

**Preliminary Study for Experimental Research on Culturally
Based Education for American Indian/Alaska Native Students**

Optional Task 3: Design Experimental Research

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**Northwest Regional Educational Laboratory
101 SW Main Street, Suite 500
Portland, Oregon 97204
(503) 275-9500**

**Kim O. Yap, Ph.D.
Project Director**

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Introduction

Executive Order 13096 seeks to improve the educational achievement and academic progress of American Indian and Alaska Native students. Section F of the Order requires the U.S. Department of Education to develop and implement a research agenda for that purpose. Among other things, the research agenda is to include an evaluation of “the role of Native language and culture in the development of educational strategies.”

In 2002, the U.S. Department of Education issued a task order to conduct a preliminary study for experimental research on culturally based education for American Indian/Alaska Native students. The purposes of the task order are to review the literature on theories and empirical evidence related to Native language and culture in education; to assess the feasibility of conducting experiments in multiple locations to determine the effectiveness of programs or interventions incorporating Native language and/or culture in education; and, if such experiments are feasible, to produce a preliminary experimental design.

The statement of work for the task order defines culturally based education (CBE) interventions as follows:

Culturally based education incorporates native language and/or important elements of native culture. Culturally based interventions are deemed to be planned activities and materials designed to improve education and introduced within the education systems. They include broad programs that engage participants for long periods with a high degree of involvement (e.g., all-day immersion programs) and more specific interventions that entail less time and involvement (e.g., a specific language text).

Under the task order, the Northwest Regional Educational Laboratory (NWREL) has conducted a review of the relevant literature and a national survey of CBE programs to assess the feasibility of conducting experimental research with such interventions. The results of these tasks were provided in earlier reports submitted to the Institute of Education Sciences (<http://www.nwrel.org/indianed/cbe/2004.pdf>; <http://www.nwrel.org/indianed/cbe.pdf>). Beginning with brief summaries of the results of the preceding tasks as background information, this report presents a preliminary design for conducting experimental and quasi-experimental research with CBE interventions. It includes sections on a conceptual framework for the proposed research, practical and technical considerations, proposed study designs, measuring the independent variable, measuring the dependent variables, site selection and recruitment, potential study sites, and a study timeline.

Literature Review

The review of extant research is to (1) determine the strength of the evidence concerning the *effectiveness* of CBE; and (2) based on past CBE research, assess the feasibility of conducting experimental research in the future. A thorough search of the literature

yielded only six studies (listed below) on CBE that involved random assignment of individuals to treatment conditions.

1. Tharp, R.G. (1982). The effective instruction of comprehension: Results and description of the Kamehameha Early Education Program. *Reading Research Quarterly*, 17(4), 503–527.
2. Omizo, M.M., & Omizo, S.A. (1989). Art activities to improve self-esteem among Native Hawaiian children. *Journal of Humanistic Education and Development*, 27(4), 167–176.
3. Clark, W.J. (1996). *Effect of a computer assisted instruction program on Aboriginal student achievement*. Unpublished master's thesis. Brandon University, Brandon, Manitoba, Canada. (ERIC Document Reproduction Service No. ED400777)
4. Omizo, M.M., Omizo, S.A., & Kitaoka, S.K. (1998). Guided affective and cognitive imagery to enhance self-esteem among Hawaiian children. *Journal of Multicultural Counseling and Development*, 26(1), 52–62.
5. Kratochwill, T.R., McDonald, L., Youngbear-Tibbitts, H., & Levin, J.R. (2001). *Families and schools together: An experimental analysis of a parent-mediated early intervention program for at-risk American Indian children. Final report*. Madison, WI: University of Wisconsin, Wisconsin Center for Education Research.
6. Lipka, J., & Adams, B. (2002). *Improving Alaska Native rural and urban students' mathematical understanding of perimeter and area*. Unpublished manuscript.

Half these studies are unpublished. As a whole, the external validity of extant research appears moderate. Only two of the six studies involved multiple schools. The study by Kratochwill and colleagues was conducted with three schools and the study by Lipka and Adams with five schools. The other four studies were each conducted at one school. The statistical validity of existing studies appears to range from weak to relatively strong. In most instances, the student performance measures are reported to be valid and reliable, and statistical analysis procedures are clearly described. While significant differences are detected between treatment and control groups, most studies do not explicitly address issues related to statistical power and sample size.

As a result of their flaws, the studies do not provide convincing evidence that the CBE programs were effective. On the other hand, they do not demonstrate that CBE is ineffective. There is no convincing evidence one way or the other. Nonetheless, the existing studies show that at least in some situations experimental research with CBE interventions is possible.

There are probably various reasons why there have been so few studies of CBE that achieve design conditions that allow confidence in establishing the efficacy of such interventions. To influence student achievement, the program must be in place and operating with fidelity over a relatively long timeframe, requiring a study of substantial duration (e.g., multiple years). A longer study costs more and faces more threats to construct, statistical, internal, and external validity. It is not surprising that all six of the studies reviewed here were conducted in a timeframe of one year or less. Research studies on CBE of a shorter duration may be easier to conduct, but the shortened time span can reduce both impact potential and relevance.

Feasibility Survey

For the feasibility survey, we first conducted a comprehensive review of documents (e.g., project applications and narratives) pertinent to existing CBE interventions. The review served a dual purpose: (a) to examine the content of existing CBE programs, and (b) to draw a sample for a national survey to assess the feasibility of conducting experimental research with such programs. The review covered the following programs:

Title VII Indian Education Programs. These grants represent a universe of locations where American Indian and Alaska Native students attend school. They also represent a universe of programs required by the Indian Education Act to provide culturally based education to have a positive impact on the educational achievement of Native students.

Administration for Native Americans Native Language Programs. These are Native language programs funded by the Administration for Native Americans (ANA).

Other Programs. These include total, partial, and two-way Native language immersion programs.

These CBE programs reflect varying degrees of emphasis in five areas:

Culturally Based Instruction (CBI). Culturally Based Instruction represents programs in which the Native language is the language of instruction and/or the language of social interaction, including teaching. These include Native language immersion efforts that encompass the entire school, Head Start immersion, immersion classrooms, and summer camp immersion programs. They include bilingual and two-way immersion efforts as well. CBI includes a range of programs that can have two distinct orientations and purposes: (a) programs that seek to create Native language fluency in a population of learners who do not know their Native language or whose Native language competence is underdeveloped when compared to fluent peers; and (b) programs that seek to provide academic content to learners through their Native language while also developing their Native first-language competence.

Native Language Instruction (NLI). Native Language Instruction differs from CBI in that Native language is the *subject* of instruction. Native students are offered language classes as an elective. Culturally relevant materials may also be used in such courses.

Native Studies Programs (NS). Native Studies represents programs offering classroom instruction in Native history and culture including contemporary events and Native civics-related subject matter, such as treaties and tribal government.

Native Cultural Enrichment (NCE). Native Cultural Enrichment represents programs that offer pow-wows, presentations by knowledgeable and respected local tribal people, arts and crafts, and culturally related special honoring. These programs bring aspects of Native culture into the school or have students experience them outside the school.

Culturally Relevant Materials (CRM). Culturally Relevant Materials comprise programs that include instructional materials that represent Native students' identity or culture within an existing course or curriculum. Typically, these include reading materials with a Native theme that are brought into a reading program.

For the national survey, a stratified random sample was drawn from Title VII programs by program type and Native student density at a school. All ANA programs that offered school-based instruction were included. In addition, a purposive sample of other programs was selected to participate in the survey. For purposes of assessing feasibility, no attempt was made to achieve a nationally representative sample of CBE programs. The survey sample consisted of 207 programs in 24 states. A majority of them were found in Alaska, Arizona, Hawaii, Minnesota, New Mexico, Oklahoma, South Dakota, and Washington.

The survey was conducted by mail in November 2003. To increase response rate, follow-up procedures (several phone calls to nonrespondents) were implemented until March 2004. A total of 105 CBE programs completed the survey questionnaire, providing a response rate of 50.7 percent.

Feasibility of Experimental Research

Results of the national survey indicated that more than one-fourth (26.6%) of the CBE interventions included Native language instruction. A majority (61.8%) offered a mix of Native studies, Native cultural enrichment, culturally relevant materials, and culturally based instruction.

A predominant majority (85.4%) of the CBE programs were implemented in schools where at least half the student population was Native American. The density of Native students at a school can have a significant impact on the nature of a CBE intervention. With a high percentage of Native students, the school's capacity to create social linguistic approaches that are congruent with the Native student population is maximized.

Respondents from nine programs indicated that (1) their CBE interventions are implemented with a high degree of fidelity and can be implemented with relative ease by other schools; (2) it is feasible to assign students randomly to treatment and control conditions; or (3) it is feasible to use matched comparison groups at the classroom or school level.

Further, most of these potential study sites appear to have other desired characteristics, including sufficient depth and duration of treatment, to warrant a rigorous investigation of their effects on student achievement. Specifically, these CBE programs offer language immersion or language instruction at least 45 minutes twice weekly or at least 30 minutes daily during the school year. Sufficiently large sample sizes appear available at these sites to ensure an acceptable level of statistical power, particularly for grades three, five, and eight.

Conceptual Framework for the Proposed Research

There are at least three theoretical approaches to CBE interventions: cultural compatibility, cognitive theory, and Cultural-Historical Activity Theory (Demmert & Towner, 2003). These three approaches represent increasingly more elaborate iterations of the concept of congruence between the social-cultural dispositions of students and the social-cultural expectations of the school. Cultural-Historical Activity Theory (CHAT), the most elaborate of the three theoretical approaches, provides a foundation for creating school conditions that facilitate language, cognitive, and psychological development and that enhances student academic achievement:

- Rich and respectful language exchanges with more competent others—teachers and community elders
- That develop community language and the language of academic disciplines
- Over shared instructional activity
- In relationship forms that are familiar to the student (community-contextualized)
- In dialogue that allows discussion of multiple identities
- Emphasizing academic goals and their relevance to the lives of students and their families

In their review of the relevant literature conducted earlier under this task order, Demmert and Towner (2003) have identified six critical elements of CBE interventions as follows:

- Recognition and use of heritage languages
- Pedagogy that stresses traditional cultural characteristics and adult-child interactions as the starting place for education (mores that are currently

practiced in the community and that may differ from community to community)

- Pedagogy in which teaching strategies are congruent with the traditional culture, as well as contemporary ways of knowing and learning (opportunities to observe, practice, and demonstrate skills)
- Curriculum that is based on traditional culture that recognizes the importance of Native spirituality, and places the education of young children in a contemporary context (e.g., use and understanding of the visual arts, legends, oral histories, and fundamental beliefs of the community)
- Strong Native community participation (including parents, elders, and other community resources) in educating children and in the planning and operation of school activities
- Knowledge and use of social and political mores of the community

Typically, these critical elements have different emphases and different manifestations from one CBE program to another. It is not known how and to what extent the six critical elements may contribute to program effectiveness. Indeed, there is no scientific evidence that CBE interventions affect student academic achievement in reading and mathematics.

Logic Model

As shown in Figure 1, the logic model begins with a set of contextual factors that influence the development and implementation of CBE interventions. For example, it is clear from our review of CBE interventions that the density of Native student population in a school is a significant determinant of the nature and scope of such interventions. Greater density is generally associated with interventions of greater intensity and duration. Similarly, locale, socioeconomic status, and heritage language are closely related to the extent to which the critical CBE elements are incorporated in the intervention.

Incorporating the six critical CBE elements in varying degrees are three major types of interventions: language immersion programs, language instruction programs, and culturally congruent curriculum. Of the potential study sites, three (Window Rock, Lower Kuskokwim, and Punana Leo) are implementing language immersion programs; three (Blackwater Community School, Little Singer School, and Tsaile Public School) are implementing language instruction programs. The Northwest Native American Reading Curriculum and Creating Sacred Places for Children offer culturally congruent curriculum.

Depending on the nature and scope of the intervention, the logic model postulates a set of possible short-term outcomes, including:

- Native language development
- Sense of community
- Positive community involvement
- Sense of identity
- Academic and career aspiration

These short-term outcomes, in turn, are expected to lead to such longer-term outcomes as:

- Enhanced self-esteem
- Improved attendance, retention, attitude, and behavior
- Internal attribution
- Increased student engagement
- Positive cultural climate

For purposes of the proposed study, the ultimate impact of CBE interventions will be measured by improved academic achievement in reading and mathematics. In this regard, the logic model includes a cautionary note on possible rival explanations for the improved academic achievement, including various threats to internal and external validity such as contextual and other conditions not under the control of the study design, as well as the quality of the overall school program.

While the primary purpose of the experimental study is to test the efficacy of CBE interventions as measured by improved academic achievement, it might be instructive to also assess the extent to which some of the short-term and long-term outcomes have occurred. For example, Native language development, academic and career aspiration, enhanced self-esteem, improved attendance, retention, attitude, and behavior may be of particular interest to some of the potential study sites.

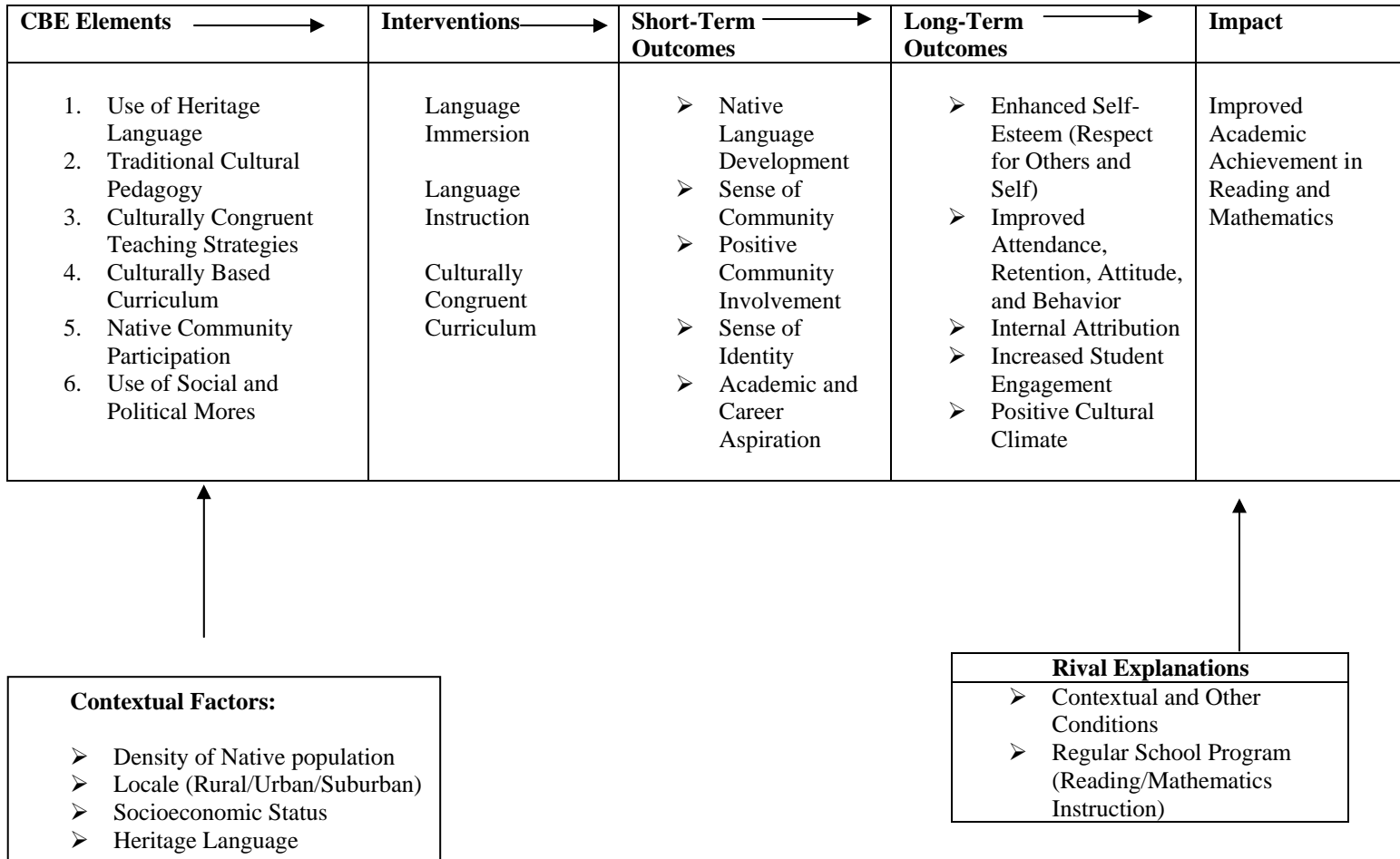


Figure 1. Culturally Based Education (CBE) Logic Model

Research Questions

The primary research questions to be addressed in the proposed research will include:

1. To what extent do programs or interventions incorporating the six critical elements of CBE improve the academic achievement of Native students in reading and mathematics?
2. Which critical CBE elements are particularly effective in contributing to improved academic achievement of Native students?

Practical and Technical Considerations

Several considerations are critical to ensuring the feasibility as well as validity of the proposed research. Some of these considerations have to do with obstacles to conducting experimental research with CBE interventions. Others relate to study features that will strengthen the validity of the proposed research.

First, it is important to note that the conditions conducive to the conduct of experimental research are reported by school or program administrators in a survey. Conditions that actually exist on the ground may differ to some degree from what is reported. For example, a majority of the CBE programs, including those identified as potential study sites, are schoolwide interventions. While randomized assignment is reported to be feasible or somewhat feasible at the potential study sites, doing so in a schoolwide CBE program would mean that half the students would not participate in the program. The extent to which this is feasible will need to be verified through on-site discussions with the stakeholders.

Second, in our follow-up discussions with the potential study sites, we realized that a formidable obstacle to randomized field trials is the relatively widespread perception that CBE is in and of itself beneficial to Native students. Hence, school administrators are reluctant to select students for participation in CBE interventions on the basis of need as determined by a cut-off criterion, which would have made it feasible to implement the regression discontinuity design (Tallmadge & Horst, 1976; Yap, 1980; Trochim, 1984).

Third, while the potential study sites reported high-fidelity implementation of their CBE programs, the extent to which each intervention has incorporated the six critical CBE elements identified in our literature review is largely unknown. We believe that the extent to which these elements are implemented will determine the extent to which the intervention is likely to lead to the desired outcomes, including improved academic achievement in core subject areas. It is therefore critical that only CBE programs that have incorporated these elements to a significant extent be included in the proposed study.

Fourth, and perhaps most important from a technical standpoint, it is difficult to conduct experimental research with existing programs, particularly programs such as CBE interventions, which typically have been in existence for a considerable length of time. As a rule, where a CBE program exists, most, if not all, students receive program services. There are few, if any, nonparticipants. Even if stakeholders are prepared to accept randomized assignment, the “control” group would essentially consist of former program participants, compromising the purpose of randomization.

Fifth, to address the difficulty of conducting experimental research with existing CBE programs discussed earlier, we propose, where feasible, the refinement of existing programs prior to conducting a test of their efficacy. There appear to be ample opportunities of strengthening existing CBE programs that are still evolving. From a technical and logistical standpoint, a strengthened program may make it more feasible to conduct research using an experimental design. For example, refining existing CBE programs for experimental research will help ensure a higher level of construct validity vis-à-vis the six critical CBE elements. The strengthened program may be seen by the Native community as a new intervention—not an existing service that has been available to all students. Randomized assignment to treatment and control conditions may therefore become more palatable and feasible.

Table 1 provides a summary of design features that will strengthen the validity of the proposed research.

Table 1
Design Features that Strengthen Validity of the Proposed Study

Validity	Design Features
Construct	<ul style="list-style-type: none"> • Refining existing CBE programs to incorporate critical elements • Rubrics to measure fidelity
Internal	<ul style="list-style-type: none"> • Randomized field trials • Matched comparison groups based on propensity scores • Longitudinal cohort analysis
External	<ul style="list-style-type: none"> • Multiple sites and multiple contexts • Meta-analysis of site-specific studies
Statistical	<ul style="list-style-type: none"> • Sufficiently large sample sizes • Substantial magnitude and duration of intervention • Valid and reliable measurement

Proposed Study Designs

Results of this preliminary study clearly show that CBE is not a unitary concept. It is an eclectic collection of treatments tailored to meet the needs of particular Native student populations in a local school context. Upon consultation with the potential study sites, we recommend the conduct of a series of efficacy studies using a combination of study designs for the proposed research. Specifically, randomized controlled trials (RCTs) will be conducted for two CBE interventions where conditions are conducive to experimental research. For six other CBE interventions for which RCTs appear infeasible, matched comparison groups will be used as a quasi-experimental design (QED). Since the two designs involve different sites, they will be conducted simultaneously.

Randomized Controlled Trials

This is the strongest design for making causal inferences of treatment efficacy. We have initiated discussion with the project staff of a CBE reading curriculum project implemented in the state of Washington. The Northwest Native American Reading Curriculum, jointly developed by the Washington Office of Superintendent of Public Instruction (OSPI) and the Evergreen State College, is currently used in some schools in the state. The reading materials are currently disseminated without any significant support of professional development. For the proposed research, we recommend increased professional development and technical assistance to further strengthen the intervention. In our discussion with the OSPI staff, it appears feasible to randomly assign the enhanced intervention to a sufficiently large number of experimental and control classrooms to carry out randomized field trials of the intervention. We recommend the use of a minimum of 100 treatment classrooms and 100 control classrooms in Washington and, if necessary, in other states to carry out the randomized field trials.

A second CBE intervention that offers the opportunity of conducting a randomized experiment is Creating Sacred Places for Children, a comprehensive school reform process developed by the National Indian School Board Association (NISBA). Like the Washington OSPI project, we recommend first strengthening the intervention with professional development and technical assistance. The intervention can then be randomly assigned to a sufficient number of treatment and control schools to carry out randomized field trials. We recommend the use of a minimum of 100 treatment schools and 100 control schools in multiple states to carry out the randomized field trials.

Matched Comparison Groups

Most potential study sites indicate that the use of matched comparison groups is feasible for a study of their CBE programs. In particular, the following CBE programs have expressed interest in participating in such quasi-experimental research:

- Window Rock in Arizona
- Lower Kuskokwim in Alaska
- Punana Leo in Hawaii

- Blackwater Community School in Arizona
- Little Singer School in Arizona
- Tsaile Public School in Arizona

These programs (described in greater detail in a later section on potential study sites) represent variations of Native language immersion or language instruction interventions. All have indicated the feasibility of finding comparison students at schools that are not implementing CBE interventions. This design option can be further strengthened by using propensity scores (D’Agostino, 1998; Shadish, Cook, & Campbell, 2002; Hansen, 2004) to identify comparison students. Variables that may be used to identify comparison students include poverty status, gender, grade level, language proficiency, and initial reading achievement.

For both RCTs and QEDs, we recommend the use of a growth curve model to track academic achievement in reading and mathematics over three years, using longitudinal scale scores from a standardized achievement test. In addition, reading and mathematics achievement can be assessed by curriculum-based measures (CBMs) in English and Native languages. Participating students can be tested in both languages and monitored for progress in each language relative to control students or matched comparison students. The cohort analysis can be part of a value-added assessment (Sanders & Horn, 1994; Webster & Mendro, 1997), taking into account the effects of schools and teachers, as well as socioeconomic status.

Upon completion of the site-specific experimental and quasi-experimental studies, we propose the conduct of a meta-analysis (Cooper & Hedges, 1994) of the results from these studies to provide an overall measure of the efficacy of CBE interventions. We expect that such an analysis will address issues of effect sizes of various CBE treatments in different contexts and for different groups of Native students.

Measuring the Independent Variable

The independent variable—CBE interventions—is not a unitary construct. We have identified, for example, six critical elements of CBE:

- Recognition and use of heritage languages
- Pedagogy that stresses traditional cultural characteristics and adult-child interactions as the starting place for education (mores that are currently practiced in the community and that may differ from community to community)
- Pedagogy in which teaching strategies are congruent with the traditional culture, as well as contemporary ways of knowing and learning (opportunities to observe, practice, and demonstrate skills)

- Curriculum that is based on traditional culture that recognizes the importance of Native spirituality, and places the education of young children in a contemporary context (e.g., use and understanding of the visual arts, legends, oral histories, and fundamental beliefs of the community)
- Strong Native community participation (including parents, elders, and other community resources) in educating children and in the planning and operation of school activities
- Knowledge and use of social and political mores of the community

Typically, these critical elements have different emphases and different manifestations from one CBE program to another.

Instruments

CBE Rubrics

We recommend the development and use of a set of CBE rubrics to measure the fidelity of the CBE interventions. The rubrics, to be based on the six critical elements of CBE, will consist of a numerical rating scale for assessing fidelity, a descriptor for each rating, and examples for each rating in various contexts. The Center for Research on Education, Diversity & Excellence (CREDE), for example, has created a set of rubrics on standards of effective pedagogy (Doherty, Hilberg, Epaloose, & Tharp, 2002). Similarly, the Northwest Regional Educational Laboratory (NWREL) has developed a set of rubrics to measure progress made by low-performing schools toward becoming high-performing learning communities (Yap, 2005). These development efforts provide a model, as well as specific steps, for constructing a set of rubrics for assessing the extent to which the critical CBE elements are incorporated in an intervention. The development process may include the following steps:

1. Develop operational definitions of the critical elements of CBE
2. Derive major domains and dimensions of CBE
3. Construct a rating scale, descriptor, and examples for each identified dimension
4. Prepare a prototype version of CBE rubrics
5. Conduct a field test of the prototype rubrics at three CBE sites
6. Revise rubrics based on field test results
7. Assess the inter-rater reliability of the rubrics
8. Prepare final version of the rubrics

The rubrics can be used for purposes of selecting study sites as well as providing a measure of the fidelity of CBE implementation at the selected sites to help establish construct validity of the proposed research.

Using the rubrics will likely require data from classroom observations and from interviews and focus group meetings with CBE program staff, as well as reviews of

various pertinent documents. Related instruments such as observation and interview protocols, focus group guides, and procedures for document reviews will need to be developed for this purpose.

In addition, the magnitude, intensity, and duration of CBE treatment—the dosage issue—will be measured. This will include whether the intervention is schoolwide, attendance and level of engagement by individual students, as well as length (e.g., in years) of participation.

Measuring the Dependent Variables

As shown in the logic model, the ultimate dependent variables are improved academic achievement in reading and mathematics. However, at least some of the short- and long-term outcomes (e.g., Native language development, academic and career aspiration, self-esteem, school attendance and behavior) are intervening variables worthy of explicit attention and measurement.

While validity and reliability are of paramount importance in measuring the dependent and intervening variables, cultural congruence and sensitivity are of particular interest in the proposed research. We will therefore pay special attention to the issue of bias in measuring the desired outcomes of CBE interventions. Indeed, educators, especially those serving Native communities, are taking steps to ensure that instruments used to measure the academic achievement of Native students are free of cultural bias.

Instruments

We learned from the national survey of CBE programs that standardized tests (e.g., SAT and CTBS) are widely used in such programs. It therefore appears feasible to use standardized tests as a measure of student academic achievement (e.g., in reading and mathematics). An advantage of using such tests is the availability of scale scores that can be used to track achievement over multiple years to measure growth, as well as to indicate achievement status at any particular time. In addition, standardized tests typically have well-established reliability and validity. We recommend the selection and use of one of the commonly used standardized tests for both RCTs and QEDs in the proposed study. We further recommend that test administration be conducted by members of the research team to ensure consistency and validity.

In addition to the use of a standardized achievement test, we propose the development and use of a set of curriculum-based measures (CBMs) to assess student academic achievement in reading and mathematics. Curriculum-based measures are increasingly used as valid and reliable measures of academic achievement (Deno, 2003; Hosp & Hosp, 2003; Fuchs, 2004). For example, the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) is widely used in the evaluation of reading programs funded by the U.S. Department of Education, including Reading Excellence Act and Reading First programs. At two of the potential study sites (Window Rock in Arizona and Punana Leo in Hawaii) efforts are underway to develop CBMs in English and in Native languages for reading

and mathematics. Preliminary results indicate that these measures have very favorable psychometric characteristics, with reliability estimates in the high .90s and concurrent and predictive validity estimates hovering around .60s. For the proposed research, CBMs can be created for various grade levels covered by the study sites.

For the other desired outcomes (e.g., academic and career aspiration, school attendance and behavior, self-esteem), appropriate instruments will be selected or created to provide valid and reliable measurement of these variables.

Site Selection and Recruitment

The selection of appropriate sites is critical to the success of the study. Thus far, we have identified several potential study sites based on the following criteria. We propose the continued use of these criteria to identify and select additional sites for the proposed research.

First, potential sites should be those that have implemented at least some of the critical elements of CBE. We recommend a visit to each candidate site to conduct an on-the-ground assessment of the extent to which the CBE program has incorporated the critical elements and the extent to which experimental or quasi-experimental research appears feasible with the intervention.

Second, as a set, the potential sites should represent the dominant program types. These include those for which language immersion is the driving intervention and those in which language instruction is of varying intensities, with cultural, curricular, or community involvement activities as the driving variables. Other program types may emerge in the site selection and recruitment process.

Third, the selected sites should cover a range of geographical regions and different contexts for experimental or quasi-experimental research. Where they are feasible, randomized controlled trials will be conducted. When randomized assignment is not feasible, we recommend using the matched comparison group design to conduct the research.

Fourth, we learned from the national survey that to make experimental research feasible at CBE sites, community involvement is critical. Not only would the research need support and approval from various community agencies, its design and implementation would also require extensive input from stakeholders. Of particular importance is support and buy-in from tribal councils, school boards, and parents. For these reasons, Native community cooperation and support are absolutely necessary.

Potential Study Sites

Based on survey results and follow-up discussions with potential study sites, we have identified a set of CBE programs where conditions conducive to the conduct of experimental research seem to exist. These sites have implemented CBE interventions

incorporating most of the critical elements. We have been in consultation with program staff members who have expressed interest in participating in the experimental or quasi-experimental research. The potential study sites include:

Randomized Field Trials

- Northwest Native American Reading Curriculum (WA and other states)
- Creating Sacred Places for Children (multiple states)

Matched Comparison Groups

- Window Rock (AZ)
- Lower Kuskokwim (AK)
- Punana Leo (HI)
- Blackwater School (AZ)
- Little Singer School (AZ)
- Tsaile School (AZ)

The potential interventions and/or study sites are briefly described below.

Northwest Native American Reading Curriculum

Jointly developed by the Office of Superintendent of Public Instruction and the Evergreen State College in Washington, the Northwest Native American Reading Curriculum provides a tool to transform how teachers approach the teaching and learning of reading for Native American students, as well as to develop trust and relationships between the school and the tribal community. Focusing on kindergarten through grade three, the curriculum and story books were developed in collaboration and consultation with tribal content experts, curriculum specialists, and cultural teachers. The curriculum guides contain lesson plans and activities that focus on the development of oral language, as well as reading and writing skills. The three units—the drum, the canoe, and hunting and gathering—have accompanying story books, a list of suggested books, stories, and other resources.

Creating Sacred Places for Children

Developed by the National Indian School Board Association, Creating Sacred Places for Children is a comprehensive school reform capacity building program designed to enhance and implement the effective schools model to better meet the needs of Indian students. The program incorporates a set of effective schools practices and indicators, including a clear sense of educational mission and purpose, frequent monitoring and feedback of school and student progress, challenging curriculum and instruction, high expectations for student success, safe and nurturing learning environment, parental and community involvement and empowerment, strong leadership, participatory management and shared governance, and cultural relevance. As a key component, the program includes a classroom-based supplemental reading curriculum.

Window Rock (AZ)

The instructional program at the school is in the Navajo language. English instruction begins in grade two where students receive English language arts (reading and writing) instruction for 45 minutes daily. An additional 45 minutes per day of English is added in each subsequent year up through grade six. By grade six, the majority of allocated instructional time is in English.

Lower Kuskokwim (AK)

In the primary grades, the Yup'ik/Cup'ig educational model focuses on the development of literacy and mathematics skills in these languages. Both Yup'ik and Cup'ig language and culture are critical components of the district's curriculum and instructional program. Each language program has phase level criteria referenced to the district's standards-based curriculum. The district has developed Yup'ik language literature and mathematics materials, including 200 books written by local authors for primary and elementary classrooms and 150 translated trade books. Time for English language development increases with each phase level until students are in a predominantly English program.

Punana Leo (HI)

Punana Leo has been in existence since 1985 when the first preschool program was established. Children are admitted to the preschool as soon as they are out of diapers to receive Hawaiian language instruction. Parents are required to take language training in Hawaiian so they can communicate with their children in the language. English language training for participants begins formally in grade five and continues through high school. Punana Leo creates a unique form of "extended family" in which all participants socialize together. Students are active in social and cultural events along with their instructors, administrators, and parents.

Blackwater School (AZ)

The native language and cultural program focuses on literacy and oral instruction in the Akimel Odham language. Language and cultural instruction is provided for 30 minutes each day to every class. There is also a language immersion evening program for parents, offered daily for 45 minutes. In addition, elders who speak the Native language and parents are invited to participate in class instruction as guest speakers.

Little Singer School (AZ)

All students at Little Singer participate in a bilingual and bicultural program. An immersion program is implemented to teach content, as well as to build and support character development. Navajo language instruction is offered 30–60 minutes daily for all grades. The program uses the local environment, tribal traditions, local institutions,

and special community or regional events, as well as occasional classroom presentations by elders or experts, as resources.

Tsaile School (AZ)

All students at Tsaile participate in a program that includes Navajo language instruction, culture classes, experts from the community, seasonal ceremonies, cultural nights, tribal traditions, and local institutions. Students in kindergarten through grade eight attend 50-minute pull-out classes twice a week for Navajo language instruction. They also attend cultural classes twice a week.

Table 2 provides a summary of intervention foci and number of participants at the potential study sites.

**Table 2
Intervention Foci and Participants at Potential Study Sites**

Study Site	Intervention Focus	Participants	Grade Span
Northwest Native American Reading Curriculum	Culturally congruent reading materials	NA	K–3
Creating Sacred Places for Children	Comprehensive school reform specific to culturally based education	NA	All grades
Window Rock	Navajo language immersion	180	K–6
Lower Kuskokwim*	Yup’ik/Cup’ig language immersion	215	K–6
Punana Leo	Hawaiian language immersion	170	PreK–12
Blackwater School	Akimel Odham language instruction	221	K–4
Little Singer School	Navajo language and culture instruction	130	K–8
Tsaile School	Navajo language instruction	395	K–8

*In addition, there are a total of 21 village schools in Lower Kuskokwim with an average enrollment of 78 elementary (K–6) students and 39 secondary (7–12) students participating in CBE at varying levels of Native language instruction.

Study Timeline

Based on the design considerations and the availability of potential study sites, we propose that a five-year longitudinal research study be carried out to test the efficacy of CBE interventions.

Year 1 of the study will be devoted to start-up activities, including the following:

- Development and field testing of a set of CBE rubrics
- Development and validation of CBMs in English and Native languages for reading and mathematics
- Selection or development of other instruments
- Site selection and recruitment
- Enhancement of existing CBE interventions
- Selection of experimental and control or comparison students

Year 2 will focus on the collection of baseline data on the independent and dependent variables:

- Extent to which the participating sites have implemented critical elements of CBE
- Demographic data on treatment and control or comparison schools
- Status and growth data on student academic achievement, including reading and mathematics for treatment and control or comparison students
- Data on other desired outcomes (e.g., attendance, self-esteem, and behavior) for treatment and control or comparison students

In Years 3 and 4, we will continue the collection of data on student academic achievement and other desired outcomes.

Year 5 will be devoted to the conduct of a meta-analysis of the site-specific studies.

Data Collection

The administration of a standardized achievement test will occur in fall and spring each school year in Years 2–4 of the study. As indicated earlier, test administration will be conducted by members of the research team. Curriculum-based measures will be administered three times each year, in fall, winter, and spring. The CBMs will be administered by school-level staff following test administration training provided by the research team. Data on other desired outcomes (e.g., academic and career aspiration, school attendance and behavior, self-esteem) will be collected by members of the research team annually in the spring.

Where data collection activities require clearance from the Office of Management and Budget, the study team will work with the U.S. Department of Education in preparing a

clearance package for approval by OMB. In addition, issues of data confidentiality and the protection of human subjects will be addressed.

Statistical Power and Sample Size

For each of the site- or intervention-specific studies, a sufficiently large sample of treatment and control units will be needed to ensure adequate statistical power to detect treatment effects. Assuming that we use a two-tailed *t*-test or ANOVA with an alpha level of .05, Table 3 specifies sample sizes that will be needed to attain two levels of statistical power and effect size.

Table 3
Statistical Power and Sample Sizes for CBE Experimental Research

Statistical Power = .80		Statistical Power = .90	
Effect Size = .30	Effect Size = .40	Effect Size = .30	Effect Size = .40
180	100	250	135

Cohen (1977, 1988) has suggested .80 as a desirable minimum for statistical power. This has become the generally accepted standard for desirable minimal statistical power. Given this minimum and the median effect size of .40 of treatment effectiveness research (Lipsey, 1990), a sample size of 100 will be needed for treatment and control groups at each study site.

Based on these considerations, we have recommended a minimum of 100 treatment and control units for each intervention-specific study. For example, for the Northwest Native American Reading Curriculum and Creating Sacred Places for Children, we will need a minimum of 100 experimental and 100 control classrooms or schools for randomized field trials. In anticipation of attrition over a three-year period, we recommend that at the outset a minimum of 120 classrooms or schools be recruited for each group.

For the matched comparison group design, all students participating in the CBE intervention will be included as treatment units. Preliminary information (see Table 2) suggests that a sufficiently large sample size will be available for each of the site-specific study. Comparison students will be identified from demographically comparable schools that do not offer CBE interventions. Full matching on propensity scores will be used to select the comparison students. As discussed earlier, variables that may be used to identify comparison students include poverty status, gender, grade level, language proficiency, and initial reading achievement.

Data Analysis

Data analysis will be conducted to address the two primary research questions:

1. To what extent do programs or interventions incorporating the six critical elements of CBE improve the academic achievement of Native students in reading and mathematics?
2. Which critical CBE elements are particularly effective in contributing to improved academic achievement of Native students?

Comparative Analysis

To the extent that the research is conducted as proposed, data analysis can be relatively straightforward for each of the study sites. For example, to address the first research question, we will compare academic achievement of students in treatment and control groups (or matched comparison groups) using a *t*-test or analysis of variance (ANOVA). The use of a longitudinal growth curve model with repeated measures is likely to increase statistical power to detect the effect of CBE. Given a sufficiently large sample size for teachers or schools in the randomized field trials, a hierarchical linear modeling (HLM) analysis (Raudenbush & Bryk, 2002) will be conducted to account for teacher and school-level effects.

With respect to statistical significance, it seems reasonable to use the traditional alpha level of .05. For a one-tailed test, the alpha may be relaxed to .10 to further increase statistical power for detecting the effect of CBE interventions.

Correlational Analysis

We propose a correlational analysis to address the second research question. As discussed earlier, a set of rubrics will be developed and used to measure the level of fidelity with which each of the CBE interventions has been implemented. Numerical data in the form of ratings will be obtained for each of the domains and dimensions included in the rubrics. These numerical data will be used in a correlational analysis to assess the relationships between fidelity of implementation and the desired outcomes, including student academic achievement.

Units of Analysis

In the randomized trials, classrooms will be used as the unit of analysis. To ensure adequate statistical power, we have recommended, for each treatment and control group, that a minimum of 100 such units be included in data collection and analysis. Aggregate scores at the classroom level will be used in data analysis. A separate comparative analysis will be conducted for each of the three years for the duration of the study.

For the matched comparison group design, individual students will be the unit of analysis. The comparative analysis will be conducted to detect any differences in academic achievement and other desired outcomes between the treatment students and their comparison counterparts. Where appropriate, covariates will be used to control for any preexisting differences among students. We anticipate having sufficiently large sample sizes to conduct a longitudinal cohort analysis with these students over a three-year period.

Data analysis will also take into account the “dosage” issue, particularly with respect to attendance and level of engagement by individual students. For example, a correlational analysis will be conducted to determine the relationship between dosage of treatment and the desired outcomes.

Other Issues and Considerations

We have proposed a combination of designs to carry out CBE research following an on-the-ground assessment and further discussions with an initial set of potential study sites. As we have discussed, there are various obstacles to conducting experimental research with existing CBE interventions. On the other hand, there are cases where the CBE intervention is less established or in need of enhancement. They offer us an opportunity of strengthening a still evolving program and rendering it a more coherent and promising intervention. In such cases, we have recommended refining and strengthening the program as a part of the proposed research. We believe there are two distinct advantages in this approach. First, in enhancing the intervention, we can increase its construct validity vis-à-vis the critical CBE elements identified in our literature review. Second, from a feasibility standpoint, a new and improved program makes it more palatable for the Native community to accept randomized assignment to treatment and control conditions.

Two other issues arise from this approach, however. First, enhancing CBE interventions as part of the research agenda will substantially increase the cost of the project. Professional development and technical assistance are time-consuming and expensive endeavors. We believe, however, that to conduct a fair test of the efficacy of CBE requires such an approach and that the benefits will outweigh the costs. Second, while we are able to identify potential study sites, the recruitment and selection of control or comparison sites will no doubt be a significant challenge. Securing support and cooperation of Native communities at the participating sites may in some cases require an incentive, including financial support to participate in the proposed research.

References

- Clark, W.J. (1996). *Effect of a computer assisted instruction program on Aboriginal student achievement*. Unpublished master's thesis. Brandon University, Brandon, Manitoba, Canada. (ERIC Document Reproduction Service No. ED400777)
- Cohen, J. (1977). *Statistical power analysis for the behavioral sciences* (Rev. ed.). New York, NY: Academic Press.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.
- Cooper, H., & Hedges, L.V. (Eds.). (1994). *The handbook of research syntheses*. New York, NY: Russell Sage Foundation.
- D'Agostino, R.B., Jr. (1998). Propensity score methods for bias reduction in the comparison of a treatment to a non-randomized control group. *Statistics in Medicine*, *17*(19), 2265–2281.
- Demmert, W.G., Jr., & Towner, J.C. (2003). *A review of the research literature on the influences of culturally based education on the academic performance of Native American students*. Portland, OR: Northwest Regional Educational Laboratory. Retrieved June 22, 2005, from <http://www.nwrel.org/indianed/cbe.pdf>
- Deno, S.L. (2003). Developments in curriculum-based measurement. *Journal of Special Education*, *37*(3), 184–192.
- Doherty, R.W., Hilberg, R.S., Epaloose, G., & Tharp, R.G. (2002). Standards performance continuum: Development and validation of a measure of effective pedagogy. *Journal of Educational Research*, *96*(2), 78–89.
- Fuchs, L.S. (2004). The past, present, and future of curriculum-based measurement research. *School Psychology Review*, *33*(2), 188–192.
- Hansen, B.B. (2004). Full matching in an observational study of coaching for the SAT. *Journal of the American Statistical Association*, *99*(467), 609–618.
- Hosp, M.K., & Hosp, J.L. (2003). Curriculum-based measurement for reading, spelling, and math: How to do it and why. *Preventing School Failure*, *48*(1), 10–17.
- Kratochwill, T.R., McDonald, L., Youngbear-Tibbitts, H., & Levin, J.R. (2001). *Families and schools together: An experimental analysis of a parent-mediated early intervention program for at-risk American Indian children. Final report*. Madison, WI: University of Wisconsin, Wisconsin Center for Education Research.

- Lipka, J., & Adams, B. (2002). *Improving Alaska Native rural and urban students' mathematical understanding of perimeter and area*. Unpublished manuscript.
- Lipsey, M.W. (1990). *Design sensitivity: Statistical power for experimental research*. Newbury Park, CA: Sage.
- Omizo, M.M., & Omizo, S.A. (1989). Art activities to improve self-esteem among Native Hawaiian children. *Journal of Humanistic Education and Development*, 27(4), 167–176.
- Omizo, M.M., Omizo, S.A., & Kitaoka, S.K. (1998). Guided affective and cognitive imagery to enhance self-esteem among Hawaiian children. *Journal of Multicultural Counseling and Development*, 26(1), 52–62.
- Raudenbush, S.W., & Bryk, A.S. (2002). *Hierarchical linear models applications and data analysis methods* (2nd ed.). Thousand Oaks, CA: Sage.
- Sanders, W.L., & Horn, S.P. (1994). The Tennessee Value-Added Assessment System (TVAAS): Mixed-model methodology in educational assessment. *Journal of Personnel Evaluation in Education*, 8(1), 299–311.
- Shadish, W.R., Cook, T.D., & Campbell, D.T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Boston, MA: Houghton Mifflin.
- Tallmadge, G.K., & Horst, D.P. (1976). *A procedural guide for validating achievement gains in educational projects* (2nd rev. ed.). (Evaluation in Education Monograph No. 2). Washington, DC: U.S. Department of Health, Education, and Welfare.
- Tharp, R.G. (1982). The effective instruction of comprehension: Results and description of the Kamehameha Early Education Program. *Reading Research Quarterly*, 17(4), 503–527.
- Trochim, W.M.K. (1984). *Research design for program evaluation: The regression discontinuity approach*. Beverly Hills, CA: Sage.
- Webster, W.J., & Mendro, R.L. (1997). The Dallas value-added accountability system. In Jason Millman (Ed.), *Grading teachers, grading schools: Is student achievement a valid evaluation measure?* (pp. 81–99). Thousand Oaks, CA: Corwin.
- Yap, K.O. (1980). *Pretest-posttest correlation and the special regression model*. Paper presented at the annual meeting of the American Statistical Association, Houston, TX.
- Yap, K.O. (2005, April). *Turning low-performing schools into high-performing learning communities: Critical lessons in school reform*. Paper presented at the annual meeting of the American Educational Research Association, Montreal, Canada.