knowledge Network web site at http://www.ankn.uaf.edu. With over 500,000 visitors to the web site in the first six months of 2000, requests for materials listed in the ANKN database has grown steadily. The curriculum clearinghouse will continue to develop and disseminate resource materials, as it works toward becoming a permanent fixture at the University of Alaska supported by a consortium of rural school districts.

The third major AKRSI initiative that was implemented during Phase I was the development of a set of "Alaska Standards for Culturally Responsive Schools," including sections on cultural standards for students, educators, curriculum, schools and communities. These standards provide guidelines for teachers, schools and districts seeking to develop curricula that are responsive to the indigenous knowledge systems and ways of knowing in rural/Native communities, while at the same time addressing high quality state and national standards. The Cultural Standards were formally adopted by the Alaska State Board of Education and have been distributed throughout the state for implementation. The Alaska Department of Education is also including them in the Alaska Math/Science Curriculum Frameworks document for use by all schools.

5.b. Hands-on, inquiry-based instruction:

The primary vehicle for promoting hands-on, inquiry-based instruction is the development of curriculum resource materials that guide teachers into the use of the local environment and cultural resources as a foundation for teaching math and science, both of which are implicitly inquiry-based and hands-on (these are the Elder's specialties). A second incentive for such instructional practices is the establishment of local chapters of the Alaska Native Science and Engineering Society in each school district, and through them the sponsorship of Alaska Native Science Fairs in which students display projects illustrating the use of science in everyday life in their community and environment. This is an area in which the teachers and students have been eager and willing participants, and they have developed judging criteria to insure that the projects that are recognized incorporate culturally appropriate and scientifically significant principles and practices.

One of the most promising vehicles for hand-on, inquiry-based instruction are the various forms of "science camps" that are being implemented by the participating AKRSI schools. We now have numerous examples of integrated science/culture camps which clearly illustrate the ways in which an extended period of hand-on inquiry in a traditional camp environment can serve as the stepping stone toward in-depth standards-based science and math curriculum and instruction back in the classroom.

The students most directly impacted by the math/science initiatives associated with the AKRSI are those involved in the ANSES chapters, science camps and science fairs. While those numbers have been small (an average of 25-30 students per region initially), as new regions, camps and fairs have been added to the ANSES network each year, the number of students has multiplied, to the point where in 2000, over 220 students will be participating in ANSES sponsored events. Those are the students who are developing a strong interest in science as a field of study, and the topics they choose to address in their science projects are consistent with the areas of choice by Native students as they choose a major in college.

5.c. Assessments:

As outlined above, we have worked with the Alaska DOE, along with several consultants who have been involved nationally with science/math standards and assessment development, and teachers from rural school districts to develop a set of performance standards and assessment measures aligned with the state standards, that will serve as the basis for a statewide science and math assessment system for ages 5-8, 8-10, 10-14 and 14+. In addition to the above, the Alaska State Board of Education has prepared an "Alaska Native Student Learning Action Plan," which includes a major component on assessment, and a joint AKRSI/DOE position has been established in the Commissioner's office to help coordinate our mutual efforts in this area.

In the area of math (as well as reading and writing), a major push is currently underway to refine statewide assessments for standards-based grade-level performance indicators for grades 4, 8 and 10, to insure that students are prepared to pass a high-stakes qualifying exam for a high school diploma, which has been mandated by the State Legislature to go into effect by the year 2002. Although a science qualifying exam has not been mandated, the development of science performance standards and age-level assessment indicators is intended to parallel the structure being established for math, reading and writing, so that student performance can be tracked throughout the school years. The most significant contribution of the AKRSI to the assessment effort has been to engage Native educators in the process of developing assessments for the science performance standards that are culturally appropriate and aligned with the cultural standards, the product of which is now being considered as a model for performance assessments in the other subject areas.

5.d. Student support:

Given the extraordinarily high levels of pathological behaviors on the part of young people in many of the rural communities and schools (including substance abuse, self-destructive behavior, suicide and most recently homicides), the most critical challenge is to support students in their need to become whole persons by providing an educational environment that connects to their world in fundamental ways. The whole thrust of the Alaska RSI has been to build bridges between the vastly different worlds the students are caught between, so when they come to school they don't have to deny who they are, but rather can build on the knowledge, traditions, world view and ways of knowing they bring with them. Then the western knowledge and ways of knowing (as reflected in the study of science and math, for example) can be learned in a value-added way, and not detract from what they and their ancestors already know. Organizations such as the Native Educator Associations and the Alaska Native Science and Engineering Society are serving as strong reinforcements and support structures for bridging the two systems and validating the knowledge and identity that serve to make today's Alaska Native students into whole people. It was these considerations that led to the addition of a section on the educational role of the community in the Alaska Standards for Culturally Responsive Schools, recognizing the need for collaboration between school and community to achieve the cultural well-being of students, as explicated in the student section of the Cultural Standards. And it was for similar reasons that the student section of the Cultural Standards were recently adopted into state regulations by the State Board of Education. We have a long way to go in this area, but the groundwork has been laid for further efforts to bring real-world significance to the Cultural Standards.

5.e. Use of environments and resources outside of schools:

One of the most successful features of the AKRSI has been encouraging the establishment of Alaska Native Science Camps in which teachers and students learn along side one another under the tutelage of knowledgeable Elders. Follow-up data on student achievement indicates a strong carry-over in subsequent academic studies in the school as a result of participation in a science camp. In the Academies of Elders, the Native Educators have taken the knowledge gained from the Elders in a traditional setting and developed curriculum units in which they integrate the math and science concepts and skills called for in the State standards in such a way that students see the two systems as complementary to one another, each adding insights to the other. Other initiatives involve students (and teachers, most of whom are from somewhere else) in the in-depth study of their environment, including doing detailed scientific field studies that make the practice of science real, as it is applied to an issue of importance to their community. These activities are supported by the expertise of practicing scientists through the Scientist-in-Residence program, which brings a science practitioner into the school for several days to a week to work with the teachers and students and bring currency to what is being taught.

A major emphasis in Year Five has been on the articulation and implementation of a "place-based pedagogy" that utilizes the local cultural and physical environment as a major focus for enhancing and giving real-world significance to the curriculum. Consideration is also being given to elaborating on the idea of "naturalist" intelligence, as recently posited by Howard Gardner as an eighth addition to his theory of multiple intelligences, the characteristics of which closely align with those associated with "Native ways of knowing."

5.f. Student-teacher-curriculum interactions:

The integration of the curricular and pedagogical changes outlined above has been fostered in three ways. The first is through the promotion of indigenous "organizers" as the basis for bringing all the elements of the educational experience together in a framework that is grounded in the cultural and physical environment in which the school is situated. Guidelines and models to assist teachers and districts in such development are included in the Alaska Math/Science Curriculum Frameworks document. The adoption of the AKRSI-sponsored Alaska Standards for Culturally Responsive Schools by the State Board of Education and their recent incorporation in the state Curriculum Frameworks document now provides teachers with explicit guidelines for the implementation of a culturally aligned, standards-based curriculum in their classrooms. In addition, the Alaska Staff Development Network has developed, under contract with the AKRSI, two distance-delivered three-credit graduate courses for teachers and administrators on "Creating Culturally Responsive Schools," which have enrolled over 200 teachers in the first year of availability. Through this course, the math and science curricular resources and pedagogical practices promoted by the AKRSI are being disseminated directly to teachers and put to use in their classrooms. The courses also fulfill the state requirement for three credits in "multi-cultural education" that teachers and administrators must complete to receive a permanent teaching license.

The second vehicle for bringing coherence to the ideas imbedded in the initiatives promoted by the AKRSI is a framework that has been developed by AKRSI staff for purposes of organizing all the curricular and cultural resources that are emerging from the schools as a result of the various initiatives. Work on the "Spiral Pathway for Integrating Rural Learning" (SPIRAL), which is structured around 12 themes and a compilation of associated cultural values, is currently underway to identify/develop curriculum resources for the various themes and grade levels, and to link the resources to Alaska standards in all subject areas. These resources are being made available to teachers on-line through the ANKN web site as they are being assembled (http://www.ankn.uaf.edu).

The third area in which AKRSI has been promoting infrastructure changes impacting student/teacher/curriculum interactions is in the use of technology to extend and deepen learning opportunities for rural students. For those regions that have full technology access, we have provided training in

implementing the "Cultural Atlas" CD-ROM/web site development project, in which students research their community/region and assemble the information through the use of technology. Several rural districts have been authorized by the State Board of Education to establish charter "Cyber-Schools," which offer specialized courses (including math and science) to students throughout the state. Other districts are now drawing on the Cyber-Schools to supplement their curriculum in areas where they have insufficient students or teacher expertise to offer specialized courses, especially in advanced subject areas.

5.g. System environment/context:

The Alaska Rural Systemic Initiative is currently serving as a guiding and synergizing link across the many elements that impact the quality of education in schools in rural Alaska. Through the Alaska Native/Rural Education Consortium, representatives from the rural school districts, State Department of Education, University campuses, Native organizations, Elders, and other related agencies and professional organizations are brought together twice yearly to be briefed on the status of AKRSI initiatives, to report on their own work related to those initiatives, and to coordinate their efforts in ways that will maximize the impact. The resources of the AKRSI are contracted out to these partners in ways that capitalize on the role and strengths that each brings to the undertaking, and then what is developed and learned is passed on to the other partners and built upon as each initiative shifts from one region to the next on a rotating basis. In this way, AKRSI serves as a catalyst to initiate change that is constructive, coherent and coordinated. When done properly, the whole becomes greater than the sum of the parts.

Several joint projects are currently underway to bring knowledge gained from related research and applied activities (e.g. rural sanitation projects, global change research, snow science, aurora studies and fish and wildlife resource management) into the math/science knowledge base being assembled by the Alaska RSI. In addition, the NSF-funded Yup'ik Math Curriculum materials development project is directly affiliated with and serves as an extension of the AKRSI, and a major contribution has been made through the Annenberg Rural Challenge to extend the impact of the project beyond math and science to include the rest of the curriculum.

While we have enjoyed a broad level of support for the AKRSI initiatives from personnel associated with the formal educational systems, the most critical support has come from the Native communities themselves, particularly in the form of Alaska Native Elders who have actively contributed their time, effort and knowledge with a level of commitment beyond what we had expected. It is a key indicator that the project appears to be on the right track, and the Regional Elder's Councils we have formed continue to be an important guiding feature in everything we do.

6. Partnerships:

Partnerships have been formed with contributors from across the spectrum of entities impacting education in rural Alaska. In addition to the partnerships established directly through subcontracts with school districts, Native organizations, non-profit service organizations, university campuses, state agencies, etc., the AKRSI has received support from over 18 businesses in the form of sponsorships of students to attend the AISES science camp and travel for community participation in various meetings and workshops, Native corporations in the form of collaboration on the use of in-house resources for curriculum materials development, higher education in the form of the establishment of the Rural Educator Preparation Partnership as a primary vehicle for increasing the number of Native teachers in rural schools, the Alaska Department of Education in the form of a joint position for rural/Native education in the Commissioner's office, and Native community members in the form of parent and Elder involvement in all aspects of AKRSI implementation. Further partnerships have been formed with the scientific community through joint curriculum initiatives with the Geophysical Institute and College of Science, Math and Engineering at UAF, through the traditional knowledge documentation efforts of the Alaska Native Science Commission, through national linkages to resources offered by

places like Los Alamos, and through the Arctic science education resources of the Arctic Research Consortium.

In addition to the examples listed above, another major partner that has taken on a key role in supporting the goals of the Alaska RSI is the Alaska Native Science Commission, which was formed concurrently through the Alaska Federation of Natives, with funding support provided by NSF. The scientific research oversight role of the ANSC and the guidance it has provided the practitioners of science are critical ingredients to creating a hospitable and supportive climate for the kind of work we are doing. All of the above has been butressed with a $510,000 grant from the Kellogg Foundation to establish a Tribal College Consortium in collaboration with the AKRSI to develop a plan for a Tribal College System in Alaska, which will provide a wholly new institutional infrastructure through which to carry on many of the initiatives established through the AKRSI. The University of Alaska and the Alaska Congressional delegation are also major partners in this endeavor.

7. Research:

Building on the joint research initiative with the Northwest Regional Educational Laboratory resulting in the detailed case studies and report on "Alaska Rural Systemic Reform," the AKRSI staff is in the process of developing a new research initiative aimed at linking the AKRSI emphasis on indigenous knowledge and Native ways of knowing to emerging literature on "pedagogy of place" and "naturalist intelligence." Oscar Kawagley, the PI on whose past research much of the AKRSI reform strategy is based, has established a collaborative relationship with one of the AKRSI rural sites that have been at the forefront of integrating local knowledge and practice into the curriculum. We have begun an in-depth study of the teaching/learning processes utilized inside and outside of the local school, from which we can take a more systematic approach to the development of curricular and pedagogical practices that are well suited to the cultural and physical environment of the Cup'ik people. This will be a long-term research endeavor that takes advantage of the new (but old) approaches to education that are emerging in rural schools as an outgrowth of the Alaska Rural Systemic Initiative.

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