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ABSTRACT

The Community-Based Education Model (CBEM) at Santa Fe Indian School (SFIS) in New Mexico was studied to determine the elements that contribute to its success and that may be replicated in other community education projects. The CBEM engages students and tribal communities in issues related to their environment, natural resources, and health in an attempt to stimulate high school student interest and motivation in math and science. CBEM is a partnership among students, SFIS, the Pueblo community, business, and government that meets the request of the Pueblo governors to educate students in the skills needed in the outside world and in their own traditions. Pueblo students are learning mainstream skills (math and environmental science), and they are interacting with mainstream organizations. Their work is rooted in the Pueblo community through local field experience programs on water quality, and connections are made to Pueblo culture through Pueblo community members. Program strengths include a committed, knowledgeable, energetic staff that shares a common educational philosophy supported by educational research and Pueblo ideas; a program that is responsive to Pueblo culture, traditions, and needs; cutting-edge technology available for student and community use; increased student motivation to learn environmental science; networks between Native and mainstream science and technology organizations; and excellent documentation of the process behind the model program. Recommendations for program improvement and replication are listed. (Contains 21 references, a table displaying CBEM themes, and figures depicting the model.) (TD)

REAL, RELEVANT, MEANINGFUL LEARNING: COMMUNITY-BASED EDUCATION IN NATIVE COMMUNITIES

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Overview

The Community-Based Education Model (CBEM) at Santa Fe Indian School (SFIS) is the focus of this qualitative research report. The CBEM brochure describes the model's goal as ". . . community-based education [that] seeks to engage students and tribal communities in issues related to their environment, natural resources, and health . . . in an attempt to stimulate [high school student] interest and motivation in the areas of math and science."

Purpose of Research

The purpose behind this research is to identify the process behind developing, implementing, and building upon the Santa Fe Indian School CBEM. This process evaluation was undertaken primarily to provide information for the CBEM program and its funders. However, there is another focus to this component. Santa Fe Indian School believes the CBEM is a program that has addressed the needs of Pueblo education in a unique and effective manner. Pueblo governors have advised SFIS to educate Pueblo students to be able to compete successfully in the outside (mainstream) world, while still honoring and learning their Pueblo traditions. School cannot teach these traditions, but it can teach students how to address the mainstream needs of the Pueblos in such a way as to encourage students to return to their communities (and thus participate in traditional life). Particularly in the Pueblos of Cochiti, Jemez, and Santa Clara, CBEM has been meeting this challenge for three years.

Because of the success of the interactions between CBEM and Pueblo communities, and because of the apparently increased motivation of students, the Circles of Wisdom project was developed and funded by the Annenberg Rural Challenge. The process behind CBEM is important to the development of Circles of Wisdom. What has allowed for the CBEM successes that Circles of Wisdom can duplicate? What barriers

has CBEM met that Circles of Wisdom can avoid? Understanding the CBEM process is important for the development and growth of Circles of Wisdom and future community-based education projects. This, then, is the second reason for evaluating the CBEM process.

Methodology

Qualitative research methods (rather than quantitative methods) are more compatible with Pueblo philosophy (Enos, 1998, 1999). Hermes (1998) finds qualitative methodology more compatible for Native people who are doing research in Native settings. For this reason, the paradigm of naturalistic inquiry (Denzin & Lincoln, 1994; Lincoln & Guba, 1985) guided the research design and analysis. The Senior Researcher coordinated the process evaluation with the help of four Research Interns. The senior researcher (that is me, Anya Dozier Enos) and three of the interns (Wanda Chavarria, Tina Harte, and Trisha Moquino) are Pueblo members, the fourth is non-Indian (Sarah Massell). In New Mexico there are 19 Pueblos, eight are considered Northern and ten are Southern. The Pueblos are in northern and central New Mexico; the designations of North and South are in reference to the Pueblos. Tina and Trisha are from Southern Pueblos; Wanda and I are from a Northern Pueblo. The Pueblos the CBEM program works with (the focal Pueblos) are representative of both regions.

All five of the researchers also have a history with Santa Fe Indian School, although none have worked with the CBEM program. As with most Pueblo people, the three Pueblo interns and I have had relatives who attended SFIS, both in the past (as long ago as the early 1900s) and in the present. In addition, the school has employed us all. Tina worked as a Special Education Teacher from 1993 – 1998; Trisha worked as an aide during the 1995 – 96 school year; Sarah has been an evening tutor since 1998; and I have worked in various capacities (teacher, coordinator, researcher) from 1990 to the present. These experiences meant we were all somewhat familiar with the school and CBEM. Although this may have created a limitation for the study, on the whole I think it enriched it. We did not know much about the particulars (design, implementation, etc.) of CBEM, but we were familiar with the names and faces of the staff. Tina and I also were aware of the complexity of the changes in leadership at the principal level. Sharing that awareness

allowed the others to read through the material with more ease. For example, the principal is referred to by name in journals, and there have been a total of 5 people in the principal position since CBEM began. Out of the 5, all have played other roles at other times (Middle School Director, Assistant Superintendent, Director of Development, Educational Planner, Teacher). Charting the names and positions of these people by semester helped to ease the reading of the journals. Acknowledging this also made us aware of the administrative complexities with which CBEM works.

According to the research plan, the interns and I read CBEM quarterly reports, journals, and other related materials from the inception of the program (July 1995) to the present. The quarterly reports are a summary of a three month period, with attachments of curricula, correspondence, training sign-ins, evaluations, and other written material produced or received by the program. Individual staff members kept the journals, which contained personal reactions and feelings related to the project. The superintendent asked the staff to keep journals to help document the process, but it was the project director, Glenda Moffitt, who read the journals.

Each of these documents had at least two different readers and usually three. As these documents were read, the readers would look for themes, sub themes, emerging themes, theories, and relevant quotations. This "grounded theory" approach allows the document data to guide the research (Glaser & Strauss, as cited in Miles & Huberman, 1984). The interns and I met once or twice a month December through June to discuss and refine this process. It was evident from the January meeting that the interns and I were all identifying similar themes and these themes, with some refinement, were used throughout the research process. It is possible that the early themes drove the research and blinded us to additional emerging themes. I doubt this to be the case, however, because Trisha joined the research team later and verified the themes. Also, additional themes and sub themes did continue to emerge until the end of the project. For example, nine major themes were listed January 12, 1999. Since that time, four of those nine have been reclassified as sub-themes, but all nine themes are present in the final list of broad themes, sub themes, and sub, sub themes created June 8, 1999. These themes form the top two rows of the theme clusters in Table 1 in the Appendix. Although this information was useful to me in creating this report, it may not make much sense to people outside the

research team. I include this table simply as a demonstration of data reduction and display. Miles and Huberman (1984) discuss this style of data analysis where data are collected, reduced and displayed, and the drawing and verifying of conclusions is an on-going, interactive process.

In addition to creating cluster charts to organize complex materials, Sarah and I tried to represent our findings visually through Venn diagrams and pictures. As the connections between themes and organizations and philosophies became more complex, these diagrams became increasingly useful to explain emerging theories and ideas about the CBEM process (see Figure 1 in the Appendix for an example).

To verify and triangulate findings from the reports and journals, I interviewed two CBEM staff members. One had worked for CBEM for two years, but has been away from SFIS for a year. The other has been involved with CBEM since it began. Since qualitative research tries to represent the participants' views accurately, it was important to conduct these interviews. Another strategy to assure we understood CBEM views was to have the researchers and CBEM staff meet together. The first meeting with CBEM staff was to develop the research plan, the second meeting was after themes began to be identified by the researchers, and the third meeting was to share the tentative report outline with CBEM. The staff interviews took place after this third meeting. At each stage, the CBEM staff answered questions to clarify the project. The staff never asked the researchers to make changes in the findings.

An unplanned aspect of the research was that the superintendent of SFIS created a Community-Based Education Task Force in February 1999. This Task Force was made up of SFIS staff, CBEM staff, SFIS students, and a parent. The Task Force met regularly (two – four times per month) through the second week of June and was charged with looking at ways to expand community-based education at SFIS. Sarah and I were participant-observers at these meetings, and thus had more data with which to triangulate our findings. This participant observation allowed us to see the interaction between CBEM and the larger SFIS school community and experience some of the philosophical tensions that exist around community-based education for Pueblo students. Research and education are never apolitical and the Task Force meetings, along with CBEM reports

and journals, uncovered issues that are at the heart of education, community, and research.

Findings

Since Santa Fe Indian School came under the control of the 19 Pueblo Governors in 1977, SFIS has attempted to become, as Superintendent Joseph Abeyta says, "A true Indian School, not just a school for Indians." Inherent in this statement is the responsibility to address the needs of the Pueblos as identified by the Pueblo leadership. How can a mainstream education be relevant to Pueblo Indian students? The Community-Based Education Model (CBEM) is an attempt to answer this question.

Philosophical Tensions

"A way of life sustains both the individual and the community" (CBEM Journal).

"There is pressure within the school to explain CBEM, which is a continual process. There is pressure to expand CBEM, but it will expand when the time is right" (CBEM staff member).

In the past, mainstream education has been used to assimilate Indians into mainstream culture (Szasz, 1974). However, Pueblo people did not want to assimilate, and racism in the mainstream did not allow Indians to truly assimilate (Spicer, 1969). Obviously, this type of education is inappropriate, yet Pueblo people do see the need for a mainstream education. How can the Pueblos protect their sovereign rights if they do not understand how to communicate and work effectively with the mainstream? It is for this reason that tribal leaders support their children receiving the highest quality mainstream education. The Pueblos also recognize their responsibility to educate their children in Pueblo traditions.

Although the basic philosophy of the CBEM staff and Pueblo traditional approaches to education fit with the philosophy of John Dewey and M. M. Bakhtin, there are tensions between some school and Pueblo approaches to education. CBEM works from the philosophy that knowledge results from activity and practice. The social interaction that occurs during the activity can never exactly be reproduced, and each

individual learns something unique in this setting. This philosophy echoes that of Pueblo people, educators (Dewey, 1933), and sociologists (Bakhtin, 1986).

However, the style of education in mainstream schools often separates learning from activity and thus does not fit with Pueblo understandings of learning. Neither does the focus on individual, competitive learning, or paper and pencil tests. The artificial separation of subject areas and the focus on preparing for an abstract future are also not parts of traditional Pueblo approaches to learning.

These tensions provide challenges in the delivery and assessment of a school curriculum for Pueblo students. The curriculum delivery must remain flexible to capitalize on field learning experiences that, by the definitions above, are unique in each instance and for each student. Since the classroom experiences build on the field experiences, these too must remain flexible. However, CBEM staff believe they are able to address most of the broad standards outlined by the state of New Mexico for science and mathematics. The staff also recognizes that standardized assessment may not reflect the student learning that is happening in the CBEM program. Alternative forms of assessment have been used since the beginning of the program, but these also do not seem to have the flexibility to test what students are learning. This is discussed in more depth under "Research" in this report.

The American Indian Science and Engineering Society (AISES) recognizes the need for standardized tests, as do the Pueblo tribal leaders, yet cautions against using this as the only measure of students' intelligence or achievement because "standardized tests can reflect serious cultural bias" (n.d., p. 5). This tension creates serious problems in the assessment of student learning in the CBEM program. This challenge will be addressed again in the Research and Evaluation portion of this report.

Other areas in education, besides testing, can result in unintentional biases, too. Non-Indian interpretations of Indian philosophy can result from non-Indian teachers teaching Indian themes to Indian students. CBEM addresses this problem by pairing non-Indian staff with both the CBEM community liaison and Pueblo members who are working in their communities.

In addition to these broad philosophical tensions, there are also conflicting ideas within the Santa Fe Indian School about the definition of community-based education.

On the whole, the CBEM staff view community-based education as Pueblo driven. That is, the Pueblo communities define the need(s) to be addressed by the school. The community identifies a theme, and the school designs the curriculum around that theme to address the community-identified need. For example, Santa Clara's newly developing environmental department needed to monitor water quality. The broad theme of water quality was the basis for the curriculum. Other (non-CBEM) SFIS staff have a broader definition of community-based education that includes the option of the school identifying a Pueblo or non-Pueblo need and then having students address that need. For example, SFIS community service projects have collected clothing for the homeless in Santa Fe and have provided high school students as tutors for elementary students in the Pueblos. Although such projects contain many of the same elements as CBEM, they still put the school in the position of power by determining the communities' needs. The result can be a waste of student effort because the need identified by the school may not be a community need. As one parent said, "Please don't have them [student volunteers] paint the Head Start building again. Every youth group that comes through has done that."

For CBEM, Community-Based Education and Service Learning are similar concepts, the only difference being that for CBEM, community-based education must be driven by community identified needs. Hall (1991) identifies traditional Native values for the 1990s: family, service to others, spiritual awareness, challenge, meaningful roles, recognition, responsibility, natural consequences, respect, and dialogue. Service learning, says Hall, is the ideal way to address these values. Later in this report, it becomes evident that CBEM addresses these values, particularly service to others, meaningful roles, responsibility, respect, and dialogue.

It is important to recognize where Pueblo education and mainstream education intersect (as with the ideas of John Dewey), as well as where tensions exist. It is also important to note that although the CBEM staff has a common definition of community-based education, the entire SFIS staff does not necessarily share that definition. There are differences in philosophy between the Pueblo and the mainstream, and within the Santa Fe Indian School. However, the intersections are where mainstream education is

relevant to Pueblo students. Pueblo community mentors and CBEM staff work together to uncover these intersections, as will be shown in the "Findings" section of this report.

The "Worlds" of CBEM

One way to think about the CBEM program is to understand it as the intersection of three "worlds": Pueblo, school, and students (see Figure 1 in the Appendix). The Pueblo, or community, has an important role in defining and implementing the field experiences that provide a base for the CBEM curriculum. The school provides the specifics of the curriculum, and the staff to assure that the field experiences and classroom learning complement each other. Naturally, the students are the most important piece of the equation, since the design of the Pueblo/school partnership is to provide a meaningful, appropriate education for them.

An underlying motivator for all three of these stakeholders – school, students, and Pueblo – is technology. The school is responsible for teaching the students how to use and understand technology, but beyond that, technology is a factor in attracting funding (first from Intel, now from the Department of Energy). Students enjoy using computers, are anxious to learn more about what computers, and often learn this information faster than adults. All these are motivators to using technology, which is an important part of the curriculum in both the field and classroom. The Pueblos also need technology to address interactions with the mainstream and to assure quality of life for their people. Technology, then, acts as motivation for the Pueblo communities, too. They need training for their staff, and they need the power of technology to analyze and present information to the mainstream. CBEM provides both the training in technology and the resource of consultation for using technology. The students become this resource for their communities and thus the reciprocal relationship of the community educating and being educated by students is nurtured.

Community

"Give value to communities; respect those communities and communities will see their role in students' education" (remark made at a meeting at SFIS).

"The success of the relationship between Santa Clara And the CBEM project has only reinforced the idea behind the whole project: the involvement of community in the education of their children" (December 1999 Quarterly Report).

As mentioned earlier, community involvement and direction is a key piece of the CBEM program. As such, relationships between CBEM (and SFIS) and the Pueblo communities are extremely important. The majority of the work on community relationships has been with the focal Pueblos of Santa Clara, Tesuque, Jemez, Cochiti, and sometimes San Ildefonso and Nambe. However, CBEM must be aware of their relationships with all the Pueblos since the Pueblos do ultimately own the school. Also, if CBEM is able to expand, more Pueblos could become focal Pueblos. CBEM enjoys a good reputation and more Pueblos would like to become focal Pueblos. There are logistical issues – such as distance, student numbers, and cost -- that limit which and how many Pueblos CBEM works with directly.

In working with the Pueblos, CBEM staff have had to be flexible, culturally aware, and willing and able to build trust. The primary way to address these three issues has been through the identification of and respect for Pueblo protocol. Cochiti Pueblo member Mary Romero (1994) did some preliminary work on defining this protocol, but CBEM staff member Matt Pecos (also from Cochiti) refined the written process (see Appendix). Basically, by recognizing that any project must first go through the Governor's office, the CBEM staff followed this protocol to assure tribal support. Meeting with the Governor (as well as other tribal staff) requires flexibility because ceremonial and governmental obligations may arise quickly and take precedence. Both written and personal contacts are important to assure clear, continuous communication. Allowing for this flexibility helps to create trust. Understanding that parents and other family members, as well as tribal leaders, are integral parts of assuring community involvement has also allowed for smooth relations. Another way the CBEM staff created trust was by providing computer and other types of training for community members. The technology at SFIS was made available to the Pueblos for training, data collection, and analysis – either by Pueblo employees and parents or by CBEM students working on projects identified by the Pueblos.

Students benefit in many ways from working closely with the communities. Adolescents need adult attention and support for their efforts; part of why students develop feelings of responsibility and dedication to their CBEM work is because of this contact with tribal leaders, relative, and peers. Many cultural values and much cultural knowledge are reinforced through these contacts. As fits with Pueblo tradition, CBEM staff and students were welcomed to communities with food. Furthermore, Pueblo members became teachers and mentors. Tribal leaders expressed their appreciation to students for the work that they did on behalf of the Pueblo, and they also reminded students of the importance of respect and good behavior. As students learned about the work their relatives and fellow community members were doing, they came to view them in a new light. Pueblo people value hard work to benefit the community. When students understood the work of community members, it was natural for them to demonstrate respect for these people. Environmental issues, that formed the basis for the curriculum, were tied to cultural knowledge, tradition, and ceremony. Hearing information about the environment from elders took on special meaning to students. It is one thing to be told by teachers to pick up trash at school, it is another to be in one's own Pueblo listening to an elder talk about how respect for land includes picking up trash. In some Pueblos, CBEM students became teachers and mentors to elementary school students in the local day schools, and thus education and values expanded and continued.

The approaches to community outlined above fit with what educational literature recommends for motivating minority students. John Ogbu (1992, 1999) notes that core curriculum and multicultural education alone cannot address the educational needs of Native American students. He believes that in order for education to be effective, Native communities must be involved in order to show students "concrete evidence that [community] members appreciate and value academic success . . . [the] community must teach the children to recognize and accept the responsibility for their school adjustment and performance" (1992, p.12). Ogbu (1999) further states the necessity of engaging the Native community in continuing dialogue about the education of their students. The complexity of the barriers to educational success must become clear to both the community and the school before school reform will benefit the students. Emmy Werner

and Ruth Smith, in their longitudinal study of resiliency (Viadero, 1995) also note the role of community resources and networks in supporting students' educational needs.

Curriculum

"[Curriculum] details change frequently due to weather, constraints, special requests by community members, and unforeseen opportunities" (March 1998 Quarterly Report).

"The community requests student help, for example with macro invertebrate sorting. Then the school becomes a forum for training professionals: community members and students learn together . . . Students learn valid scientific protocol for scientific study" (CBEM staff member).

"[This is] the most rewarding experience I have ever had teaching mathematics" (CBEM staff member).

The curriculum is built on the community/ school partnership. It is important to note that the groundwork for the curriculum development – the development of the community relationships -- took a year, and the bulk of the work for the basic curriculum took an additional semester. The curriculum continues to be modified to suit the changing needs of the communities and students, but it is usually the delivery (as determined the field experiences), not the content, that is altered.

The Pueblo-identified, broad, encompassing theme for the CBEM program is water. The two basic curricula are math modeling and environmental science. The June 1998 Quarterly Report states, "all Pueblos have environmental issues," and, for this reason, the natural environment makes the ideal field of study. It may also be that this is an area that is particularly appropriate for Pueblo-style educational issues to be addressed because Pueblo culture and traditions are dependent on their environment.

Field experiences and classroom work – both supported by technology – are the mainstays of the curricula. A Native consultant, Dorame and Associates, developed field manuals for use with CBEM curriculum. With the focus on practical application and real world work, student interest and motivation is generally high (as measured by student feedback and observations of tribal members and CBEM staff). Students give presentations on their work and findings to the tribes and to private, state, and federal

organizations. Students and community members alike identify the field experiences as the most meaningful part of the project and recommend that there should be more time spent in the field.

Since the focus of this piece of the research is the process behind the development of the CBEM program, an analysis of the curriculum is beyond the scope of what is reported here. However, it would be interesting to know exactly how the curriculum addresses the state standards in math and science, as well as understanding the delivery of the curriculum. It is recommended that a consultant with a solid background in curriculum development evaluate the CBEM curriculum.

Students

"CBEM offers real, relevant, meaningful learning. . . teens are prime to experience [this] with open minds" (CBEM staff member).

Case studies, student essays, student journals, and student program evaluations demonstrate that CBEM motivates students to be involved in the program. Although this component of the research did not assess student performance, previous case studies and student journals and evaluations were part of the documents the research team analyzed. Students consistently identify the fieldwork and chance to work on computers as primary motivators. Students appreciate the opportunity to help their communities, and they always learn something new about their communities. This appears to be the most important piece of the program for the students. It is not clear if the science and math content are learned in a way that can be demonstrated on a test (refer to the problems mentioned before about testing students for content). However, one of the CBEM staff members said that two thirds of the CBEM students go on either to work in environmental fields, or to take college course work in these areas. The Santa Clara Governor points to the positive impact CBEM students have had on his community – both through CBEM field experiences and after these students graduate from the program. At the beginning of the 1998-99 school year he had three former SFIS students working in his environmental program. Since that time, one of the students has been employed by Los Alamos National Laboratories, one is studying a related field in college, and the other continues to work for the Pueblo's environmental program.

Another argument for looking at alternative assessment for CBEM students is that Pueblo students may have a tendency to approach a solution to a problem as a group, rather than as individuals. Ladson-Billings (1992) and Foster (1990) both recognize the collaborative process to education that occurs for African-American students. Enos (1998) wonders if looking at groups of Pueblo students, rather than individual students, is a better view of educational progress. CBEM experiences seem to support these ideas. Staff has observed that students become "experts" in one area, but work together as a group to meet all the requirements of the curriculum.

Students' assessments of the program are generally positive, but they do recommend that more time should be spent in the field and that enough time be allotted to classroom work when they are learning difficult concepts, such as mathematical formulas. The best schedule would allow extra teacher preparation and daily blocks of time for students. CBEM teachers need extra time to prepare for and build on field experiences. Students need daily blocks of time to learn the concepts, apply them in the field, and take the field data back to the classroom for analysis. Teachers, students, and communities want the students in the community on a weekly basis.

Also, although the amount that students write increases during their time in CBEM, the quality of the writing does not seem to change much. In response to this, in the 1997-98 school year, an English teacher was hired to work with CBEM. Students became more aware of the requirements for oral presentations and became good at critiquing each others' presentations. The quality of student writing also improved during this time. There was no English teacher for the 1998-99 school year. Because of the importance of written and verbal communication skills in the mainstream, I recommend that a communications component be a permanent part of CBEM.

Students give informal verbal input to CBEM teachers on a regular basis. In fact, driving to and from communities is often a valuable time for student feedback. However, it is not clear how this feedback is incorporated into the curriculum or program. For example, although students have requested consistency in scheduling to allow for blocks of classroom and community time on a weekly basis, the CBEM schedule changes on an annual -- sometimes on a semiannual -- basis. It must be noted that these changes are out of the control of CBEM; the changes are a result of CBEM's dependence on SFIS's

schedule. Since CBEM students also take classes in the regular program, CBEM's schedule must fit with the SFIS schedule. This "school within a school" situation causes some constraints for CBEM.

Except for what is mentioned above, the research team did not really hear the students' voices in the development and implementation of the program. We know from the literature (Harvard Educational Review, 1996) that youth voice is an important element in creating effective programs for adolescents. Students this age have insight into their needs and the energy to follow through on programs in which they have a stake. Certainly the CBEM program has hooked student interest through assuring the fieldwork has a clear connection to students through their communities, but the research team would like to hear a stronger voice coming from the students in the CBEM quarterly reports and the curriculum. Having a communications teacher to help students articulate their ideas through writing and speaking may help to address this need.

Research and Evaluation

"Whose measure of progress do we use? Certainly it seems illogical that we be measured by those who are outside and have no experience with it [Pueblo education]" (CBEM Journal).

"Communities do not define achievement in terms of academics. They take into consideration information/ values and those can't be measured in terms of academics" (December 1999 Quarterly Report).

Research and evaluation have been incorporated into the CBEM program since the beginning. There have been both beneficial and negative effects from this. The focus on research has meant that careful, well-organized records have been kept (at least since the fall of 1995). These records allowed the current process evaluation to happen smoothly. The documentation of process -- and the honesty of the pros and cons to developing the program -- will assist future program development. In particular, the following processes are important: the protocol to contacting the Pueblo governments; the consistent communication with the focal tribes; the need for time to address logistical issues associated with school/ community relations; the time needed for curriculum development and implementation. In fact, the Circles of Wisdom program (a program

that focuses on developing a K – 12 curriculum that is aligned with state standards and incorporates community-based education for all Pueblo students) has already benefited from the model of CBEM by following the processes outlined above.

However, there are also problems associated with the research and evaluation. The experimental design of the first evaluation was inappropriate given the small, unique population of students that make up SFIS. It is impossible to control for variables such as economic background, family education, family make-up, tribe, intelligence, etc. because of the small population. As mentioned earlier, it is also a design that does not fit with Pueblo philosophy. Another problem associated with the experimental design was that a sophisticated computer lab was off limits to students for a period of time so as not to "taint" the research. While the experimental and control groups were being determined, no students could use the computer lab so that the variable "lab use" would be controlled.

Since the experimental design was clearly not appropriate as the sole evaluation tool, a research plan was developed that had a mixture of quantitative and qualitative approaches. One staff member questioned whether this design was to serve the agenda of a university, rather than to address the needs of SFIS students. At any rate, this design was cumbersome for a small project and the length of the study was too short (one semester) to yield much data. The case study portion of the research provided rich data and a view into student motivation (Gulibert, 1998). Again, the only problem was the short duration of the study. Given the need for student voice in this project, it is my recommendation that case studies of two or three students be done each year.

The evaluation of student progress also seems weak. (Again, it must be noted that this portion of the research did not look specifically at assessment.). The program design and philosophy of the CBEM staff, SFIS, and Pueblo people all support alternative assessment. The Annenberg Rural Challenge Harvard Evaluation Team (1999) notes that alternative assessment is often necessary for evaluating student progress, particularly when students attend a school that is part of a school reform effort. However, to date, no workable plan for the assessment of CBEM students' progress has been developed. It appears that a point of reference for success for CBEM staff, SFIS, and Pueblo leaders alike is the fact that CBEM students either work in environmental and/or technical fields (usually for their own tribe) or go into post-secondary education in environmental/

technical fields. It may be that follow-up on CBEM students is the best assessment of the program. A longitudinal follow-up needs to be designed to follow all students after they leave the CBEM program, though it is important that the follow-up be practical given the constraints of time and logistics. Another caution comes from Dean (1999), who warns that impersonal surveys, such as those that are mailed out, are not successful for gathering information from Native populations.

Standardized test scores may have to play a part in student assessment because of the importance the mainstream places on standardized tests, and because of the importance tribal leaders place on their students being able to compete in the mainstream. This is problematic, however, since it is inappropriate to compare these scores to a population that is significantly different from CBEM students. Since CBEM students are unique, it is not possible to find a comparable group of students (this was the problem with the experimental design mentioned earlier).

Contacts and Networking

"The real danger is to do nothing at all [in terms of working with other environmental agencies and programs]" (June 1997 Quarterly Report).

"The sharing of information and programs gave me much clearer direction on how to proceed" (CBEM Journal).

In addition to working on the relationship between CBEM and the Pueblos, contacts and networking with other organizations -- both private and governmental – have been necessary for the development of CBEM. The relationship with the Los Alamos National Laboratories (LANL) has been important on many levels. The responsibility LANL has to the Accord tribes (the CBEM focal Pueblos) has resulted in support for the technology goals of both CBEM and the Pueblos. The Department of Energy (DOE) funds CBEM and has also provided financial incentives for the coordination between CBEM and the Accord tribes. It is necessary to stress the importance of these financial incentives. First Intel and now DOE have provided the financial support CBEM needs to provide the small student to teacher ratio and the extra time to develop and strengthen the interrelationship between curriculum and community.

Just as Pueblo/School interactions have provided challenges because of their different approaches, so have interactions between CBEM and Intel. Intel, as a business, has different goals and different approaches to meeting those goals than a school does. Santa Fe Indian School and Intel both needed to make adjustments to their usual styles in order to appropriately address the needs of students and their communities. As a school that is dependent on federal funds, SFIS has had more experience working with the United States government than big business. It is to the credit of both the school and Intel that the relationship was successful. The SFIS partnerships with Intel and the Department of Energy have provided the financial support necessary for the success of CBEM. They also demonstrate the importance of generous funding for successful education programs, and the importance of business and government involvement in developing quality educational programs.

Science and environmental programs have also provided support for CBEM. American Indians in Science and Engineering Society, the San Juan / Chama Diversion Project, other New Mexico environmental contacts, and the Gila River Indian community in Arizona are examples of CBEM contacts. To keep track of and build upon these connections, CBEM has kept copies of forms, letters, and conference agendas. Students have made presentations to these organizations and others both within and outside of the state of New Mexico. Although the original Intel goal of having Gila River and SFIS continue a partnership was not accomplished, many other contacts have been made and maintained. CBEM also tracks communication with tribes, parents, and within SFIS. This attention to detail has meant that a vast network of organizations and individuals has been created.

CBEM Structure

"It seems you have to keep going and keep going [if you work in the CBEM program]. This reminds me of the Hopi [Pueblo] philosophy: 'Do what you can, every day.' Progress [in CBEM] is seen. But the vision keeps expanding" (Research Intern comment on CBEM Journal).

The quarterly reports produced by CBEM are time consuming, but the pay off is the organization of the program that allows for the networks discussed above. The

process focuses the deliverables and timelines and helps the program stay focused and run smoothly. The program also schedules professional development (computer training and environmental symposiums) for both SFIS staff and Pueblo members. Meetings with tribal governments and other organizations, as well as providing technical support, mean that CBEM staff are kept very busy. The high level of organization and attention to detail are necessary to the success of this project. Because these duties take time, the research team suggests that an administrative assistant be hired to do some of the scheduling and detail work. For example, snacks are provided for computer trainings. This is an effective way of encouraging participation, but shopping for these snacks seems a poor use of the coordinator's time. An administrative assistant could do these tasks.

An extremely important part of the CBEM program is the staff. Too often in the evaluation of model programs, the personal attributes of the staff are ignored. Clearly CBEM would not be successful without the dedication and expertise of the staff. All staff put in a significant amount of time beyond the regular workday in order to address the needs of the students and communities. The program has had clear direction and follow-through under Glenda Moffitt and Theresa Chavez. Ms. Moffitt provides guidance, and Ms. Chavez assures that organization is maintained while acknowledging the individual strengths of her staff, as well as continuing relationships with other SFIS and community staff. Part of Matt Pecos' expertise as a community liaison lies in his ability to articulate Pueblo ideas to non-Pueblo staff. His focus on Pueblo philosophy has allowed CBEM to be truly a community program. Past staff members Paul Bunker and Lars Rahm provided vision for the present program. Mr. Rahm's background in mathematics and his developing interest in computers enhanced the math modeling curriculum. Mark Ericson's understanding of adolescents and environmental science combine to provide an exciting educational experience for students. Arthur Ebereil focused on technical support for CBEM, and more recently has expanded to increased technology for all of SFIS. Joseph "Smokey" Trujillo brings an expertise in both mathematics and computer construction.

There are challenges to being a model program – with a focus on creative solutions to education – within a regular school structure. One of the most glaring is that

CBEM must follow the August through May school year and the 8:00 AM to 3:00 PM school day. As SFIS experiments with block scheduling, so must CBEM adapt. Some years this has meant that CBEM had the same students every day, but only for one semester. Last year it meant that CBEM had a different group of students every other day all year long. Each time the schedule changes, new arrangements must be made with the communities. And always, the school and the program must be sure students are getting the credits they need to graduate from high school and attend various post-secondary institutions. As such, this report touches on just some of the complexities behind school reform for Pueblo students!

Conclusions and Recommendations

In reality, CBEM is more than the "worlds" of student, school, and Pueblo community. It is made up and answerable to business (Intel), government (DOE), Pueblos, and school (see Figure 2 in the Appendix). Each of these entities has its own stake in the education of Pueblo students: future consumers, future work force, mainstream citizens, Pueblo citizens, etc. It is to CBEM's credit that they have negotiated successful relationships with all of these entities, despite the differing philosophies and goals of each. The emphasis on clear, consistent communication, excellent records that keep track of this communication, and the flexibility to adapt have been the keys to negotiating the politics of education. In doing so, CBEM does indeed provide a model of education that Pueblo governors have requested for years: Pueblo students are learning mainstream skills (math and science); they are interacting with mainstream organizations; and their work is rooted in the Pueblo community with connections being made to Pueblo culture by Pueblo community members. Below is a summary of specific strengths and recommendations for an already highly successful program.

CBEM Strengths

- Staff hold a common philosophy to approaching Indian education that is supported by both educational research and Pueblo ideas.
- CBEM is made up of committed, knowledgeable, energetic staff.

- CBEM is responsive to Pueblo community culture, traditions, and needs.
- Cutting edge technology is available for student and Pueblo use.
- There is an apparent increase in student motivation to learn environmental science.
- CBEM funding is used to create a high-quality program.
- Networks are built with Native and mainstream science and technology organizations.
- CBEM has excellent written documentation of the process behind creating a model program.

Recommendations for CBEM

- Include student voice in all aspects of the program.
- Design a long-term research and evaluation plan – in cooperation with communities and students -- to include:
    1. A student assessment that matches the philosophy and practice of the program;
    2. A system of tracking CBEM students after they leave the program;
    3. Yearlong case studies of two or three CBEM students for every year of the program.
- Have a consultant with a solid curriculum assessment background evaluate the CBEM curriculum.
- Add a communication skills component to the math and science focus.
- Allow for consistent blocks of time for field and classroom work (field experience should happen weekly, classroom time should happen daily).
- Add an administrative assistant.

Possible Applications Beyond CBEM

There are lessons to be learned from the CBEM program that can help other organizations to develop community-based education programs:

- Choose staff who can be flexible so that community priorities are addressed.
- Pair non-community staff with community members.
- Allow time for staff to sort out the program's philosophy.

- Allow time for solid community relations to develop (each community is unique and dynamic).
- Allow time to develop the curriculum based on community input before students begin the program.
- Allow extra time once students are in the program to assure curriculum meets community and student changing needs.
- Both community field experiences and classroom work need consistent blocks of time on a regular basis. Once a week for field experiences and classes four times a week seems to work best.
- Organized documentation of the program (a "paper trail") is important.
- Develop networks within and outside of the school.
- Assure adequate funding.
- Constant re-evaluation of the program is beneficial.

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COMMUNITY	CURRICULUM	RESEARCH	CONTACTS/ NETWORKS	CBEM PROGRAMMING	TECHNOLOGY	STUDENTS
Community Involvement **Community Relations** **Focal Pueblos**	**Curriculum** **Field manuals** Vegetation studies Ethnobiology Watershed Water quality **Student Motivation** **Field Experiences** 1X/wk necessary Curriculum driven by community needs Lack of confidence by tribal personnel Community mentors **Environmental issues**	**Research** **Evaluation**	**Native American** contacts outside focal Pueblos **Non-Native** contacts Federal State business	**CBEM structure** **SFIS/CBEM** **Logistics** **Time** **Funding** **Personality of staff**	**Training** **Analysis Uses**	**Student motivation** **See also Curriculum**
Accord Tribes Jemez Historical/cultural emphasis Cochiti Elk migration, fish studies, garden plots, clean water, biology, community revitalization Santa Clara Environmental issues Tesuque Watershed biology [San Ildefonso] **Community Relations/ Involvement** relationships education	Environmental education Biodiversity Environmental symposium Environmental science Math modeling Community issues Dorame Field Manuals Expand technology education Academic needs vs. community needs Language arts support Teaching method Coordination with standards Research methodology Continual development Technology	Methodology for curriculum research CBE, not research plan, should determine evaluation Research agenda detrimental Experimental design problematic Case study after, not during, program Qualitative vs. quantitative issues Validity of student work Baseline data Overwhelmed by issues/complexity Student motivation Community involvement	<u>Native American</u> Gila River SW Tribal Energy Conference AISES Different tribes Laguna Uranium concerns <u>Non-Native</u> LANL Intel DOE Los Alamos study group NM environmental contacts **Other Networking** Summer Programs Forms/letters/agendas Contact people	Logistics Time Change issues Field work School schedule Small student numbers needed for CBEM Computer – internet Library growth Conflicting schedules for field trips Constraints Too many obligations (G/T) Lack of time Teaching concepts takes time Community visits take time	Motivates students and adults New software Internet Staff/teacher/community training on computers SFIS technology plan Arthur Computers Community Employment of students Post-secondary education Summer programs Networking/wiring the school Computer training	Community (not abstract future jobs) is motivator for students Choice for program Computers Field work Engagement Relevant work Awareness = interest

Table 1. Theme clusters.

COMMUNITY	CURRICULUM	RESEARCH	CONTACTS/ NETWORKS	CBEM PROGRAMMING	TECHNOLOGY	STUDENTS
watershed food flexibility day schools cultural awareness trust adult attention service field work environmental issues ceremonial issues ownership protocol invitations/letters program goals and objectives MOA Written protocol Communication Contacts Parents Tribes Community involvement Parents Expectations Voice in all aspects of CBEM, from development to evaluation Natural resources Pueblo staff as educators/ mentors/ "seed teachers" to students and staff at SFIS Computer training Tools for community projects Data collection Native language and use in class	Philosophy behind curriculum Student motivation Student presentations Student awareness/interest Guest speakers Field work Peer teaching at Day School Non-Indian interpretation of Indian culture Professional development Acceptable knowledge	Develop standards Student respect Tools: survey, pre-tests Attendance Experimental/ control groups Focus groups Student jobs in environmental areas Methodology Agenda Curriculum Logistics development parent attitudes student attitudes community attitudes student performance community service community relations hands-on evaluation problems Native language/culture/traditions Student evaluation of program: pros/cons, high interest, social issues, desire to help community LANL and CBEM well coordinated Community positive about student work Students' learning by working in community Student internships, opportunities Student interests	Guests Conferences Funders/ partnerships San Juan/ Chama diversion project Personal contacts: with tribes, parents, school Funerals Coordination Networking MOUs	Processing field data takes time Depth vs. breadth **CBEM/ SFIS** Technical committee Computer training Expand CBEM to SFIS Schedule issues Expand school Collaboration/contact with other teachers Support/encouragement from Superintendent CBE and future of SFIS CBEM Structure Deliverables Timelines Professional development Community involvement Concern Scheduling Meetings with parents Meetings with tribal governments Evaluation Brochure Programming Student selection (experimental vs. control groups) Role clarification Evaluation Program Curriculum Student progress Scheduling Quarterly Reports Organization of materials	Access for all to CBEM computer lab Time Equipment GIS Workshops Computer construction Water/soil analysis Document implementation Map school Gila River ARC view workshop popular with non-CBEM Pueblos	

Table 1, cont. Theme clusters, continued.

The Wisdom of Circles

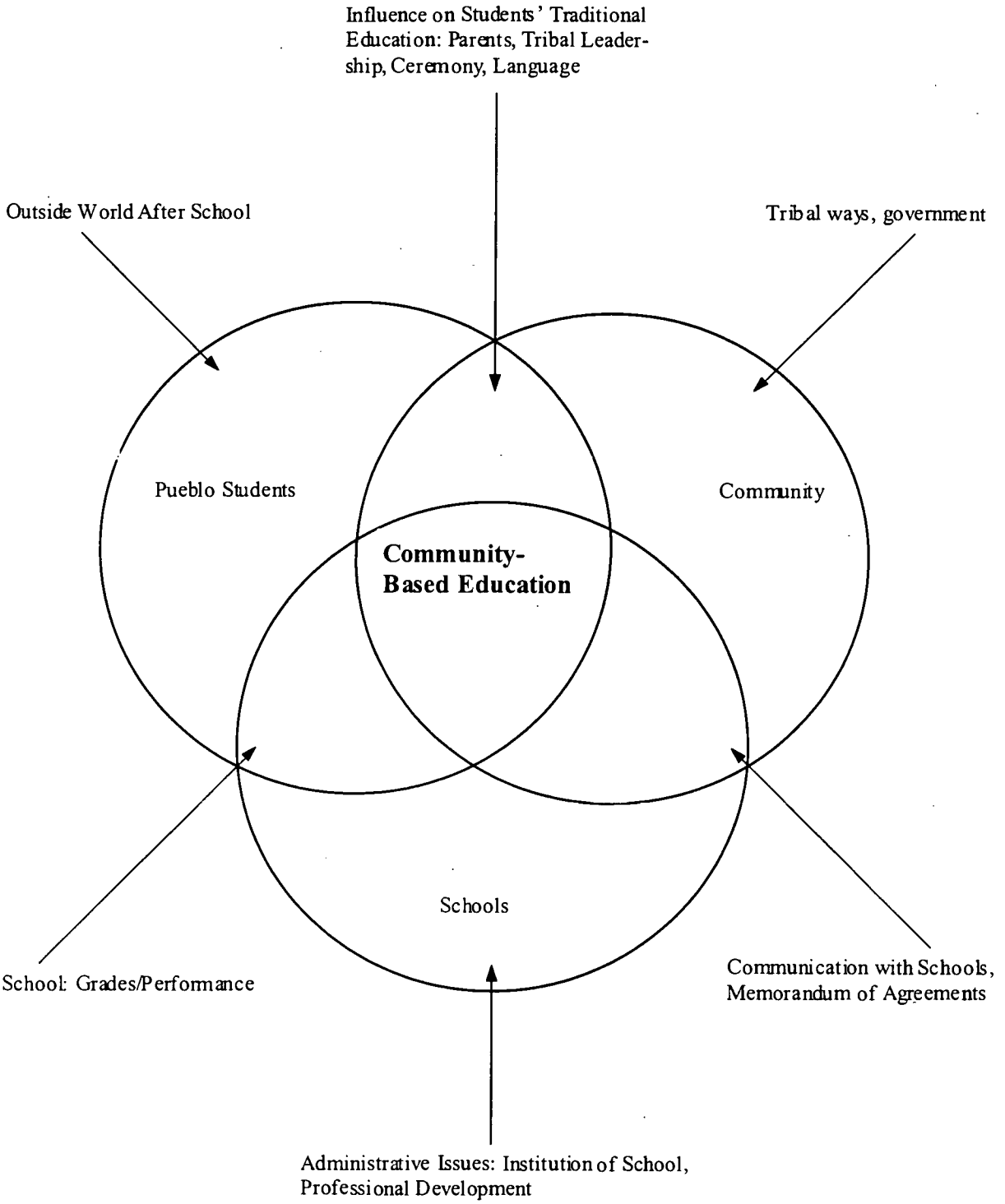

Figure 1: Wisdom of Circles.

CBEM Influences

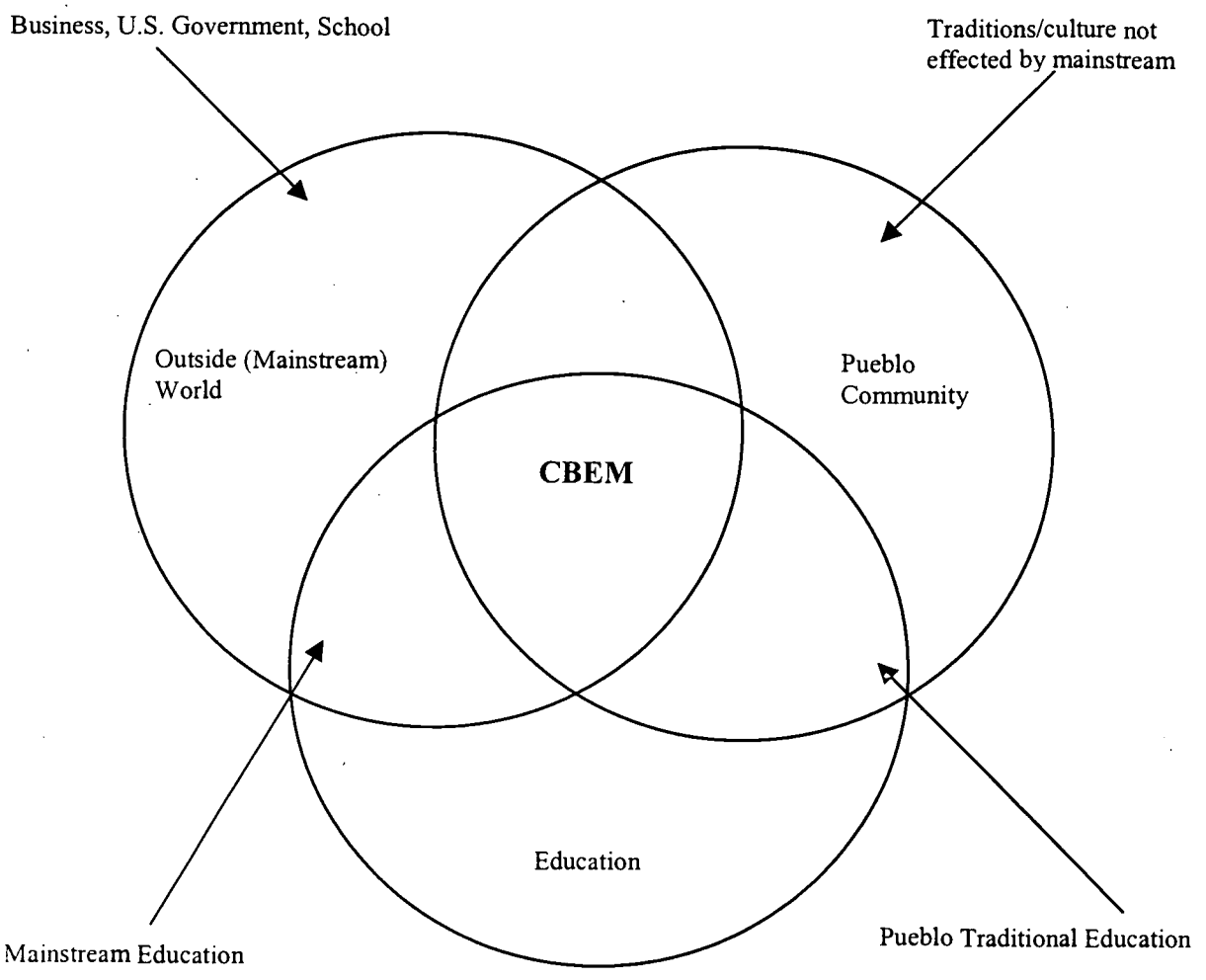

Figure 2. Influences on CBEM: Pueblo, Education, and Mainstream.

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