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ABSTRACT

This paper describes systemic thinking in support of the recently established Navajo Nation Rural Systemic Initiative (RSI). The RSI aims to create a standards-based student-centered teaching and learning environment in mathematics, science, and technology in the 173 elementary and secondary schools on or near the Navajo Nation, including public, private, and Bureau of Indian Affairs (BIA) schools. The convergence of limited resources within the service area is intended to address the complexities of standards-based reform in a very rural area lying within Utah, Arizona, New Mexico, and territory served by the BIA. The RSI has six priorities (program "drivers"): (1) student attainment and achievement (data collection through indirect measures, process measures, and criterion-referenced and norm-referenced tests); (2) strategies to close the gap between Navajo and non-Navajo students (integration of Navajo and Western knowledge, use of Navajo role models, career exploration); (3) culturally relevant curriculum and assessment and use of Dine (Navajo) philosophy in teacher preparation programs; (4) educational policy and procedures consistent with Navajo self-determination; (5) resource convergence (partnerships, networking, recognition of promising practices); and (6) cultivation of broad-based support across educational, business, and government/services sectors of the Navajo Nation. A table compares traditional and systemic thinking about large-scale change and improvement efforts. (SV)

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SYSTEMIC THINKING TO SUPPORT DINE EDUCATION

Introduction

The Navajo Nation is the largest American Indian nation in existence, covering a vast geographical area of 25,000 square miles within the states of Arizona, New Mexico, and Utah. The Division of Dine Education is the agency within the Navajo Nation government with responsibilities for: (a) developing policies and programs for quality education; (b) promoting the inclusion of Navajo language and culture into school curricula; (c) advocating for unmet educational needs; and, (d) identifying and promoting innovative solutions to educational problems. Over the past twenty-seven years since the Division of Dine Education established, the agency has consistently pursued its agenda of capacity building through the cultivation of substantial inter-agency partnerships. This paper describes systemic thinking in support of the recently established Navajo Nation Rural Systemic Initiative for the improvement of mathematics, science, and technology within p-12 schools on or near the Navajo Nation. This system focused change project builds on the successful experiences gained through the Ford Foundation funded Navajo Teacher Education Consortium and the National Science Foundation funded Navajo Coalition of the UCAN (Utah, Colorado, Arizona, New Mexico) Rural Systemic Initiative.

The Navajo Nation Rural Systemic Initiative was established specifically for the benefit of the 70,518 Navajo and other students attending 173 elementary and secondary schools on or near the Navajo Nation. The purpose of the Rural Systemic Initiative is to create a standards-based, student-centered teaching and learning environment in mathematics, science, and technology within each school. This ambitious project seeks to attain this vision through the accomplishment of six distinct program drivers that include the following: (1) student attainment and achievement; (2) closing the gap between the achievement of Navajo and non-Navajo students; (3) curriculum and assessment; (4) policy; (5) resource convergence; and, (6) broad-based support. This paper provides a description of all six program drivers, with specific attention to the systemic thinking those guides the development of the program in meeting the unique needs of teachers and students in the rural areas of the Navajo Nation. The project focus includes public schools, Bureau of Indian Affairs schools, boarding schools, and private schools. The convergence of limited resources within the service area is intended to address the complexities of standards-based reform in a geographical area that impacts the most rural situation within Utah, Arizona, New Mexico, and the territory served by the Bureau of Indian Affairs.

Student Attainment and Achievement Driver

A variety of information on the educational achievement of Navajo students has been collected through the efforts of the National Science Foundation's UCAN Rural Systemic Initiative. Minnick & Varoz (1997) summarized a variety of data that were obtained through student surveys, teacher surveys, school reports, based on survey instruments of their own construction. Outside reports from the American College Testing Service, the Councils of Post-Secondary Education, the State Departments of Education in Arizona, New Mexico, and Utah, and the National Center for Advanced Placement examinations were also utilized to address different aspects of student achievement and attainment.

The types of results being pursued include a number of indirect measures of student achievement such as increases in positive attitudes toward mathematics and science and increased participation in

mathematics and science clubs. Process measures have been identified including indicators such as increased student enrollments in mathematics and science courses and increased access to the inter-net. Another set of process measures considers the increased numbers of students enrolling in post-secondary educational institutions.

The direct measures of student achievement and attainment are also included within the design and encompass the numbers of students taking and passing criterion-referenced mathematics and science tests. The more traditional measures such as increased numbers of students scoring in the top two quartiles on norm-referenced mathematics and science tests are also included. A difficulty in the analysis of this information can be found in the different norm-referenced measures of student achievement that are currently being used in the different state education agencies serving the Navajo Nation. To address these issues, the Navajo Nation Rural Systemic Initiative has embarked on the development of a Navajo Education Information System (NEIS) to systematically collect and address these differences (Rude, Hopkins & Horton, 1998). The NEIS represents an expansion of data collection efforts from the Division of Dine Education, and support the quality efforts for dissemination through publications such as the Statistics on Navajo (Dine) education (Izzo-Mannymules, 1996).

Closing the Gap Driver

The under-achievement and under-representation of students from the Navajo Nation in the mathematics and science curricula remain major challenges to the educational system that it represents. There is a tremendous gap between the potential of Navajo students as they make their way through the preschool through grade twelve educational experience and the numbers of Navajo students entering the professional job market. This provides a pronounced disadvantage to Navajo youth as they pursue post-secondary options for careers that require extensive knowledge and application of science, mathematics, and technology.

A variety of strategies have been identified that will assist the various schools to overcome the gap between actual and expected levels of achievement for Navajo students. It is critical to provide early models of successful engagement in career fields that utilize mathematics, science, and technology as a vehicle for career exploration and choice in these disciplines. These career exploration programs extend beyond high school students to enrich the lives and potential professional occupations of middle school and upper elementary school students. Navajo children and youth are exposed to an education that integrates Navajo and Western knowledge about science, mathematics, and technology that provides a significant advantage in the quest to close the gap. The systematic incorporation of Navajo role models who have pursued careers as engineers, scientists, mathematicians, professors, and representatives of other professional fields is essential to building the strong foundation of interest and commitment to future careers and commitments to these disciplines. A progression of content includes the following sequence: (1) awareness of the importance of science, mathematics, and technology in every day life; (2) recognition of the importance of pursuing post-secondary education options to prepare for a professional career; (3) in-depth exploration of career fields in the areas of science, mathematics, and technology; and, (4) conceptual understanding of the integration of Navajo and Western scientific knowledge.

Curriculum and Assessment Driver

The Division of Dine Education has developed a comprehensive framework of curriculum based on Navajo language, culture, and the Dine Education Philosophy. A cornerstone of the Dine philosophy can be described as "Hozhoogo Naashaa" or "in beauty we walk." The inter-connectedness of Navajo and Western thought is particularly useful as a model for incorporating the critical directional concepts of thinking (east), planning/career (south), social/family (west), and reverence/respect (north). The balance of male protection way teachings and female blessing way teachings provide a complementary inter-relationship of values, concepts, curricula, and inter-disciplinary approaches.

The focal point of the Navajo system of education is found in the developing Elementary Teacher Education Program that was initiated in 1996 at Dine College in Tsaile, Arizona. The vision of this innovative program is to prepare Navajo teachers who are proficient in both Navajo and English language, with a focus on Navajo culture and the Dine Education Philosophy. The Dine themes that guide the program include: (1) Nitsaahakees which entails thinking about, conceptualizing, designing, researching, and preparing; (2) Nahat'a which focuses on planning, inquiring, investigating piloting, and experimenting; (3) Iina which fosters doing, accomplishing, producing, performing and publishing; and, (4) Siihasin which features the concepts of becoming experienced, expert and confident, able to adopt, adapt, and problem solve, and able to operate at a critical level of reflection. The curriculum and assessment focus incorporates Dine curriculum and assessment practices into pre-service and continuing education programs across the preschool, elementary, secondary, and post-secondary education systems. This lends support for an integrated system of Navajo and Western knowledge, performance, and dispositions.

Policy Driver

Through the sponsorship of the American Association of Colleges for Teacher Education and the Ford Foundation, the Navajo Nation Education Policy Forum was conducted in 1995. The results of the policy forum produced recommendations for improving the quality of Navajo education by: (1) increasing the number of certified Navajo teachers; (2) providing Navajo specific curriculum; (3) ensuring the teaching and learning of the Navajo language and culture; and, (4) expanding the infrastructure for delivery of educational services to the various schools and classrooms that comprise the Navajo system of education.

The Navajo Nation through the Division of Dine Education has consistently pursued a course of self-determination in the policies and procedures for its educational system. Hopkins & Rude (1996) summarized the major issues in support of this goal to include the following: (a) the sovereignty of the Navajo Nation government with legitimate authority for all aspects of the Navajo education system; (b) the need to recruit and retain qualified Navajo educators to deliver a quality educational experience to all Navajo learners; (c) the expectations for teacher preparation programs that are specifically designed for delivery to prospective teacher candidates in rural and remote areas of the Navajo Nation; and, (d) the support for Dine Education Philosophy as the guiding force behind all innovations in the Navajo system of education.

Resource Convergence Driver

A variety of resources and activities are available to assist the Navajo Nation in providing technical assistance and support for enhanced science, mathematics, and technology instruction in the various schools across the Nation. This priority recognizes the variety of promising practices that are currently taking place across the Navajo Nation that are not connected through a systematic network for dissemination and technical assistance to enhance the instructional outcomes in science, mathematics, and technology.

The convergence of resources targets the systematic linkage of promising partners within the preschool-grade twelve schools, higher education, business and community interests, parents/families and extended families, and the variety of educational associations. These stakeholders are concerned about raising the level of awareness, knowledge, performance, and dispositions related to the targeted areas of curriculum. To achieve this end, a variety of communications, networking, dissemination, and collaboration goals and strategies have been developed. This has resulted in a resource bank of technical assistance providers in science, mathematics, and technology across the Navajo Nation.

Broad-Based Support Driver

The cultivation of broad stakeholder support for the Navajo Nation Rural Systemic Initiative is paramount to implementation and institutionalization of the priority goals and outcomes of the project.

The integration of Western and Dine scientific knowledge requires system-wide understanding to achieve meaningful outcomes of effectiveness. To facilitate the understandings, connections, and support for the project, a multi-faceted campaign of awareness, information, and involvement has been developed.

The Navajo Nation Rural Systemic Initiative has developed a comprehensive strategy to publicize the efforts of the project and enlist the necessary support to expand and sustain the desired outcomes. A coordinated media campaign, selected workshops and conferences, brochures and other print media, periodic focus groups, and summaries of program results are among the more tangible outcomes that enlist broad-based support. The broad range of stakeholder representatives across education, business/economic development, and other government/service sectors of the Navajo Nation have been selected for participation to ensure the effectiveness of this driver to support the project.

Systemic Thinking as a Guide

The innovations specified by the Navajo Nation Rural Systemic Initiative are focused on increasing the success of Navajo learners in the critical areas of sciences, mathematics, and technology. As with most change efforts in education, the project specifies priorities that are technically simple and socially complex in relative terms. To connect the various pieces of the Navajo system of education in a purposeful manner requires a different type of thinking on the part of teachers, administrators, and parents. Thinking in strategic dimensions requires personal change and commitment on the part of stakeholders to consider new options for thinking beyond current issues and concerns. All change and commitment must start with the individual or the potential for deep change is effectively neutralized. Quinn (1996) contrasts the requirement for deep change as a personal commitment with the reluctance of individuals to venture outside their comfort zone of routines. He refers to those individuals who are unwilling or unable to make a commitment to change as the vast number of individuals who are: "dying a slow death." Dying a slow death in an organization takes on a variety of connotations that imply that all change must occur "out there" rather than within their own experience. The lessons of systemic thinking illustrate the types of personal commitments that result in systems change. Table one illustrates the differences between traditional thinking and systemic thinking as it relates to large-scale change efforts such as the Navajo Nation Rural Systemic Initiative.

Table 1. Comparisons of Traditional and Systemic Thinking

TRADITIONAL THINKING	SYSTEMIC THINKING
Considers what is not working and typically looks for "victims" to blame.	Describes how components of a system are working and encourages accountability for different results.
Protects the turf and works to maintain the environment.	Constantly seeks to reposition to establish more strategic opportunities.
Invests in those efforts that allow the organization to become larger.	Considers the most effective means of working in a larger context and works to make the organization become lean.
Is comfortable with routines and standard operating procedures	Wants to know where he/she should be next to improve the system.
Describes what is present within the organization that contributes to present outcomes.	Identifies what is missing that would potentially improve the performance of the organization and the larger system.
Takes pride in the activities of the team or organization.	Takes pride in the results that are produced by the team, organization, and system.
Provides attention to the individual members of an organization.	Focuses attention on the vision being pursued by the organization.
Measures efforts against job description.	Measures effectiveness against descriptions of tactics and strategies.
Seeks stability to anchor the organization.	Pursues approaches that allow the individual and organization to become more agile.
Concerned with getting more to make the organization bigger and better.	Wants to "give it away" to build the capacity of the system.

As the process of systemic change unfolds within the structure of the Navajo Nation Rural Systemic Initiative, the guiding force for change is the unique needs of the diverse learners who comprise the rural environments of Navajo schools.

A variety of change agents have made commitments to a collaborative enterprise described by the project. Systemic thinking provides the vehicle to open the doors for purposeful action that leads to the outcomes of the project. As clear and simple purpose is identified, the cultivation of complex and intelligent behaviors is supported among the participants.

Summary

This paper has summarized the key features of the Navajo Nation Rural Systemic Initiative sponsored by the National Science Foundation and implemented by the Division of Dine Education. The project seeks to create a standards-based, student-centered teaching and learning environment in science, mathematics, and technology for a broad cross-section of students in elementary and secondary schools on or near the Navajo Nation. The priorities that have been identified to achieve the vision of the project include six drivers that lead to systemic reform. These six drivers are as follows: student attainment and achievement; closing the gap; curriculum and assessment; policy; resource convergence; and, broad-based support.

The implementation of systemic change can only be attained through the efforts of stakeholders who practice systemic thinking. Thinking in strategic dimensions requires personal change and commitment on the part of stakeholders to consider new options for thinking beyond current issues and concerns. This is the basis for systemic thinking that operates in contrast to traditional thinking that typically endeavors to maintain the status quo. A variety of examples of systemic thinking are provided with contrasting examples of traditional thinking. The intent of this approach is to identify clear and simple purpose that leads to intelligent and complex outcomes.

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