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ABSTRACT

The Alaska Rural Systemic Initiative (AKRSI) was established in 1994 to develop pedagogical practices that incorporate the indigenous knowledge systems of Alaska Native peoples into formal educational programs. The statewide project is organized around five initiatives, each of which is implemented in one Native cultural region at a time on a rotational schedule over 5 years. A sixth initiative focuses on developing a statewide educational telecommunications infrastructure. This report addresses questions associated with the following six "drivers": (1) implementation of comprehensive, standards-based curricula, including assessment, in every classroom and learning experience provided through AKRSI; (2) provision of high quality mathematics and science education and preparation and support of teachers; (3) convergence of all resources that support science and mathematics education into a focused, continuously improving program; (4) generation of parent and community support for the program based on presentations, evidence, and critical discussions; (5) accumulation of evidence that the program is enhancing student achievement in science and mathematics; and (6) improvement in the achievement of all students, including those historically underserved. During the first 3 years of implementation, AKRSI schools showed a net gain relative to non-AKRSI schools in mathematics achievement scores and dropout rates. (TD)

ALASKA RURAL SYSTEMIC INITIATIVE

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

YEAR THREE ANNUAL PROGRESS REPORT

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Project Summary

The Alaska Rural Systemic Initiative was established in 1994 under the auspices of the Alaska Native/Rural Education Consortium, with administrative support provided through the Alaska Federation of Natives in cooperation with the University of Alaska and the National Science Foundation. The purpose of the Alaska RSI is to implement a set of initiatives to systematically document the indigenous knowledge systems of Alaska Native people and develop pedagogical practices that appropriately incorporate indigenous knowledge and ways of knowing into educational programs. The central focus of the AKRSI reform strategy is the fostering of interconnectivity and complementarity between two functionally interdependent but largely disconnected 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 for students throughout rural Alaska.

The key agents of change around which the AKRSI educational reform strategy has been constructed are the Alaska Native educators working in the formal education system coupled with the Native Elders who are the culture-bearers for the indigenous knowledge system, along with the Quality Schools Initiative and math/science standards adopted by the Alaska Department of Education. Together, these agents of change constitute a considerable 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. The statewide project is organized around the following six major initiatives (including the regional focus for the third year):

1. Native Ways of Knowing and Teaching (Athabascan)
2. Culturally Aligned Curriculum Adaptations (Inupiaq)
3. Indigenous Science Knowledge Base (Yup'ik/Cup'ik)
4. Elders and Cultural Camps (Tlingit-Haida)
5. Village Science Applications (Aleut/Alutiiq)
6. Educational Technology Infrastructure (Statewide)

Each of the first five initiatives is being implemented in one Native cultural region at a time on a rotational schedule over a five-year cycle. The sixth initiative is focused on assisting in the development of the telecommunication links and support necessary for rural schools to gain access to and make effective use of educational telecommunication services on a statewide basis. Along with the rotational schedule of regional initiatives, there are also a series of cross-cutting themes that integrate the initiatives within and across regions each year. While the regional initiatives focus on particular domains of activity through which specialized resources are brought to bear in each region each year (culturally aligned

curriculum, indigenous science knowledge base, etc.), the following themes 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, schools across the state are engaged in common/shared endeavors that unite them, at the same time that they are concentrating on particular initiatives in ways that are especially adapted to their respective regions. Together, these initiatives are intended to generate a strengthened complex adaptive system of education for rural Alaska that can effectively integrate the strengths of the two constituent emergent systems. The exact form this new integrated system will take remains to be seen as its properties emerge from the work that is underway.

A summary of the current activities that link the regions together through the five integrating themes is provided in the following chart:

INTEGRATING THEMES ACROSS AKRSI REGIONAL INITIATIVES

Integrating Themes/ Regional Initiatives (1998)	Documenting & Gathering Cultural Knowledge (year 1)	Identifying Indigenous Teaching Practices (year 2)	Integrating Indigenous Knowledge in S-B Curr. (year 3)	Building Teacher Support Systems (year 4)	Adopting Appropriate Assessment Practices (year 5)
Culturally Aligned Curriculum (Inupiaq)	Identify existing cultural materials and resources	Academy of Elders ANKN	S-B Curric. Frameworks implement. SPIRAL	Alaska Native Knowledge Network	Identify indicators of standards achievement
Indig. Sci. Knowledge Base (Yup'ik)	Regional cultural atlas	Developing culturally appropriate pedagogical practices	S-B Curric. Frameworks ASC Curric. units	Regional cultural atlas Cultural Standards	Math/science assessment processes/ S-B Curric. Frameworks
Elders and Cultural Camps (Southeast)	Academy of Elders	Academy of Elders Cultural Standards	S-B Curric. Frameworks Science Camps	Native Educ. Associations X-C orient. for teachers	Assessment criteria for Native science projects
Village Sci. Applications/ Careers (Aleut/Aluti)	AISES/ Science Fairs	AISES	S-B Curric. Frameworks ANSE Coalition	Village Sci. AISES Sci. in Res.	AISES/ Science Fairs ANSE Coalition
Native Ways of Knowing (Athabascan)	Reg. NWoK document. and implement.	Academy of Elders Cultural Standards	NWoK chap. in S-B Curriculum Frameworks	Academy of Elders ANKN	Cultural component for assessing AK teaching standards

Although there are activities currently underway in each thematic area listed, the emphasis each year revolves around one integrating theme, moving across the chart from left to right, from year one (documenting cultural knowledge) to year five (appropriate assessment). Each set of initiatives and themes build on each other from year to year and region to region through a series of statewide events that bring participants together from across the regions. These include working groups around various themes, academies of Elders, statewide conferences, the AN/RE Consortium meetings, the Alaska Native Science Education Coalition, the Leadership Development Institute and the Alaska Native Knowledge Network.

The initial indicators of the effects of the first three years of implementation of the above initiatives/themes 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 declined from a mean of 4.4 in 1995 to 3.6 in 1996, with a slight increase to 3.7 in 1997, whereas the dropout rate increased from 2.7 to 3.2 and then went back down to 2.6 in non-AKRSI rural schools in the same time period. The details and significance of these and other related data are included in the latter part of this report.

Third-Year Activities and Critical Developments Driving Systemic Change in Rural Alaska

The following report addresses the questions associated with each of the six "drivers" outlined in the "Instrument for Annual Report of Progress in Systemic Reform" provided by NSF, along with an additional section addressing the newly established "leadership development" component of the AKRSI. The summary of the third-year activities will also take into consideration the overarching goal, the fundamental elements and the cross-cutting variables in addressing progress in meeting project objectives.

Driver 1: Implementation of comprehensive, standards-based curricula as represented in instructional practice, including student assessment, in every classroom, laboratory, and other learning experience provided through the system and its partners.

1.1 To what extent is the curricula that is implemented of high quality and aligned with national standards?

The Alaska Rural Systemic Initiative has taken several major initiatives in year three 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 continued to work directly with the Alaska Department of Education to help develop science and math performance standards and assessment measures for ages 5-8, 8-10, 10-14 and 14+, that will serve as benchmarks for student performance on the state content standards. This effort was gotten underway with technical assistance through Westat/McKenzie (Megan Martin and Dan Ochs provided national expertise in drafting appropriate performance standards), and in conjunction with local participants from school districts throughout the state at the "Alaska Standards in Action Forum," held in Anchorage Sept. 25-27, 1997. 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 (see Appendix A) and developing/field testing in-depth science curriculum units, based on the Alaska Curriculum Frameworks effort from Year One. The following chart summarizes the activities that have taken place during year three, leading toward the adoption of a standards-based assessment system for all schools tied to the Alaska standards (which are closely aligned with the national standards).

1997-98 IMPLEMENTATION PLAN FOR CULTURALLY ALIGNED, STANDARDS-BASED CURRICULUM AND ASSESSMENT

Spring, 97	Sum., 97	Fall, 97	Spring, 98	Sum/Fall, 98	Fall, 98/ Spring, 99
Distribute Alaska DOE math/science curriculum frameworks document to all schools in Alaska, providing guidance for sch. dist. to implement. standards-based, cult. aligned curricula.	AKRSI/DOE obtain tech. assist. from national exp. to dev. draft perf. stds. based on AK science stds. for review by dist. reps. at Sept. forum. ---------- Draft math perf. stds. ready for review	Rev. science and math performance standards for grades 2, 4, 8 and 12, working with teams of teachers from AKRSI partner sch. districts. ---------- Stds/Action Forum, Sept. 25-27	Intensive workshops to develop assessment measures linked to math/science perf. stds. ---------- Conduct unit-building workshops with teachers producing model stds./ cult.-based science curricula	Intensive workshops to assist sch. dist. in impl. assessment measures linked to math/science perf. stds. ---------- Field test math/science assessment measures for baseline data on elem., ms & hs stud. in AKRSI schs	Implement math/science performance standards & assessment measures in schools throughout Alaska. ---------- Publish tools and guides for schools & teachers to implement curricula based on sci. perf. stds.

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, along with 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. Requests for materials listed in the ANKN database has grown steadily since it was established in 1997. 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 Year Two was the development of a set of "Alaska Standards for Culturally Responsive Schools," including a section on cultural standards for curriculum (see Appendix B). 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 are now being 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.

1.2 To what extent is the high quality curricula implemented with all students?

The Alaska DOE Science Coordinator has convened the Alaska Native Science Education Coalition, which is made up of over 20 statewide agencies and professional organizations with an interest in science, math and technology education in Alaska. Representatives from each of these organizations are focusing on identifying ways in which they can bring Alaska Native science perspectives into their respective activities for dissemination to schools throughout the state. During year three they established a process for science unit building work in each cultural region in conjunction with the Alaska RSI partner school districts to provide concrete examples of curriculum units that focus on the integration of indigenous and Western knowledge in the teaching of science. Nearly a dozen sample in-depth units are in various stages of development and field-testing, with most scheduled for publication and distribution during the coming year. These units will then be incorporated into the professional development activities associated with the Alaska Science Consortium, starting in the summer of 1999.

While the original intent of the Alaska Rural Systemic Initiative was to directly impact all students in rural Alaska with the initiatives implemented through the AKRSI, it became apparent in year two that such an effort would likely result in improvements in rural schools that were a mile wide, but only an inch deep. We have, therefore, sought to rescale our efforts to focus on those school districts with the highest proportion of Alaska Native student enrollment and the lowest achievement levels. Consequently, we have narrowed our primary efforts to the 20 rural school districts that we are currently working with, which together serve approximately 70% of the Alaska Native students in rural Alaska (see Appendix C). However, the results of our efforts in the twenty AKRSI partner districts will be disseminated to the remaining 28 rural school districts (most of which are serving primarily non-Native students), as well as to the five urban districts in the state (in which there is considerable interest), so that all Alaska students will eventually benefit from the AKRSI effort.

1.3 To what extent is there an assessment system in place that is aligned with the high quality curriculum?

Through the efforts of the Alaska Rural Systemic Initiative in conjunction with the Alaska Department of Education, there will be standards-based assessment system in place by 1999. As outlined in 1.1 above, we have been contracting with several consultants (Megan Martin and Dan Ochs) who have been involved nationally with science/math standards and assessment development, who are working with the Alaska DOE and the 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. 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 establish 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. A national test publishing company has been contracted by the state to develop a qualifying exam based on the state standards, with pilot testing to begin in the spring of 1999. 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.

1.4 To what extent is this assessment system used with all students?

Once the assessment system outlined above has been developed, it will be put in place by the Alaska DOE for all students and schools in the state.

1.5 To what extent is there an ongoing professional development program in place that provides teachers and other staff with the skills and knowledge to implement the high quality curriculum?

Included in the unit-building workshops sponsored by AKRSI in each of the cultural regions during year three was training for participating teachers in standards-based curriculum and instruction, so that the units that were prepared by each team incorporated the most current thinking and were closely aligned with the state content standards, as well as the cultural standards that were under development at that time. In addition, the Alaska Staff Development Network, which serves school districts throughout Alaska, has been contracted by AKRSI to develop an inservice program for teachers based on the "Alaska Standards for Culturally Schools," which will also meet the state multicultural education requirement for teacher certification. The program will be pilot tested during the fall of 1998 and will be offered to school districts beginning in the spring of 1999, as a response to the professional development priorities that the districts have identified.

In cooperation with the College of Natural Sciences at the University of Alaska Fairbanks, a Scientist-in-Residence program has been established which makes practicing scientists available for extended visits to rural schools and districts to help the teachers improve their science and math curricula, while at the same time providing scientists an opportunity to interact with Native people. The second round of Scientist-in-Residence activities occurred this year in the school districts serving the Inupiaq and Yup'ik regions, where a biochemist, a physicist, and a geophysicist from the College spent from 3-5 days working with teachers in rural schools. Follow-up to the S-i-R visits are provided via e-mail, as well as through cooperative efforts in the sponsorship of two regional Native Science Fairs, which will took place in the Inupiaq and Athabascan regions.

Included in the activities of the Alaska Native Science Education Coalition and the Alaska Science Consortium are an on-going series of workshops for and by teachers in which the most current materials and practices are demonstrated for use in the classroom. In addition, Peggy Cowan and Nanci Spear have incorporated AKRSI activities in the inservice training they perform for school districts in their role as the state science and math coordinators respectively.

1.6 To what extent do all teachers, teacher aides, and other staff participate in this professional development program?

Based on a successful AKRSI initiative in the Interior Athabascan region during years one and two, this year we sponsored in each of the five regions a process we are calling an Academy of Elders. An Academy is made up of Native teachers, Elders and practicing scientists, 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 into publication form for distribution to other teachers and schools.

This process is now coupled with the AKRSI sponsorship of a series of regional Native Educator Associations, one function of which is to host the regional Academy and an annual meeting in which the work of the teachers is shared with school board members, superintendents, teachers, teacher aides and students. The first meeting reflecting the outcome of this process took place in August, when the Association of Interior Native Educators held their annual meeting and the Native teachers, Elders and scientists presented curriculum workshops on the cultural uses and scientific properties of birch trees, and on a comparative look at indigenous numeracy systems, both of which were products of the 1996 and 1997 Academy of Elders in the Interior region. Included in the meeting was a workshop by Dr. Fred Begay, a Navajo physicist from Los Alamos, in which he compared the modulo 8 numeracy system of the Navajo to that of the Athabascans in Alaska.

In addition, the University of Alaska and the Alaska Department of Education have established a Rural Educator Preparation Partnerships Center to revitalize the system for preparation of teachers for rural schools in Alaska, with a particular emphasis on building partnerships with rural districts to increase the number of Alaska Native teachers in rural schools throughout the state. This is part of a broader coordinated effort between the University of Alaska, the Alaska Federation of Natives and the Commissioner of Education, Shirley Holloway, to pursue a rural school reform agenda that is consistent with the goals of the Alaska RSI. As a result of this initiative, a new rural baccalaureate degree and support structure for preparing rural teachers is being developed which will serve as the vehicle for much of the preservice and inservice teacher preparation in the future. Likewise, a new graduate degree in "cross-cultural studies" based on the comparative study of indigenous knowledge systems that will be made available throughout rural Alaska via distance education is under development for implementation by 1999.

In addition to the above, the 21 hours of video tapes of a statewide two-way video/broadcast television course on "Native Ways of Knowing," taught in 1996 by Co-PI Oscar Kawagley, is now being re-broadcast on the public television station, and has attracted sufficient interest on the part of statewide educators that Oscar was named as a recipient of the "Distinguished Service in Education" award, presented by the Alaska Association of Secondary School Principals at their annual meeting in October. This course is having a major impact on educational practices throughout the state, and is the basis for much of the curriculum development work that is currently underway in many of the rural school districts. Oscar is currently working with the Center for Distance Education in the construction of a web-based version of the course, which will be offered beginning in the spring of 1999.

Driver 2: Development of a coherent, consistent set of policies that support: provision of high quality mathematics and science education for each student; excellent preparation, continuing education, and support for each mathematics and science teacher (including all elementary teachers); and other learning experiences provided through the system and its partners.

2.1 To what extent do policies for mathematics and science education indicate a coherent vision that encompasses all students?

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 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 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 are working with them to insure that the standards that emerge are compatible with multi-graded classrooms in small schools with limited resources.

Following the NSF-sponsored "Leadership Institute" in February, 1998, the AKRSI staff formulated a "Leadership Development Plan" outlining ways in which we can engage administrators and policy-makers at all levels of the educational system in furthering the goals and processes articulated in the AKRSI Strategic Plan (see details in Appendix D). 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.

To address these lingering issues, in August we drew together a group of educational leaders from around the state to help us review the current activities under the Alaska Rural Systemic Initiative and to explore the idea of co-sponsoring an Alaska Rural Education Leadership Retreat in cooperation with DOE during this coming year. There was general agreement that such a retreat would be very timely, given the many state mandates and rural school reform initiatives that school districts are contending with right now, so we have proposed to the Commissioner of Education (see Appendix D) co-sponsorship of a two-staged event, starting with a 3-day retreat this year involving a small group of 50-60 invited participants, to be followed with an open statewide conference next year in which we highlight the models and honor the practices that exemplify the future direction for rural education in Alaska. The focus of the retreat will be to bring together a select group of rural superintendents, key policymakers, Native educators and Elders to take a comprehensive, in-depth look at the current status of rural education in Alaska - how did we get here and where do we want to go in the future? What contributions are the current rural school reform initiatives (Quality Schools, AOTE, AKRSI, ARC) making to shaping a coherent agenda for rural school renewal? How do the Native Student Action Learning Plan and the Alaska Standards for Culturally Responsive Schools contribute to that agenda? These questions will be taken up by the Leadership Retreat Planning Team, with a target date of mid-year for hosting the first event.

2.2 To what extent do policies for mathematics and science education require that all students be enrolled in high quality and rigorous programs?

While Alaska has adopted demanding math and science standards, the next step 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 conference, workshops and meetings have been held over the past year 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, where student enrollments increased another 4% from 1996 to 1997.

2.3 To what extent do policies for mathematics and science education strengthen the emphasis on mathematics, science, and technology?

Given all the policy issues that are currently under consideration, and the many different initiatives that are underway, one of the most critical steps for strengthening the role of math, science and technology in education is a coordinated and focused public awareness campaign to insure widespread understanding of the issues involved. In that regard, the Alaska RSI has been publishing a bi-monthly newsletter, "Sharing Our Pathways," which is targeted to rural/Native communities, but has attracted a broad-based readership of nearly 3000 people going into the 15th issue. Information on policy matters related to indigenous

applications of science and math is also shared through the Alaska Native Knowledge Network web site (at http://www.ankn.uaf.edu). Further public awareness of science policy issues has been generated by the preparation of a series of radio programs on "Alaska Natives and Science," which are being broadcast statewide (Alaska Public Radio Network), nationally (NPR), and internationally (Voice of America and Public Radio International).

2.4 To what extent do policies support the preservice education of a high quality teaching force in mathematics and science?

The two most important policy/action items that are currently impacting preservice education are a move by the State DOE and the University of Alaska to promote the development of a standards/performance-based approach to teacher education, and the establishment of a Rural Educator Preparation Partnerships Center by the University of Alaska to support the implementation of a performance-based approach in partnership with the rural school districts. In both cases, the emphasis is on preparing more Alaska Native teachers and upgrading the cross-cultural understanding of non-Native teachers. As one component of this initiative, the AKRSI staff are working with the University of Alaska to develop a new interdisciplinary baccalaureate degree in math/science that can be offered through the rural campuses to students throughout rural Alaska who are interested in teaching math and science subjects in a rural high school (see Appendix E). It is anticipated that this new option should be available to rural students by 1999, so that high quality math/science teachers specially prepared to adapt their teaching to the needs of rural students should be in the classrooms by 2001.

2.5 To what extent do policies assure adequate time for the ongoing professional development of mathematics and science teachers?

A wide array of Alaska RSI-sponsored professional development opportunities are underway 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, 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 results of these efforts are beginning to be evident in the schools, as new instructional and curricular approaches are being implemented at the local and district levels.

2.6 To what extent do policies require a tight alignment among curriculum, instruction, assessment, and professional development?

The "Alaska Native Student Learning Action Plan" currently being implemented by the Commissioner and State Board of Education is intended to provide guidelines and incentives for the alignment of all elements impacting rural/Native students educational experiences throughout Alaska. Within the Alaska RSI, the emphasis on bringing an indigenous perspective into the educational systems requires attention to all aspects of curriculum, instruction, assessment, and professional development simultaneously, at the regional as well as the statewide levels. Similar considerations are included in the process currently underway for the development of content area performance standards and assessment measures, as well as in the construction of new standards-based, performance-oriented guidelines for teacher licensure renewal and teacher evaluation.

2.7 To what extent do policies assure adequate financial and administrative support for the ongoing professional development of mathematics and science teachers?

While "adequate financial and administrative support" is not yet assured, the commitments embodied in the creation of the Rural Educator Preparation Partnerships Center are intended to move the University of Alaska, the Alaska DOE and the rural school districts toward such support. The Director for the Center has been invited to join the AN/RE Consortium to make sure the efforts of the Alaska RSI and the Center are closely coordinated. At the school district level, most teachers have been able to take professional or administrative leave with district support to participate in professional development activities. The AKRSI "Leadership Development Plan" is also aimed at gaining administrative support for the implementation of culturally appropriate, standards-based curriculum, and in providing a supportive policy and professional environment for teachers to implement such curricula (see Appendix D).

2.8 To what extent are policies designed to recognize and reward excellence in mathematics and science teaching?

In addition to the on-going annual awards for excellence for science and math teaching granted through DOE and local districts, the AKRSI science/math unit-building workshops implemented through the Alaska Native Science Education Coalition called for district sponsorship of participating teacher teams, as a way of providing recognition and support for their initiative aimed at improving science and math teaching. In addition, teachers who are recognized by their district for their exemplary teaching practices are provided opportunities to present workshops and attend state and national conferences.

2.9 To what extent do policies support the system's capacity to collect and use program data for continuous improvement?

The Alaska RSI has joined forces with the Alaska Department of Education to help put in place a statewide performance standards and an assessment system that provides benchmarks regarding what students should know and be able to do in math and science, and thus will serve as a guide for identifying areas in need of improvement. In addition, the Department of Education has developed an on-line data reporting system for school districts and has recently initiated plans for using that system to promote "data-driven decision-making" in schools throughout the state. The AKRSI science and math liaisons are members of the DOE planning committee for the development of guidelines for the use of this system and have been able to draw upon their experience with the NSF "core data elements" in constructing the state initiative.

Driver 3: Convergence of the usage of all resources that are designed for or that reasonably could be used to support science and mathematics education fiscal, intellectual, material, curricular, and extra-curricular into a focused and unitary program to constantly upgrade, renew, and improve the educational program in mathematics and science for all students.

3.1 To what extent is there coordination among existing funding sources in support of systemic reform in mathematics and science?

The rural school districts with which we are working are now beginning to target their Title I, Migrant Ed, Johnson-O'Malley and Indian Ed funds to provide supplemental support to the AKRSI initiatives in their regions, including the sponsorship of local AISES chapters, science camps and science fairs. 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). The Lower Kuskokwim, Lower Yukon and Yupiit School Districts have served as models for the convergence of resources focusing on the development of strong standards- and culturally-based curriculum, which we are now encouraging other districts to emulate.

3.2 To what extent have additional funds been leveraged in support of improving mathematics and science education?

Several joint projects are currently underway to bring knowledge gained from related research and applied activities (e.g. Yup'ik math, rural sanitation projects, global change research and fish and wildlife resource management) into the math/science knowledge base being assembled by the Alaska RSI. These have been especially helpful in the "village science applications" component of the AKRSI. Two externally funded multimedia projects in cooperation with practicing scientists at the University of Alaska are leading to the development of curriculum resources in the form of two CD-ROM disks focusing on "Glacier Power" and "Aurora Alive," which include culturally and geographically relevant material aligned with state and national standards. Other partnerships contributing to the overall AKRSI effort include Dept. of Commerce internships for university students pursuing studies in math and science fields, joint funding of an Alaska Native Middle School Science Camp with the American Indian Science and Engineering Society, joint sponsorship of two Arctic Science Education Conferences with the Arctic Research Consortium and with Ilisagvik College, and several collaborative curriculum materials development projects with support from NSF and other sources.

3.3 To what extent is there coordination between the initiative and other stakeholders that support mathematics and science education?

Besides the coordination provided through the AN/RE Consortium, the Alaska RSI is working closely with the Science and Mathematics Consortium for Northwest Schools, which is providing support for numerous initiatives in Alaska that are compatible with the AKRSI goals. The Alaska Coordinator for the SMCNWS serves on the AN/RE Consortium, and a member of the AKRSI serves on their Advisory Board. A similar function is served by the Alaska Native Science Education Coalition in the area of math and science curriculum development, and by the AKRSI Leadership Planning Team in coordinating with administrators, school board members and policy-makers.

3.4 To what extent have the general theories and specific recommendations of outside experts been used to support mathematics and science education?

The Native American/Alaska Native RSI curriculum meetings held in Denver, Albuquerque and Bismarck were excellent sources of outside expertise, ranging from Siaka Kroma of Sierra Leone to Stephanie Robinson of the Education Trust, all of whom contributed to and extended our understanding in this vital area. During the past year, national figures in the area of standards-based education, such as Dan Ochs, Megan Martin and Doug Reeves, were major contributors to the development of deeper understanding of its implications for curriculum, teaching and assessment. Ochs and Martin continue to be important resources as the science performance standards and assessment system is refined and pilot tested throughout the state.

We have also been involved in two international Arctic Science Education Conferences, which have brought us in contact with key scientists, researchers and educators who have contributed to the science knowledge base in the Arctic, and are currently working in close collaboration with the Yup'ik Math Project, which involves prominent math educators from the Livermore Lab in California. Oscar Kawagley, AKRSI Co-Director, was invited to give a keynote address to the New Zealand Maori Association for Math, Science and Technology annual meeting, at which there were prominent math and science educators from throughout the South Pacific. In July, 1998, Oscar and Co-Director Ray Barnhardt were invited participants and presenters at an International Institute on Aboriginal Education at Brandon University in Manitoba, Canada. All of the above have played a prominent role in shaping the work of the Alaska Rural Systemic Initiative, as well as the work of the 40 organizations with whom we contract to implement the various initiatives.

3.5 To what extent are technology and telecommunications used to support mathematics and science education?

The Alaska Native Knowledge Network world wide web site is up and running, with links being formed across the US and to several other countries in which indigenous science/math initiatives are underway. In addition, through the UAF Center for Distance Education, we are now using the web site as the basis for delivering courses to rural teachers, as well as assisting schools to integrate its use in their curricula. We are in the process of working with several school districts in the Yup'ik region on the development of the third version of a regional cultural atlas, using multimedia and CD-ROM technology. Some of the early results of this effort can be seen on the world wide web at http://www.ankn.uaf.edu/akula/. We are also assembling curriculum resources in 12 thematic areas applicable to rural schools to be placed on CD-ROM for distribution to all schools in the state.

The Alaska Division of Information Services has worked with the AKRSI to demonstrate what can be done when the telecommunications infrastructure in rural Alaska is upgraded to link all schools in a geographic region with high-capacity data transmission services (which have been lacking in most rural regions until recently). The Alaska DOE and Governors office have taken an active role in highlighting exemplary multimedia and telecommunications projects to illustrate the importance of telecommunications access for rural schools, and thus to convince the private and public sector providers to invest in upgrading transmission capacity throughout the rural areas of the state. At the present time, progress is occurring at varying rates on a region-by-region basis. Some of the implications for local

cultures of linking rural communities in Alaska to the rest of the world were captured in a recent article about Toksook Bay (an AKRSI site) in the Washington Post describing how "Eskimos Warm to the Digital Age" (see Appendix F).

Driver 4: Broad-based support from parents, policymakers, institutions of higher education, business and industry, foundations, and other segments of the community for the goals and collective value of the program, based on rich presentations of the ideas behind the program, the evidence gathered about its successes and its failures, and critical discussions of its efforts.

4.1 To what extent is there a comprehensive effort to maximize broad-based support for the goals of the program?

The Alaska Education Summit, which was held in October, 1996 had as its two primary foci engaging schools in the process of integrating the Alaska standards into educational planning at all levels, and enhancing the educational potential for the use of technology and telecommunications in the schools throughout the state. AKRSI is an integral part of both of these efforts as they apply to rural communities, schools and districts, and it is out of these deliberations that the AKRSI/ADOE partnership arose. The "Standards in Action Forum" held in September, 1997 was a direct outgrowth of the actions set in motion at the summit, as were the steps outlined in 1.1 that have been taking place over the course of Year Three. In addition, AKRSI sponsored the first Native Educators Conference in February, 1998, which served as a follow-up to the bi-annual conference of the Mokakit Native Education Research Association, which was organized and hosted by AKRSI in February, 1997. A major outcome of the Native Educators Conference was the completion and formal adoption of the "Alaska Standards for Culturally Responsive Schools," which were subsequently endorsed by the Alaska State Board of Education. All of these forums have served to gain support for AKRSI goals from the many stakeholders associated with the project.

One of the most significant indicators of "broad-based support for the goals of the program" was the granting of $3,000,000 to the Alaska RSI by the Annenberg Rural Challenge to extend the integration of indigenous and Western knowledge systems into curricular areas beyond math and science. This was the largest grant awarded by the ARC, and reflected a great deal of national interest in the goals, strategy and design of the AKRSI. The ARC funds have been coupled with the NSF/RSI funding to form a comprehensive effort at reform in rural education under the guidance of the AN/RE Consortium. The national significance of the work we are doing in constructing a "pedagogy of place" was reinforced in July, 1997 and again in 1998, when AKRSI was highlighted as an exemplary program at the annual conference of ARC projects from around the country (where "sense of place" and "sense of community" emerged as major themes of the national Rural Challenge initiative). This has been further reinforced as various AKRSI staff and partners have made presentations at numerous national and international events (International Conference on Environmental Education, National Rural Education Association annual meeting, National Indian Education Association annual meeting, World Conference of Indigenous Peoples Education, American Indian Science and Engineering Society annual meeting, etc.).

A similar indication of broad-based support was evident in the awarding of $510,000 by the Kellogg Foundation to support an AKRSI-initiated planning process for the development of a Tribal College system in rural Alaska over the next

four years. This project has gotten underway with the formal establishment of a Consortium for Alaska Native Higher Education, involving participation from each of the five cultural regions through the leadership of Ilisagvik College in partnership with AKRSI, Tanana Chiefs Conference, Kawerak, Association of Village Council Presidents, Tlingit-Haida Central Council, and the five public and private higher institutions currently serving Alaska. The institutional structures that emerge from this statewide effort are the vehicles by which much of the groundwork that has been laid by the AKRSI initiatives will be built upon.

Two other public outreach components that are aimed at gaining broad public understanding of the purposes of the AKRSI are the production of a series of public radio news segments on "Alaska Natives and Science," and the production of a broadcast-quality half-hour video on "Yup'ik Education," which captures key elements of what is happening in schools through the Yup'ik region. Both of these initiatives have been completed and have been broadcast and circulated throughout the state as a public education activity. The radio series has received national and international exposure through NPR, PRI and VOA. A new radio series highlighting Alaska Native scientists, and a third video focusing on rural science camps and Native science fairs are currently under production.

One initiative that has not succeeded in achieving the level of support needed to justify its continuation was the formation of a National Native Science Education Advisory Council. After some difficulty in establishing a membership roster, and three unsuccessful attempts at convening enough members to hold a formal meeting (though the few who did attend were enthusiastic about the idea), we have concluded that there is insufficient national purpose to warrant continuation of the initiative, and therefore it will not be included in the AKRSI Strategic Plan for year four.

4.2 To what extent has there been an increase in the level of support for science and mathematics education among all relevant stakeholders?

In addition to the predictable support from personnel associated with the formal educational systems, the most critical increase in support has come from the Native communities themselves, particularly in the form of Alaska Native Elders who have actively and consistently 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 Elders Councils we have formed continue to be an important guiding feature in everything we do. It was through the initiative of one of the participating Elders that a major research project was funded by the federal government to determine the extent of mercury contamination in the food chain of the Kuskokwim Delta as a result of extensive mining activities in some of the key watersheds where Native people harvest their subsistence foods. This same region has now formed its own "Calista Elder's Council" and will be co-hosting a Regional Elder's Conference in September, 1998, with a focus on the educational and cultural well-being of the young people in the region. AKRSI Co-Director, Oscar Kawagley and Regional Coordinator Barbara Liu will be key participants in the conference.

4.3 To what extent has the goal of improving the achievement of all students in mathematics and science been embraced by all relevant stakeholders?

In addition to the examples listed above reflecting strong ADOE, school district and community support, another major player that has taken on a key role in promoting

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 work of the ANSC has included education as a major consideration in the guidelines that are being developed for any research activities that are contemplated for rural/Native communities in Alaska. Consequently, the AKRSI has joined with the ANSC in the preparation and submission of a proposal to NSF for a project focusin on "Knowledge and Distributed Intelligence," aimed at developing a context-sensitive system for more appropriately codifying indigenous knowledge in ways that link related data in culturally constructed networks.

In addition to the work of the ANSC, the Arctic Research Consortium of the US has completed reports on "Human Dimensions of the Arctic Environment" and "Science Education in the Arctic," both of which incorporate a strong educational component consistent with the goals of AKRSI. The scientific research oversight and planning roles of the ANSC and ARCUS and the guidance they provide the practitioners (and funders) of science are critical ingredients to creating a hospitable and supportive climate for the kind of work we are doing.

4.4 To what extent have all relevant stakeholders understood and accepted systemic change as a strategy for improving mathematics and science education?

The best gauge of the degree of interest in and acceptance of the AKRSI systemic change strategy is the level of interest from various educational and science-related organizations in forming collaborative relationships, as well as the attendance and participation in the AN/RE Consortium meetings, which have consistently exceeded our expectations. School districts and other participating organizations have shown up with 2-3 additional participants, funded from their own resources, either to expose them to what is being done through the AKRSI, or to eagerly present the work they are doing in line with the goals of the project. We have maintained open meetings and have welcomed all interested parties to join the discussions. Likewise, we have joined in the preparation of at least a dozen proposals for funding of closely aligned projects. These have included affiliations between AKRSI and the Geophysical Institute, the Center for Global Change, the Mount Sanford Tribal Consortium, the Northwest Regional Educational Laboratory, the Ilisagvik College, the Alaska Staff Development Network, the Geophysical Institute, as well as several school districts and Native organizations, all of which have strongly endorsed "systemic change as a strategy for improving math and science education."

Driver 5: Accumulation of a broad and deep array of evidence that the program is enhancing student achievement, through a set of indices that might include achievement test scores, higher level courses passed, college admission rates, college majors, Advanced Placement Tests taken, portfolio assessment, and ratings from summer employers, and that demonstrate that students are generally achieving at a significantly higher level in science and mathematics.

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. In this way, we hope 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 years two and three of the AKRSI on which the following summaries are based are included in Appendix C, with the AKRSI partner school districts identified with an asterisk (*).

5.1 To what extent is there increased enrollment in higher level mathematics and science courses?

The first challenge of the AKRSI in this area has been 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.

The most promising avenue for achieving increased interest in advanced level courses is the establishment of local chapters of the American Indian Science and Engineering Society, which is now in its third year/region. Three high school chapters of AISES have been established in the school districts serving the Inupiaq Eskimo region, four in the Athabascan region, and three in the Alutiiq/Aleut region. Each is sponsoring an Alaska Native Science Fair in their district, with a cross-regional Native Science Fair scheduled for November. Last spring, eight student entries from the regional fairs attended the national AISES Science Fair in South Dakota, two of whom took first and second place in their categories. It is the same students who participate in the AISES Science Fairs who are attending the regional Science Camps that are being sponsored by the AISES chapters in each region. We will continue to track those students and schools to see to what extent these activities contribute to a greater interest and involvement in science courses in the future.

5.2 To what extent are students having greater success in mathematics and science courses?

The first step in this objective 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 considerable promise 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 into greater success in the classroom and laboratory setting.

A comparative analysis of student academic performance following one such NSF-funded science camp (CAMP W.A.T.E.R.) 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

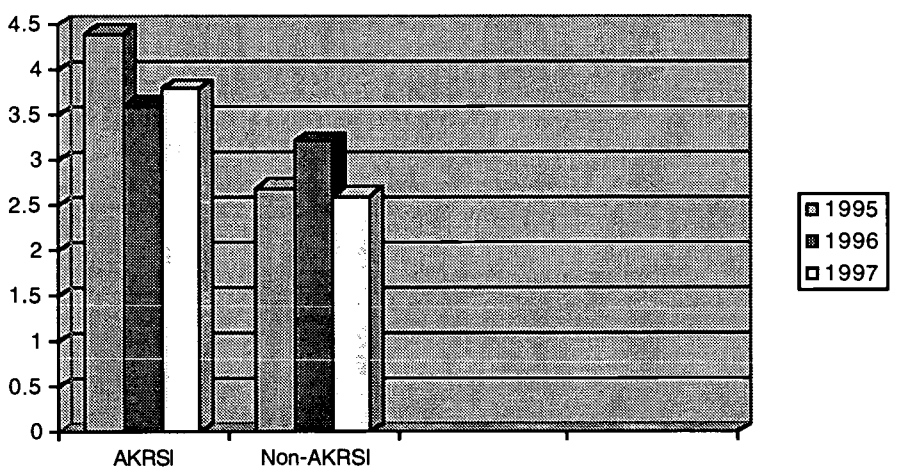
control group declined in a pattern typical of students at those grade levels in that district (and many others). However, when the data was disaggregated by gender and ethnicity, the Alaska Native students who attended the Camp showed a significant gain over the previous years academic performance, 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 is planning on 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 (see Appendix G).

5.3 To what extent is there an increase in high school graduation rates?

The measure that we are 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 two 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 average decline in dropout rates of .8% the first year and .6% the second year, while the non-AKRSI districts reported an average increase of .5% the first year and a .1% decrease the second year. The following chart illustrates the difference, and the district-by-district breakdown is provided in Appendix A. In general, the dropout rate has decreased more in the AKRSI districts than in the non-AKRSI districts.

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

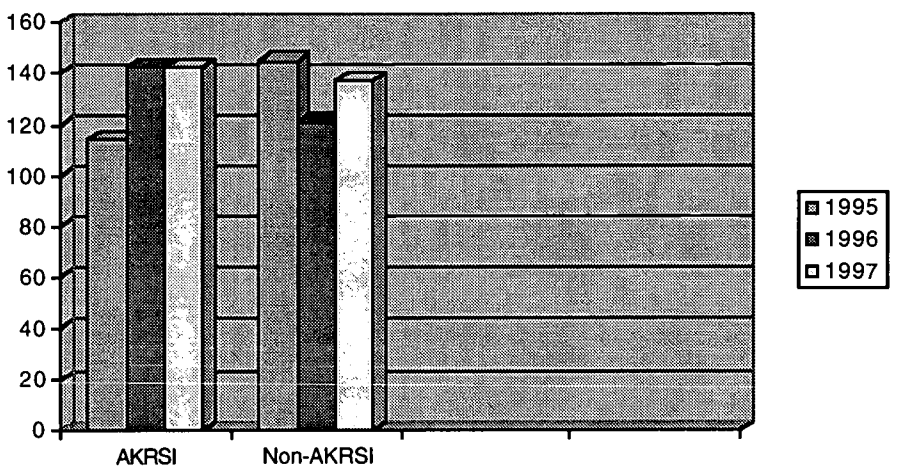


It is too early and we have too little evidence at this point to draw any significant conclusions from this data. We will continue to track this information through the remainder of the AKRSI initiative, eventually doing an analysis around other variables in the way the districts participated in the AKRSI initiatives.

5.4 To what extent are more students seeking and gaining admission to post-secondary education?

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 by 19% in 1996 and held steady in 1997, while the enrollment of new rural students from non-AKRSI rural districts in Alaska (28 districts, 120 communities) decreased by 12% in 1996, and then rebounded by 9% in 1997, but is still below the baseline enrollment level in 1995. 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 is too early to read too much into this data, or to see if it remains consistent over the remaining years of the AKRSI. Still, it is encouraging to see the continuation of increased enrollments of rural/Native students at the university, whatever the impetus.

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



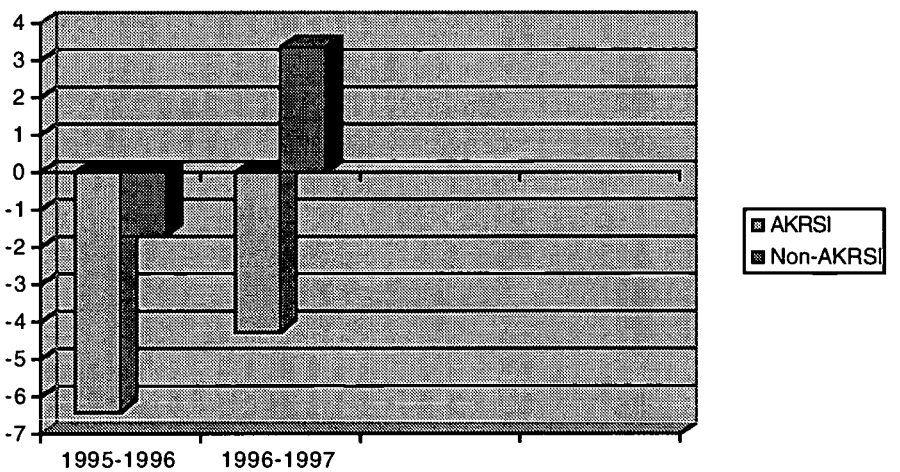
5.5 To what extent are students attaining higher scores on measures of learning in mathematics and science?

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 are 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

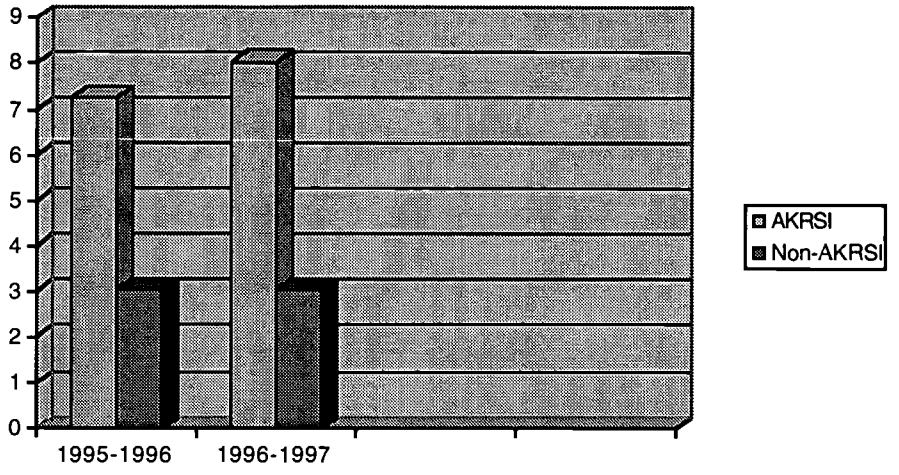
from administering the Iowa Test of Basic Skills in reading, language arts and mathematics to grades 4,6 and 8, to administering the California Achievement Test, 5th Edition in the same subject areas, but to grades 4, 8 and 11. Since the same conditions apply to all schools in Alaska, it is a valid exercise to compare the performance of students across districts, while there are problems with comparison across the two transition years. This year, we are able to make more extensive comparisons, including between the 1996 and 1997 grade 11 performance levels.

The initial indicators of the effects of the first three 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 (i.e., a decrease in dropouts) between AKRSI partner schools and non-AKRSI rural schools of 4.7 percentage points in 1996 and 2.8 percentage points in 1997 in the mean of the percentage of students who are in the lower quartile on 8th grade standardized achievement tests in mathematics. A corresponding difference of 4.2 points in 1996 and 0.8 points in 1997 indicates a greater increase in the percentage of students who are performing in the top quartile for AKRSI partner schools over non-AKRSI rural schools. The raw data for this analysis are also included in Appendix C.

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

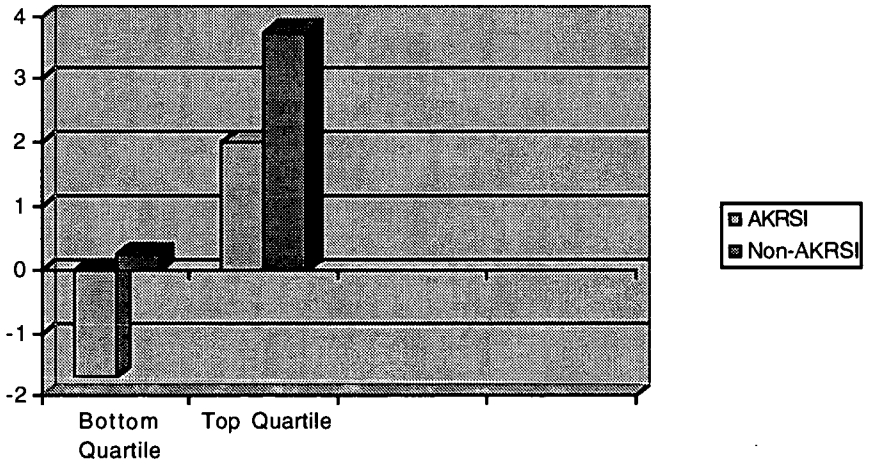


EIGHTH GRADE MATHEMATICS PERFORMANCE – 1995/96, 1996/97
Cumulative Change in % Rural Students in **Top Quartile** on CAT-5



At the 11th grade level, for which this is the first year comparative scores are available, the data indicates that the percentage of students from AKRSI schools who ended up in the bottom quartile of the CAT-5 in 1997 decreased by 1.8% points, while the percentage of non-AKRSI students increased by 0.2% points. At the same time, the percentage of AKRSI students in the upper quartile increased by an average of 2% points, and the non-AKRSI students increased by 3.8% points. This 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. We will be taking a closer look at the non-AKRSI schools during Year Four to try to discern what accounts for the increased representation in the upper quartile at the 11th grade level (e.g., course offerings, demographics, teaching practices, technology).

ELEVENTH GRADE MATHEMATICS PERFORMANCE – 1996/97
Change in % Rural Students in **Bottom and Top Quartile** on CAT-5

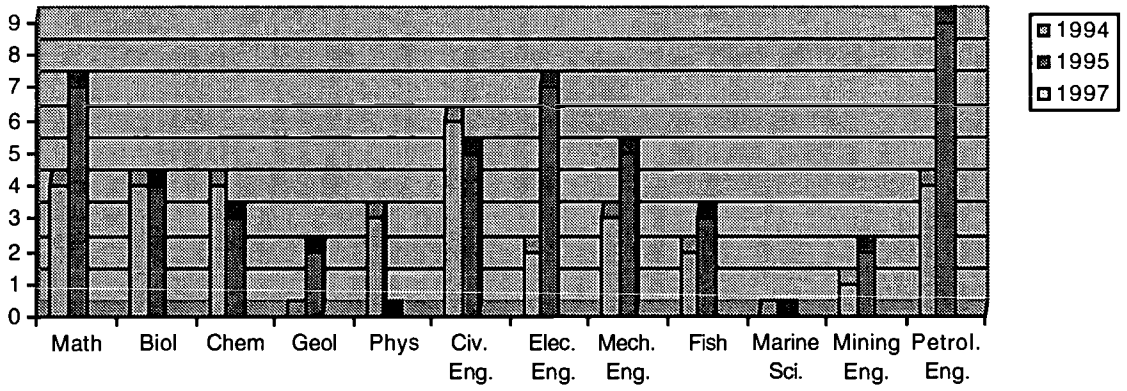


While this data indicates significant increases in the percentage of students who have performed in the upper quartile on standardized math tests in AKRSI schools (and a corresponding decrease in the percentage of AKRSI students in the lower quartile), the data are too preliminary to be able to draw any kind of definitive conclusions. However, the data do indicate 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 over two years).

5.6 To what extent are students showing greater interest in pursuing mathematics, science, and other technology-based careers?

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 are 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 following Year Two in seven fields (math, geology, civil engineering, mechanical engineering, fisheries, mining engineering and petroleum engineering), stayed the same in two (biology and marine science), and decreased in three (chemistry, physics and civil engineering).

% ALASKA NATIVE STUDENT ENROLLMENTS AT UAF IN MATH/SCIENCE MAJORS
1994, 1995, 1996, 1997



One of the 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 presence of a strong active chapter of the American Indian Science and Engineering Society on campus (it has been selected as "National AISES Chapter of the Year" for two of the last three years). AKRSI has been working with the UAF Chapter 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.

Driver 6: Improvement in the achievement of all students, including those historically underserved.

6.1 To what extent are gains in each of the following areas found for students in all geographic regions, racial/ethnic groups, special and regular education classes, and both genders?

The data summarized in Driver 5 encompass 70% of the Native students in rural Alaska who are located in the 20 rural districts directly involved with the AKRSI, most of which serve a student population that is over 90% Alaska Native, so no attempt has been made to distinguish Native from non-Native students in those districts. Since the Alaska Rural Systemic Initiative is being implemented in all geographic regions of the state and is focused specifically on Alaska Native students in small rural schools, students from all categories (gender, special education, etc.) are participating in whatever limited programs the schools are able to offer. As different indicators are impacted by the different regional initiatives (e.g., the AISES chapters, or science camps), we have gathered data for all classes of students associated with the project, and the appropriate distinctions have been included in the data presented under Driver 5, so no further elaboration is necessary here.

Summary of Progress Toward Alaska Rural Systemic Initiative Objectives

The above report provides a summary of the Alaska RSI's progress-to-date toward the objectives outlined in the Cooperative Agreement with NSF. Appendix I includes copies of the 1997-98 subcontracts we have initiated, which detail the work that is underway, as well as the cost-sharing for the current year. A summary of the next cycle of subcontracts will be included with the Strategic Plan for Year Four. At this point, we anticipate less than 10% unexpended funds at the end of the Year Three (Nov. 30, 1998). Our intent is to request that any carryover funds be used to extend certain subcontract activities for an additional six months (through May. 31, 1998). These extension requests will be submitted to NSF in early November for review and approval. The next round of subcontracts will begin with the new calendar year and the beginning of the second school term.

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