Communities of Effective Practice, 2008-2009 Evaluation

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Executive Summary

The Communities of Effective Practice (CEP) project is a National Science Foundation (NSF)-funded project to develop a professional development model for supporting math and science instructional practices that are culturally responsive within American Indian communities. The three-year proof-of-concept project was developed to: 1) design a series of culturally relevant professional development modules for teachers of grades 4 through 6 that include an American Indian perspective and that satisfy national and state of Utah core curriculum requirements in math and science; and 2) develop a template that describes the organization and methods for creating a Community Advisory Panel (CAP) of teachers, American Indian students, community leaders, parents, and tribal elders who work to incorporate important cultural knowledge reflecting their specific community into math and science curricula.

David Heil & Associates (DHA) was contracted to provide formative and summative evaluation support to the project, specifically to: 1) identify changes, if any in participating teachers' knowledge of science and math principles, shifts in their attitudes toward teaching science and math and changes in their science and math teaching techniques to reflect a more culturally relevant content; 2) assess the impact on students, as reported by teachers; 3) describe the process of the formation, function and effectiveness of the CAPs; and 4) assess the robustness of the program model to gauge readiness for wider dissemination.

The CEP model was implemented in two American Indian communities: the Mexican Hat Elementary School community and the W. Russell Todd School (Todd Elementary School) community. These two locations were selected because they serve two different Indian American communities (Navajo and Ute, respectively) and therefore offered opportunities for insights to support the scale-up of the project for additional cultural communities. During Year 1 of the Project, the Todd Elementary School community was selected as the focus of the evaluation; in Year Two, the programs at both Todd Elementary School and Mexican Hat Elementary School were included in the evaluation, and in Year Three the evaluation focused on the Mexican Hat Elementary School program.

This report summarizes findings from the Year 3 evaluation (conducted during the 2008-2009 academic year) and discusses these findings within the context of the results of evaluations from Years 1 and 2. The Year 3 findings are based on 1) on-site, qualitative research conducted with teachers and CAP members representing Mexican Hat Elementary School and 2) a quantitative analysis of videotaped classroom observations with Mexican Hat Elementary teachers who participated in the CEP project.

Based on the three-year proof-of-concept projects at Mexican Hat Elementary and Todd Elementary, the major aspects of the CEP program model that require attention are: 1) the formation and sustainability of the CAP; 2) the teacher professional development program to support culturally relevant math or science instruction; and 3) efforts to engage parents in the CEP community. Figure 1 summarizes key considerations related to these three aspects of the CEP Project.

Figure i. Key Considerations for the CEP Program Model

Key Considerations in the Formation and Sustainability of the CAP

1) Allow a considerable time investment (up to 1 academic year) to fully establish the CAP;
2) Establish a point person to oversee the recruitment of CAP members who represent the community and the school; and
3) Identify a leader who works within the school of interest or who can visit the school often as is necessary to support the teachers throughout the process.

Key Considerations for Teacher Professional Development

1) Engage teachers early in the project to obtain teacher buy-in;
2) Develop a professional development experience that includes opportunities for teachers to collaborate;
3) Use an instructional model, such as the 5-E Learning Model, to provide a framework for the use of inquiry-based instructional strategies and the incorporation of culturally relevant content; and
4) Provide opportunities for teachers to meet with CAP members throughout the academic year.

Key Considerations for Engaging Parents

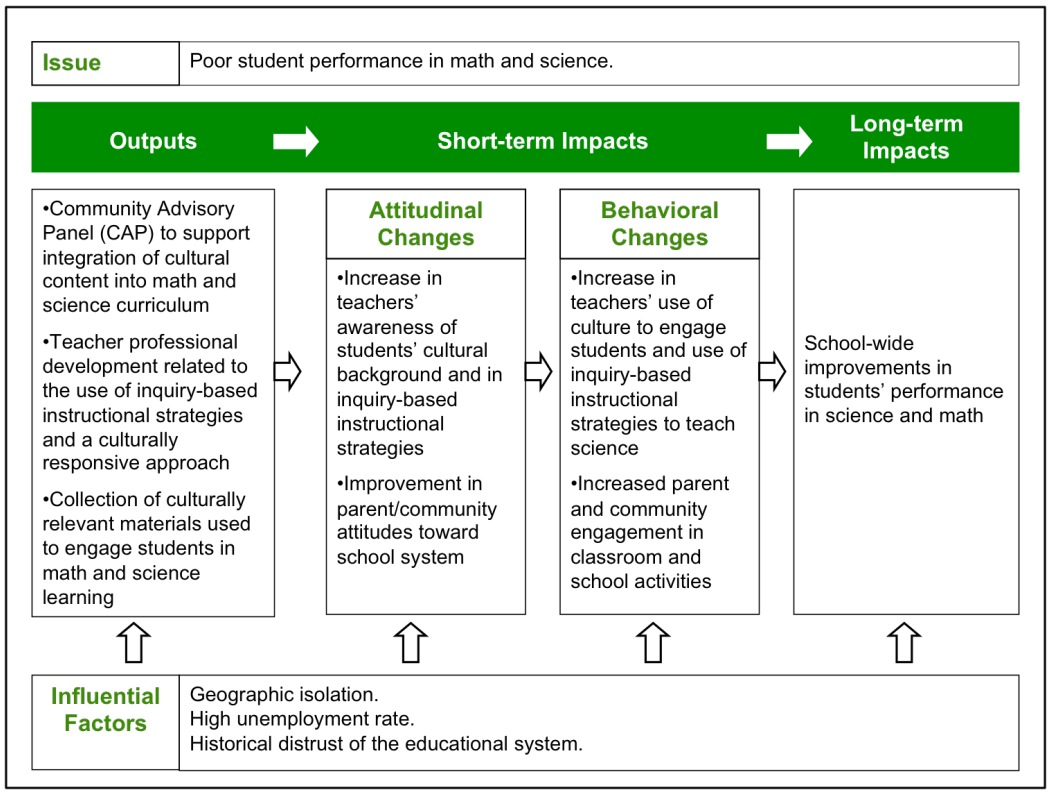
1) Increase awareness among teachers as to barriers to parental involvement;
2) Explore ways to address barriers to parental involvement:
   - Tie science and mathematics activities to well attended family and community events (e.g. host Family Science Nights)
   - Develop take-home materials to involve parents in classroom activities
3) Explore opportunities to involve parents as cultural resources to the school and classroom.

The implementation of the CEP project has allowed both Todd Elementary and Mexican Hat Elementary to explore and self-reflect on their abilities to meet the scholastic needs of their American Indian students. However, perhaps the most important impact of the CEP project is that it has revealed the cultural factors that influence the progression of the project within the community and clarified the order and distinction of the project's goals for future implementation. Results from the three-year proof-of-concept project suggest that it is essential to identify the contextual factors within a CEP community and to implement activities designed to foster attitudinal changes (e.g. interest and awareness) before implementing those that are designed to foster behavioral changes (e.g. instructional strategies and engagement).

The experiences at the Mexican Hat and Todd Elementary sites suggest that adequate time must be invested in addressing the attitudinal changes during the early phase of the project – through the development of the CAP team and efforts to gain teacher support – before behavioral changes can be expected (e.g. changes in teacher instructional strategies and

parent involvement). Figure ii below provides a revised CEP logic model that is designed to highlight both the important influential factors that impact the design and progress of a CEP project and the distinction between attitudinal and behavior changes for teachers, parents, and community members. Future CEP projects should recognize that a significant time investment is required to build relationships within and between teachers, schools, and the broader community. It is only with this investment that stakeholders in these communities may begin to see the changes in both teaching practices and community involvement that will ultimately contribute to improvements in student performance in math and science.

Figure ii. Revised CEP Logic Model



Introduction

The Communities of Effective Practice (CEP) project is a National Science Foundation (NSF)-funded project to develop a professional development model for supporting math and science instructional practices that are culturally responsive within American Indian communities. The three-year proof-of-concept project was developed to: 1) design a series of culturally relevant professional development modules for teachers of grades 4 through 6 that include an American Indian perspective and that satisfy national and state of Utah core curriculum requirements in math and science; and 2) develop a template that describes the organization and methods for creating a Community Advisory Panel (CAP) of teachers, American Indian students, community leaders, parents, and tribal elders who work to incorporate important cultural knowledge reflecting their specific community into math and science curricula.

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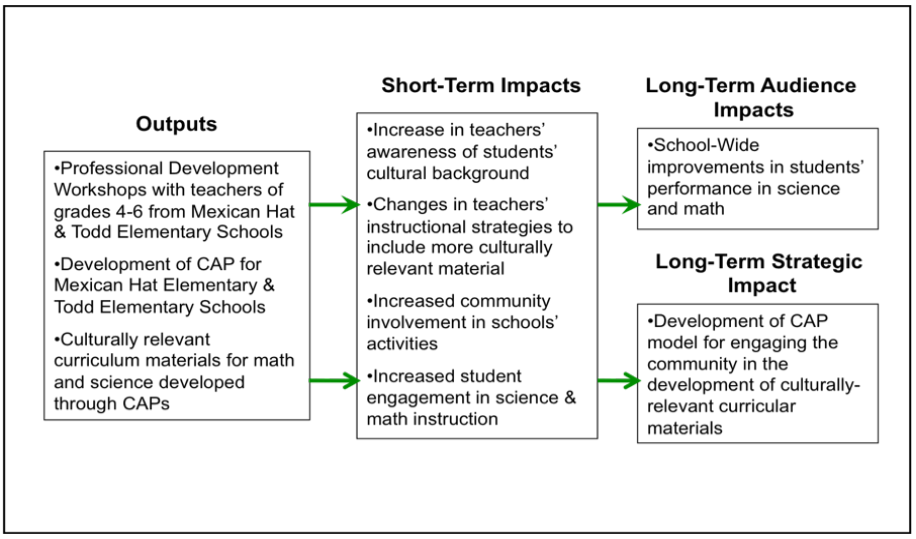
As a first step in the evaluation process, DHA worked with the program administrators to develop a logic model to represent the theory of action for the project. The logic model displayed in Figure 1 visually describes the original goals and anticipated impacts of CEP project. This logic model provided a framework for the design of the evaluation and is used as an organizer for summarizing the Year 3 findings presented in this report.

Figure 1: CEP Logic Model



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1 of the Project, the Todd Elementary School community was selected as the focus of the evaluation; in Year Two, the programs at both Todd Elementary School and Mexican Hat Elementary School were included in the evaluation, and in Year Three the evaluation focused on the Mexican Hat Elementary School program.

Mexican Hat Elementary is located in the southeastern region of Utah in the town of Mexican Hat, and is one of six elementary schools and one of twelve schools included in the San Juan School District. The school serves a student population that is 99% Navajo. The geographic location and the size of the school district often isolate the schools within this district from educational opportunities to which students in other school districts typically have access. Unemployment rates in San Juan are 300% higher than the national average, which contributes to students' inability to access educational opportunities and resources outside of the school system. These contextual factors are important considerations when interpreting the Year 3 findings presented in the Results section of this report.

This report summarizes findings from the Year 3 evaluation (conducted during the 2008-2009 academic year) and discusses these findings within the context of the results of evaluations from Years 1 and 2. The methodology and findings from the Year 3 evaluation are summarized in the following sections. These sections are followed by a discussion section that uses the evaluation findings across all three project years as the basis for a discussion of important considerations when replicating the CEP model.

Methodology

The Year 3 findings presented in this report are based on 1) on-site, qualitative research conducted with teachers and CAP members representing Mexican Hat Elementary School and 2) a quantitative analysis of videotaped classroom observations with Mexican Hat Elementary teachers who participated in the CEP project. Each data collection methodology is briefly described below.

Teacher Discussion Group. A discussion group was conducted with four science teachers at Mexican Hat Elementary during May of 2009. The teacher discussion group sought to capture the teachers' impressions of 1) the current challenges that they face in the classroom and the current efforts to address these challenges, 2) the composition and function of the professional development experience, 3) the classroom- and school- level outcomes based on the professional development experience, 4) the perceptions of what factors are important to a CEP project, and 5) parent and community involvement with the school. See Appendix A for a review of the discussion group transcription.

CAP Member Interviews. During the spring of 2009, semi-structured interviews were conducted with six CAP members. The CAP member interviews focused on obtaining responses related to 1) the current challenges facing the schools and the current efforts to address these challenges, 2) the composition and function of the CAP, 3) the perception of what factors are important to a CEP project, and 4) the perception of parent and community involvement with the school.

Classroom Observations. Four teachers from Mexican Hat Elementary were videotaped as they taught a science lesson in their classroom at least three times each throughout the 2008-2009 school year. A trained observer reviewed the14 videos and rated the videos using the Reformed Training Observation Protocol (RTOP) as an observation tool. The RTOP was developed by the Evaluation Facilitation Group (EFG) of the Arizona Collaborative for Excellence in the Preparation of Teachers (ACEPT). The RTOP is a 25-item protocol measuring five different subscales: lesson plan and implementation, propositional pedagogic knowledge, procedural pedagogic knowledge, communication interactions, and student/teacher relationships (see Appendix B for a copy of the instrument). Each item of the RTOP is a positive statement of reformed teaching that is rated on a 5-point scale from not descriptive of the classroom being observed (0) to very descriptive of the classroom being observed (5). Table 1 displays the inter-rater reliability and construct validity for the subscales.

Table 1. RTOP Reliability and Validity

Subscale	Inter-rater reliability (R2)	Construct validity (R2)
Lesson Design & Implementation	.915	.956
Content – Propositional Pedagogic Knowledge	.670	.769
Content – Procedural Pedagogic Knowledge	.946	.971
Classroom Culture – Communication Interactions	.907	.967
Classroom Culture – Student/Teacher Relationship	.872	.941

Note. Inter-rater reliability based on 16 pairs of observations. Construct validity based on the subscale of predicative ability for the total scores for the instrument.

Although the unique dimensions measured by the RTOP subscales are of interest for examining changes in teachers' instructional strategies based on the CEP experience, perhaps the most relevant scale is an index of items across these subscales that measures teachers use of an "inquiry orientation." An exploratory factor analysis conducted by the EFG using a database of 153 observations resulted in a group of 7 items that loaded onto a factor that the group identified as strongly suggestive of the pedagogy of inquiry. Table 2 below lists the RTOP items in the scale and provides the loading for each item on the Inquiry Orientation factor. In addition to the RTOP subscale scores discussed above, scores for the Inquiry Orientation scale were calculated for each teacher and analyses were conducted to examine trends in the scores over time.

Table 2: Inquiry Orientation Scale of the RTOP

Item Number	RTOP Item	Factor Loading
3.	In this lesson, student exploration preceded formal presentation	0.86
4.	This lesson encouraged students to seek and value alternative modes of investigation or of problem solving.	0.84
11.	Students used a variety of means (models, drawings, graphs, concrete materials, manipulatives, etc.) to represent phenomena.	0.68
12.	Students made predictions, estimations, and/or hypotheses and devised means of testing them.	0.83
13.	Students were actively engaged in thought-provoking activity that often involved the critical assessment of procedures.	0.78
14.	Students were reflective about their learning.	0.78
16.	Students were involved in the communication of their ideas to others using a variety of means and methods.	0.75

Note. Maximum Possible Factor Loading = 1.00.

Results

The Evaluation of the 2008-2009 CEP project included both on-site data collection activities and structured classroom observations using the RTOP rating tool. The results from each of these data collection activities are summarized separately.

On-Site Data Collection

On-site data collection activities, including CAP member interviews and a teacher discussion group, were conducted during spring of 2009. Findings from these data collection activities are summarized according to the logic model displayed in Figure 1, with a discussion of findings related to the program's short-term impacts related to teachers' instructional strategies and community involvement followed by a summary of the long-term audience impacts related to student academic achievement.

Short-Term Impacts

As shown in the logic model in Figure 1, the primary short-term impacts proposed for the CEP project include increasing teachers' awareness of students' cultural backgrounds, changing teachers' instructional strategies to include more culturally relevant material, increasing community involvement in school activities, and increasing student engagement in science and math instruction. The teacher discussion group and CAP member interviews conducted during Year 3 of the project specifically explored participants' impressions of changes in

science instructional strategies, the integration of cultural content into science lessons, and parental involvement in the class and school. These findings are summarized below.

Science Instructional Strategies. The teachers at Mexican Hat expressed excitement about how comfortable they were becoming with teaching science as a result of their involvement in the CEP project. Prior to the beginning of the CEP project, science was taught using the departmentalized model and none of the teachers participating in the CEP project were originally science teachers. During the first year of the CEP project, the school's model changed to self-contained classrooms, and the teachers had to instruct science for the first time. The teachers discussed how the CEP project helped them transition to their roles as science teachers.

> *"It [the CEP project] served like a springboard….I think it helped me, as I look at the outcome I see myself evolving and trying different lesson plans." - teacher*

> *"I use to be afraid of science but since starting this [the CEP project] I'm kind of excited about it and like it and realize how much I enjoy it." - teacher*

When the teachers were asked what differences they had noticed in their instructional practices since participating in the project, they all agreed that they grew more comfortable teaching science with each year of the CEP project. The teachers noted they are trying new ideas in their classrooms more often than they did in the past, and they were incorporating more inquiry-based instructional strategies into the classroom – based upon the inquiry-based science workshops led by the CEP program director.

> *"For me it's like anything else, it just gets better and better every year. You see things that I can improve here and do this unit better, this concept better this way." - teacher*

> *"Each year we get a little bit more hands-on. We figure out things we can do." - teacher*

> *"There is no right or wrong [when it comes to science experiments]. That is what we discovered." - teacher*

CAP members discussed how the teachers were resistant to the project's goals initially and had only recently started to grow comfortable with making changes to their instructional strategies. The principal noted that although teachers' abilities to teach science have improved recently, their stress levels have also increased since the start of the project. The majority of the CAP members reported that it would have been better for the sake of the project if they had invested more time upfront to preparing teachers for the CEP project given that it took a significant amount of time to get teachers on board with the goals of the project. However, CAP members agreed that positive changes occurred in teachers' attitudes and teaching strategies since starting the CEP project.

> *"The CAP has helped make the science lessons more hands-on, and since the lessons are created by multiple people [CAP members], they seem to be better." – parent, CAP member*

"This project has helped standardize the way science is being taught [by teachers at Mexican Hat]." – Mexican Hat Principal, CAP member

All of the teachers agreed that their decision to teach science from a more inquiry-based instructional strategy had a positive influence on the students' attitude and behavior in the classroom. Teachers discussed how their students wanted the science lessons to be longer because they enjoy them more than other lessons.

"I think we are a more cohesive unit. They are excited and enthused not only about science but about others things and they will come tell me, "I noticed this and this and this. We talked about this in science. I saw that." They're reporting things and that almost seems to open lines of communication in other areas, which I think really helps." - teacher

"Last year, I had half a dozen kids who wanted to grow up to be scientists…One student told me if he could start a business he wanted to start a science business – to do science experiments so kids could do them because they are fun." - teacher

One concern that teachers did present with regard to their ability to conduct inquiry-based science lessons was the availability of the supplies needed for conducing these lessons. The principal of Mexican Hat also indicated that the school was in need of additional science materials.

"You can't just read the book. You've got to have manipulatives. You've got to experiment. You've got to do stuff." – teacher

"We were thinking how nice it would be to have an account set up at one of the local stores so we could just go in and charge the science equipment that we needed, such as cups for growing crystals or things like that." - teacher

Cultural Content. The teachers and CAP members were asked to discuss how they felt about incorporating cultural knowledge into their science lessons. All of the teachers and CAP members valued the importance of discussing culturally relevant information to engage students in the science lesson. When asked to rate the importance of incorporating cultural knowledge into the lesson plans on a scale from one to ten with ten representing very important, all of the teachers rated the importance as an eight or higher.

"It [the incorporation of cultural knowledge] gives them ownership. It's not something that is clear over here for these people to learn. Everybody can learn it because everybody already has a little part of it." - teacher

"It's important. It adds an element….They feel like it's something personal, something that relates to them." - teacher

"They [the students] feel better when they feel connected [to what they are learning]." – school district employee, CAP member

"Adding Navajo culture, simplifies the lessons [for the students]." – parent, CAP member

Although the teachers and CAP members reported valuing the incorporation of cultural knowledge into science lessons, reports of *using* culturally relevant information in the classroom are not as positive. In fact, during the 2007-2008 evaluation, participants provided a more positive account on the use of cultural knowledge in the classroom than participants reported during the 2008-2009 evaluation. The teachers who are not Navajo felt uncomfortable using some of the cultural materials provided to them, such as the Navajo vocabulary sheets or telling some of the Navajo stories. These teachers also discussed how they typically asked the teachers who are Navajo for advice on what cultural information to incorporate into a lesson at the last minute because they did not feel they have enough cultural resources readily available to them. One of the CAP members who is primarily responsible for providing culturally relevant information discussed how the teachers did not directly contact him for material support, but rather the curriculum developer for Mexican Hat tells this CAP member what is needed by the teachers to improve the lesson plan's cultural relevancy – which may explain why teachers rely on the Navajo teachers for support since they can provide them with more immediate access to the information they need. Teachers who are Navajo and CAP members also mentioned how the variations in Navajo stories make it difficult for them to teach others about Navajo culture.

> *"I haven't really investigated [new culturally-relevant information]. Are there legends you can put on a DVD? Are there a lot of those because I didn't find any even when Clayton and Don [cultural experts] came down [to the school]. There are a few, but see that's what I would like is to actually have them readily accessible in the Navajo language – present it like the stories of the stars, the stories of the seasons, the stories that surround the moon and things like that in the Navajo culture, which I haven't been able to find." – Teacher who is not Navajo*
>
> *"Everything that I have done [physical experiments, hands-on stuff] with my classroom, the perishable stuff, I have provided myself. But as to the culture aspect with the teachers who are Navajo I can run screaming down the hall "Guys, help, help!" And they are right there. I have access to the culture, not my culture, but they are more than happy to say this is how it works." – Teacher who is not Navajo*
>
> *"The thing of it is there are different perspectives on just about everything [in Navajo culture] and micro-perspectives." – teacher who is Navajo*
>
> *"Culture can be very hard to teach because there are so many variations [to interpretation]." – school district employee, CAP member*

Parental Involvement. Both teachers and CAP members were asked to describe parental involvement with students' science education. Both teachers and CAP members reported parental involvement as the weakest link in the CEP project. The teachers discussed how difficult it is for the parents to be involved because many of them face economic hardship, so they do not have the time and resources to be very involved with the school system. This reasoning for lack of parental involvement is more sympathetic than the reasoning provided by teachers in previous years of the CEP project. Therefore, it is possible that the CAP is working well as a mediator between the school and the community.

CAP members reported how parental involvement by the Navajo community is very weak, but it is slowly improving. The principal cautioned that even if the involvement improved within the

next year that parental involvement with the school from the Navajo community could look different than parental involvement with a school by another community. He discussed how he thinks parents are more likely to get involved with the school by helping their children with their homework rather than visiting the school often for after-school activities. However, a parent and CAP member did report that a recent science on wheels exhibit at the school brought many families to the school in the evening. Two of the CAP members discussed how parental involvement needs to be implemented more broadly at the school level before parents will become more involved in their children's science lessons and homework. One of the district members discussed how they auctioned off bails of hay for the students' parents, because bails of hay are a necessity for many of the families within the school district. This service was provided in order to improve the relationship between the students' parents and the school.

Prior to the start of the CEP project, Mexican Hat Elementary provided at-home science kits, or science experiments, that students could take home to conduct with their parents. CAP members reported how well received these kits were with the families. The development and dissemination of more at-home science kits has been discussed among the CAP members and the teachers, and they are hoping that this will improve future parental involvement with the school. A few of the CAP members reported that they would like at-home science kits to be disseminated again, but they would want the families to keep track of the activities they do in order to know if they are really being used by the families. Other CAP members also suggested keeping track of those who use the at-home science kits to determine if this form of parental involvement has an influence on science scores.

> *"We need to provide extensions to the school. Not just at the school, but also where they can take home science kits and science activities that they can actually play with at home. It is something that can bring parents/families together…I think it is something that would really inspire them and it would really lend itself to the test at the end of the year." – teacher*

> *"I don't think it [the CEP project] has really affected that [parent involvement] because within the family setting I think the parents are barely surviving. They are taking care of what they need to and if we have this extension [at home science kits] that could be another avenue where they don't have to worry about spending their own money for the materials. The materials could be right there in a packet and we could encourage them to be a part of what the kids are learning. Make the materials accessible to them." – teacher*

Long-term Audience Impact: Academic Achievement

One of the long-term intended impacts of the program is to improve American Indian students' academic achievement. Teachers discussed how difficult it is for their students to do well on the standardized tests because of the language barrier. The principal reported that it is difficult to provide students' materials that will help them prepare for standardized tests that are translated into the Navajo language. They are not as easily available as materials that are translated into other languages, such as Spanish.

"Vocabulary is hard for them [the students]. When they see those vocabulary words [on the standardized test] they just don't want to think anymore – "I'll just choose 'B'." – teacher

"If you translate the question for them – which we cannot do [during the standardized tests] – they will get it." – teacher

One of the CAP members who works for the district discussed how Mexican Hat's science scores on the state test improved from the 2006-2007 year to the 2007-2008 year, and the only difference in the school's science curriculum during this time is that the teachers were provided with new lessons and teaching strategies to use based on the guidelines of the CEP project – which is a sign that the CEP project could have a positive influence on statewide test scores in the future. However, even though students' state test scores improved during the 2007-2008 year, Mexican Hat Elementary was still placed on the "needs improvement" list by the National Child Left Behind Act. Statewide scores for the 2008-2009 school year have yet to be released.

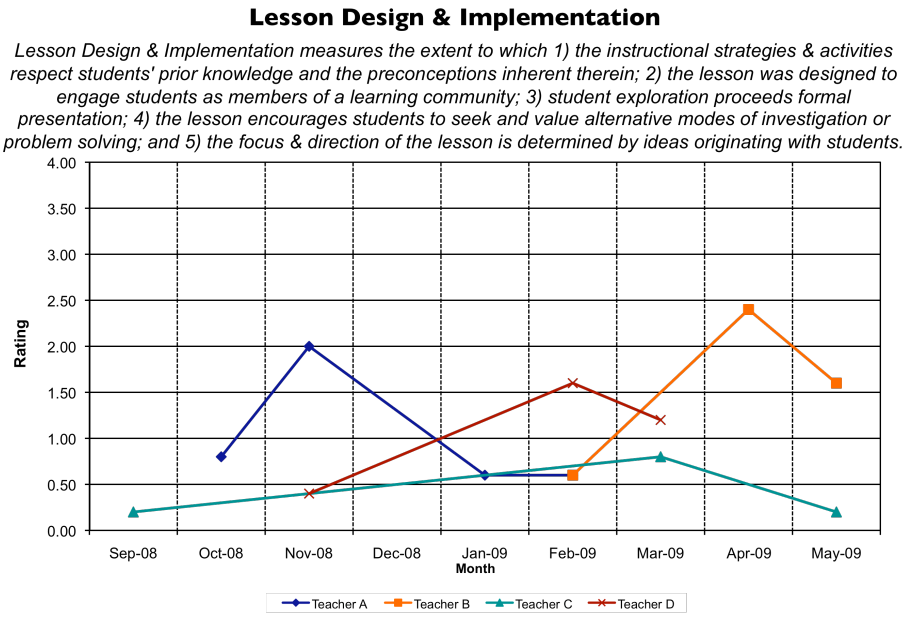
Both teachers and CAP members determined they need to evaluate the scores students receive on science tests all year round, rather than just determining the CEP project's influence on the end of the year state science test. Although it is important to monitor students' progress in science on other criteria besides the state standardized test scores, a CAP member who works for the district noted that if the CEP project ultimately does not improve state standardized test scores, then the project needs to restructure to ensure that this goal is reached.

Classroom Observations

A trained observer reviewed 14 videos of Mexican Hat teachers conducting a science lesson within their classrooms and rated their instruction using the RTOP. The observer rated these scales on a 5-point Likert scale from "strongly disagree" to "strongly agree". Analyses were performed to examine the trend in the teachers' ratings over time. The results for each subscale and the Inquiry Orientation scale are summarized below, followed by a summary discussion of the RTOP findings.

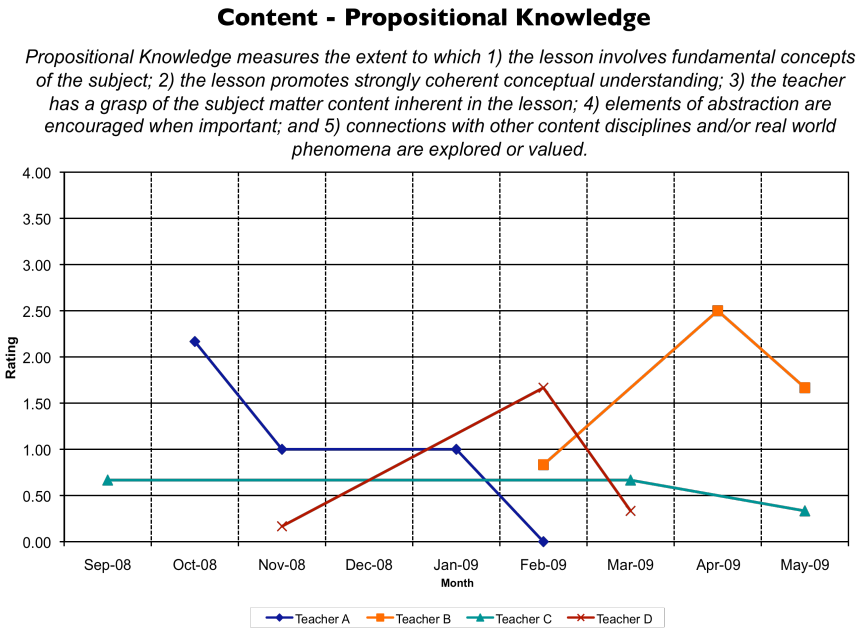
Lesson Design and Implementation. Figure 2 displays the trend for the Lesson Design and Implementation subscale results over time. On this subscale, all four teachers were rated higher on their second classroom observation compared to their first observation. However, rating improvements did not continue to increase for the third and fourth observations. Only one lesson received an average rating on lesson design and implementation higher than a rating of two. An item-by-item analysis demonstrates that participants rated the highest, with an average rating of 1.77, on the item: The instructional strategies & activities respect students' prior knowledge and the preconceptions inherent therein. Participants were rated the lowest, with an average rating of 0.08, on the following item: The focus and direction of the lesson is determined by ideas originating with students.

Figure 2. RTOP ratings for Lesson Design and Implementation



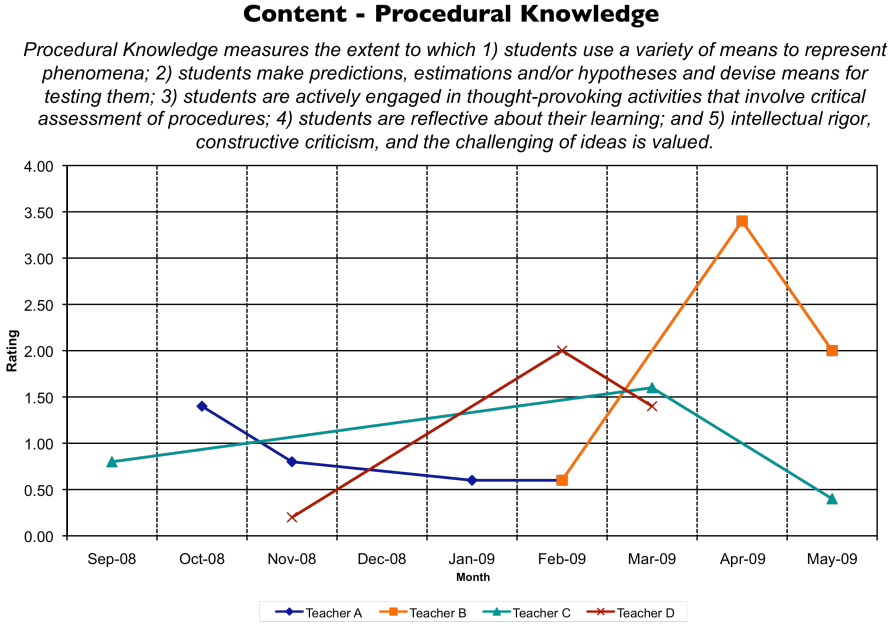
Propositional Knowledge. Figure 3 displays the trend for the Propositional Knowledge subscale results over time. The highest rating for the subscale was a 2.50. The lowest rating for the subscale was 0.00. An item-by-item analysis demonstrates that participants' scored the highest, with an average rating of 1.69 on the following item: The lesson involves fundamental concepts of the subject. Participants' scored the lowest, with an average rating of 0.62, on the following item: Connections with other content disciplines and/or real world phenomena are explored or valued.

Figure 3. RTOP Ratings for Propositional Knowledge



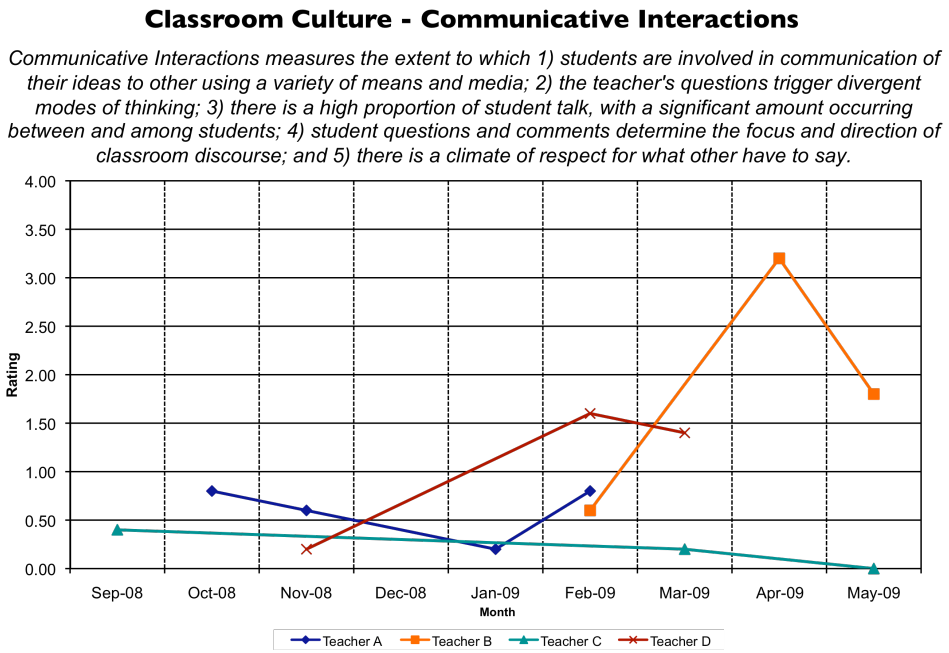
Procedural Knowledge. Figure 4 displays the Procedural Knowledge subscale results over time. The highest rating on the subscale was a 3.40. The lowest rating was a 0.20. An item-by-item analysis demonstrates that participants scored the highest, with an average rating of 2.15, on the following item: Students are reflective about their learning. This item scored the highest average across all items of the RTOP and was the only individual item to receive a score above a score of two or "neutral" rating. Participants scored the lowest, with an average rating of 0.62, on the following item: Intellectual rigor, constructive criticism, and the challenging of ideas is valued.

Figure 4. RTOP Ratings for Procedural Knowledge



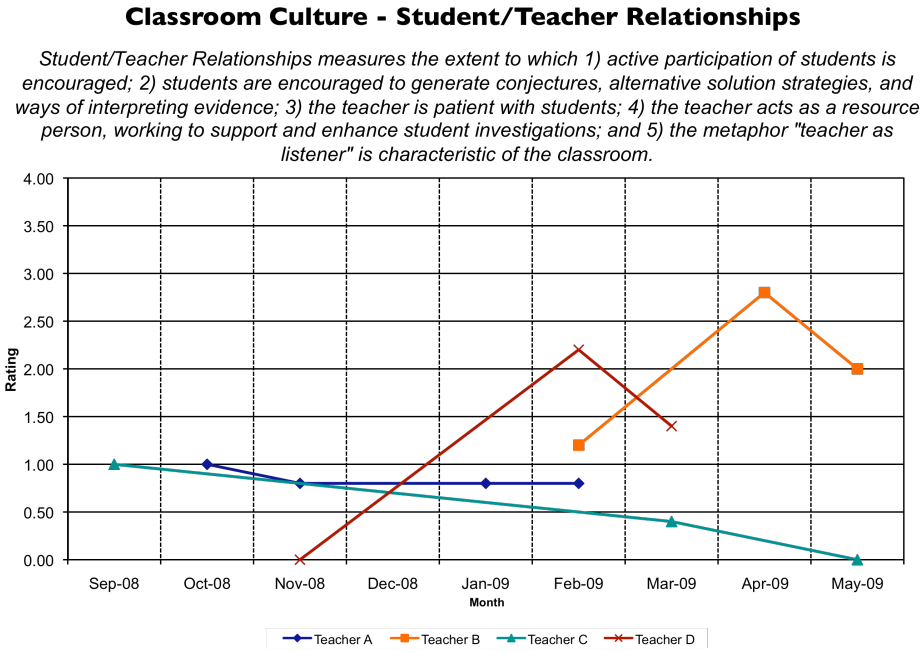
Communication Interactions. Figure 5 displays the trend for the Communication Interactions results over time. The highest rating was a 3.20. The lowest rating was 0.0. An item by item analysis demonstrates that participants scored the highest, with an average rating of 1.54 on the following item: There is a climate of respect for what others had to say. Participants scored the lowest, with an average rating of 0.15 on the following item: Student questions and comments determine the focus and direction of classroom discourse.

Figure 5. RTOP Ratings for Communication Interactions



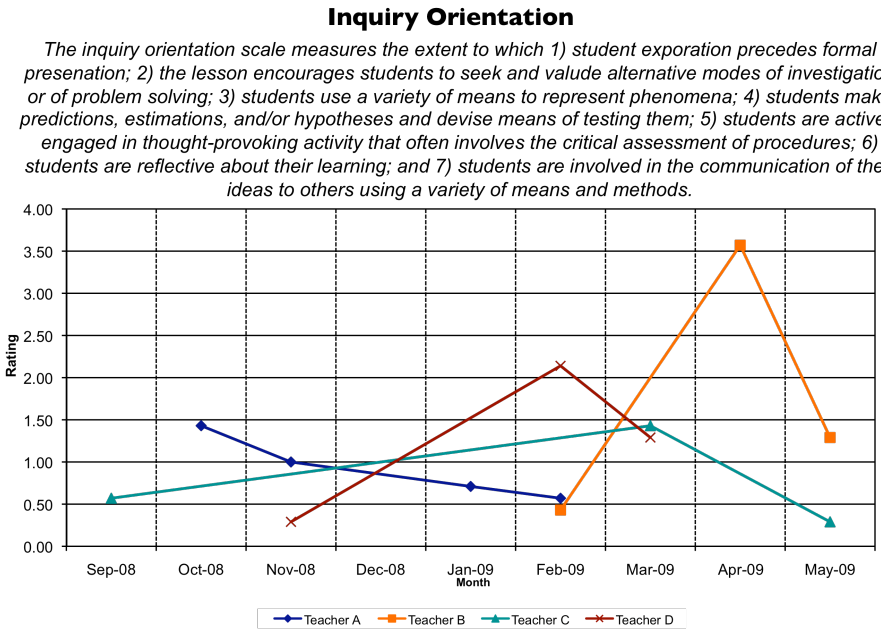
Student/Teacher Relationships. Figure 6 displays the trend for the Student/Teacher Relationships subscale results over time. The highest rating was a 2.80. The lowest ratings was 0.00. An item by item analysis demonstrates that participants scored the highest, with an average rating of 1.77, on the following item: The teacher acts as a resource person working to support and enhance student investigations. Participants scored the lowest, with an average rating of 0.46, on the following item: Students are encouraged to generate conjectures, alternative solution strategies, and ways of interpreting evidence.

Figure 6. RTOP Ratings for Student/Teacher Relationships



Inquiry-Orientation Scale. Figure 7 displays the Inquiry Orientation scale results over time. The highest average rating was a 3.57. The lowest average rating was a 0.29. An item by item analysis demonstrates that participants scored the highest, with an average rating of 2.15, on the following item: Students were reflective about their learning. Participants scored the lowest, with an average rating of 0.85, on the following item: Students used a variety of means (models, drawings, graphs, concrete materials, manipulatives, etc.) to represent phenomena. A distinct pattern in the trajectory of the data does not exist.

Figure 7. RTOP Ratings for Inquiry Orientation



Summary of RTOP Findings. For each subscale, looking across teachers and over time, there is no clear trend in teacher performance with regard to the dimensions measured by the RTOP. It is important to note that given the small number of data-points available for this analysis, it may not be possible to discern a distinct trend over time. If these results were monitored over a longer period of time or using a larger sample of teachers, it may be possible to identify a pattern to teacher performance overtime.

In addition, although one would expect teacher performance to improve over time given access to ongoing coaching in the use of inquiry-based and culturally responsive approaches to instruction, other factors may also contribute to a teacher's performance on a given lesson. For example, the appropriateness and feasibility of an inquiry-based approach likely varies according to the lesson topic, and each of the observed lessons focused on a different subject: plants and environments, condensation, rocks, crystals, fossils and dinosaurs, compass and magnets, erosion, landforms and electricity, forces that shape the earth, inherited traits, seasons, 8 constellations, fungi, and microscopes. Another factor that may have contributed to teacher performance was the timing of the lesson, which could have affected teacher-preparation for delivering the lesson give the seasonal variation in time commitments that teachers face.

Given that some teachers' RTOP scores remained low throughout the academic year, it is useful to examine potential areas for improvement based on the RTOP results. An item-by-item analysis across all observations was conducted to identify the items for which teachers never received a score of three or four. Five items were identified: 1) The focus and direction of the lesson was determined by ideas originating with students; 2) Connections with other content disciplines and/or real world phenomena were explored and valued; 3) Students' questions and comments often determined the focus and direction of class discourse; 4) Students were encouraged to generate conjectures, alternative solution strategies, and way s of interpreting evidence; 5) The metaphor "teacher as listener" was very characteristic of this classroom. The last three items listed are from the two subscales on classroom culture.

In addition to the quantitative RTOP ratings, the classroom observations provided an opportunity to better understand how participating teachers' included culturally responsive content within the science lessons that were observed. The observer who rated the RTOPs was asked to provide open-ended comments to substantiate her ratings for each item on the RTOP. The observer noted several times that the teachers tried to connect the lesson plan to the students' American Indian culture through storytelling; however, the observer reported that the time spent connecting the culture to the lesson plan was often too long – cutting into time that should have been spent on the subject matter of the lesson. Moreover, the observer reported that the connection between culture and the science subject was often weak.

Discussion

As the final report in the three-year evaluation of the CEP proof-of-concept project, this report provides an opportunity to examine findings across all three years of the project to understand both the benefits of using the CEP model and the challenges inherent in implementing the model. Although the findings from the current year's evaluation are based on the Mexican Hat Elementary site, it is useful to reflect back on findings from the Todd Elementary site in Years

1 and 2, because the different experiences at the two sites provide insights into the relative effectiveness of alternative implementation approaches. The discussion provided in this section is intended to support future efforts to implement the CEP model in communities that serve American Indian students.

Based on the three-year proof-of-concept projects at Mexican Hat Elementary and Todd Elementary, the major aspects of the CEP program model that require attention are: 1) the formation and sustainability of the CAP; 2) the teacher professional development program to support culturally relevant math or science instruction; and 3) efforts to engage parents in the CEP community. Each of these aspects of the CEP model are discussed below.

CAP Formation and Sustainability

The Year 2 Evaluation Report explored the differences in the formation and function of the Todd Elementary and Mexican Hat Elementary CAPs. During Year 1 of the project, the program director at Mexican Hat Elementary focused her efforts on the formation of the CAP, and by Year 2 of the project, the Mexican Hat Elementary CAP was well established at the site. However, the program director continued to struggle to engage the Mexican Hat Elementary teachers in the project throughout Year 2. Meanwhile, the program director at the Todd Elementary site struggled to engage the community members in the CAP meetings, which were poorly attended, and instead forged ahead with a series of professional development workshops for teachers. As a result of these efforts, teachers at the Todd Elementary site were more engaged in the project from the on-set of its implementation, but the CAP team was never fully established and the project ultimately lacked full community engagement.

As discussed in the findings of this report, by Year 3 Mexican Hat Elementary had made substantial progress in implementing the CEP project in their community. The work undertaken to cultivate a well-established CAP appears to have resulted in a group of community members who are eager to assist the school in incorporating cultural knowledge into science lessons. In the past three years, the CAP has consistently met with one another and developed and compiled lesson plans to support teacher instruction.

Findings from the Year 3 Mexican Hat Elementary CAP member interviews are informative for understanding key elements of success for the formation and sustainability of a CAP. All participating members of the CAP acknowledged the importance of choosing the right players to represent the CAP in order for the goals of the CAP to be accomplished. To ensure the CAP was representative of the community and the school, the program director oversaw the decision-making process of the CAP formation. The CAP members noted especially how important it is to have one member of the CAP be in charge of planning and organizing the meetings and actions of the CAP. For this CAP, that leader was the

Key Considerations in the Formation and Sustainability of the CAP

1) Allow a considerable time investment (up to 1 academic year) to fully establish the CAP;
2) Establish a point person to oversee the recruitment of CAP members who represent the community and the school; and
3) Identify a leader who works within the school of interest or who can visit the school often as is necessary to support the teachers throughout the process.

curriculum developer for Mexican Hat Elementary. The teachers and principal of Mexican Hat discussed how beneficial it was for them to have the leader on the CAP working within the school every day, available to them for guidance on the project. The CAP members also reported on the importance of allowing themselves to use the entire first year of the CEP project to assemble the CAP into a cohesive unit before utilizing the CAP to promote change in the school system. Future efforts to implement the CEP model should ensure that considerable time is dedicated to the formation of a CAP team and should ensure that the team includes strong leadership that can support the CAPs work within the school.

Teacher Professional Development to Support Culturally Relevant Instruction

Findings from the professional development programs at Mexican Hat Elementary School and Todd Elementary School provide insight into important considerations when implementing the professional development component of the CEP model in the future. These findings point to three key considerations related to the teacher professional development program: 1) the importance of teacher buy-in; 2) the use of an appropriate instructional model; and 3) opportunities for collaboration. Each of these considerations is discussed below.

Importance of teacher buy-in. Teacher participation in the CEP project at Mexican Hat Elementary has evolved over the course of the three-year project. Teachers were introduced to their responsibilities during the last half of the project's first year, and they were asked to implement changes in their teaching practices during the 2007-2008 school year. As discussed in the Year 2 Evaluation Report, the program director at the school struggled to get teachers to embrace the project during Year 2. However, by Year 3 teachers at Mexican Hat reported a positive experience with the project, and suggested that it had improved their use of inquiry-based instructional strategies and their incorporation of culturally relevant content into their instructional practices.

The course of the teacher experience at Mexican Hat Elementary suggests that, like the development of the CAP team, a significant time investment is necessary to engage teachers in a meaningful effort to make modifications to their teaching strategies. An important component of this process appears to be the time spent gaining teacher support for community involvement in the development of instructional approaches and the incorporation of culturally relevant content into science and math lessons. The challenges that the Mexican Hat Elementary program director faced in Year 2 of the project appear to have been related to poor teacher buy-in for the project. Both CAP members and teachers reported that had teachers been more informed of the project earlier in the process, there would likely have been less conflict between the CAP and the teachers during the second and third years of the project. Future CEP projects should ensure that teachers are comfortable with the project early on in the project by meeting with the teachers at the beginning of the timeline to gain their input and support for the project.

By year three, teachers at Mexican Hat Elementary reported positive changes in their use of inquiry-based instructional strategies, the inclusion of the cultural content into their lessons, and their overall classroom culture. However, these comments were not substantiated by a positive trend in the independent observers' ratings on the RTOP. Time is certainly a factor in the lack of a clear trend of improvement for the teachers' RTOP ratings. If teacher attitudes towards inquiry-based instructional strategies and culturally relevant teaching practices only began to become more positive during the third year of the project, it is unlikely that these

changes in attitudes would have been immediately translated into improvements in their instructional strategies (changes in behavior). Future projects should work to ensure that teachers buy into the project early on, so that the professional development program can focus on helping them to develop meaningful changes in their instructional strategies.

Use of an Instructional Model. Both the findings from the independent observations and comments from the participating teachers indicate the teachers at Mexican Hat Elementary would have benefited from additional guidance for incorporating inquiry-based instructional strategies and culturally responsive approaches into their teaching practices. Teachers reported that they struggled to effectively link culturally relevant material to science lessons, and the observer noted that these connections sometimes diminished the scientific content of the lesson.

One option for future CEP programs is to incorporate an instructional model as a framework for all curricular materials developed through the CEP project, and to provide explicit direction as to where the cultural component of the instruction fits within this framework. The 5E Learning Cycle (Bybee, 2006), described in the box below, may provide a useful framework for the development of meaningful inquiry-based learning experiences that include a culturally-responsive component. For example, it may be appropriate to include the cultural content only in the Engagement component of the 5E Learning Cycle, which encourages teachers to use materials or resources to engage students in the lesson. Establishing guidelines for how cultural content is integrated using this instructional model my make the goal of integrating cultural knowledge into the lessons more accessible to teachers and students.

5E Learning Cycle

Engagement. The teacher or curriculum task accesses the learners' prior knowledge and helps them become engaged in a new concept through the use of short activities that promote curiosity and elicit prior knowledge. The activity should make connections between past and present learning experiences, expose prior conceptions, and organize students' thinking toward the learning outcomes of current activities.

Exploration. Exploration experiences provide students with a common base of activities within which current concepts (i.e., misconceptions), processes, and skills are identified and conceptual change is facilitated. Learners may complete lab activities that help them use prior knowledge and generate new ideas, explore questions and possibilities, and design and conduct a preliminary investigation.

Explanation. The explanation phase focuses students' attention on a particular aspect of their engagement and exploration experiences and provides opportunities to demonstrate their conceptual understanding, process skills, or behaviors. This phase also provides opportunities for teachers to directly introduce a concept, process, or skill. Learners explain their understanding of the concept. An explanation from the teacher or the curriculum may guide them toward a deeper understanding, which is a critical part of this phase.

Elaboration. Teachers challenge and extend students' conceptual understanding and skills. Through new experiences, the students develop deeper and broader understanding, more information, and adequate skills. Students apply their understanding of the concept by conducting additional activities.

Evaluation. The evaluation phase encourages students to assess their understanding and abilities and provides opportunities for teachers to evaluate student progress toward achieving the educational objectives.

From Table 1 of *The BSCS 5E Instructional Model: Origins and Effectiveness* (Bybee et. al., 2006).

Opportunities for collaboration. Fundamentally the CEP project is intended to encourage collaboration among teachers and the community. The projects at both Mexican Hat Elementary and Todd Elementary suggest that facilitating effective collaboration is an essential component of the project, and provide insights into the forms of collaboration that are most effective. These findings suggest that the program should support both collaboration among participating teachers and collaboration between teachers and the CAP members by facilitating on-going meetings with these groups.

One of the key findings from the Year 2 evaluation of the CEP project at Todd Elementary was that teachers highly valued the opportunities that the CEP professional development program afforded them to collaborate with one another. Teachers at both schools reported that outside of the work undertaken through the CEP project, they lacked opportunities to collaborate with one another to develop lesson plans and to work towards school goals. The professional development programs at Todd Elementary and Mexican Hat Elementary differed in their formats. The program director at Todd Elementary led a series of professional development workshops that included opportunities for participants to collaborate, while the program director at Mexican Hat Elementary used a mentoring model in which she made herself available to teachers for coaching throughout the day two times a month. Given that teachers at both school were interested in more opportunities for collaboration with teachers, and that teachers at Todd Elementary clearly valued their opportunities to collaborate with one another, future CEP projects should ensure frequent opportunities for teacher-collaboration. Regardless of whether a CEP professional development program utilizes a coaching or a workshop approach, frequent opportunities to facilitate teacher collaboration should be built into the model.

Findings from the Year 3 teacher and CAP member interviews at Mexican Hat Elementary School suggest that there was a disconnect between what the CAP provides the school for use in the classroom and what the teachers are capable of and comfortable with using in the classroom. Teachers reported that having Mexican Hat's curriculum developer contact the cultural experts to coordinate cultural materials was helpful, but this structure meant that they lacked meeting time with the cultural experts themselves. Building in opportunities for the participating teachers to meet with the CAP members throughout the academic year would likely help teachers to take ownership of the process of incorporating culturally relevant material into their instruction, would provide teachers with direct access to the CAP's cultural expertise, and would provide CAP members with a better understanding of the challenges that teachers face in the classroom.

Key Considerations for Teacher Professional Development

1) Engage teachers early in the project to obtain teacher buy-in;
2) Develop a professional development experience that includes opportunities for teachers to collaborate;
3) Use an instructional model, such as the 5-E Learning Model, to provide a framework for the use of inquiry-based instructional strategies and the incorporation of culturally relevant content; and
4) Provide opportunities for teachers to meet with CAP members throughout the academic year.

Efforts to Engage Parents in the CEP Community

Across all three years of the evaluation, both teachers and CAP members emphasized the importance of parent involvement to ensure students' success in school. However, even with the CAP firmly in place at Mexican Hat Elementary during Year 3 of the proof-of-concept project, teachers and CAP members still reported parental involvement as the weakest link of the CEP project. The Year 2 Evaluation report discussed a number of barriers to parent participation that the CEP must contend with, including: lack of reliable transportation, poor communication due to lack of telephones and email; the low educational status of many parents; and lack of parental trust in the education system due to previous negative experiences with the system.

Findings from the Year 3 evaluation suggest that while teachers at Mexican Hat Elementary may not have found ways to address the challenges to parental involvement, they did appear to become more aware of the challenges that parents face. This finding suggests that the collaborative model instituted by the CEP approach does serve to facilitate greater communication and understanding between teachers and the community. This awareness of the obstacles that parents face is likely to be the first step towards addressing these barriers.

Future CEP programs should explore creative ways to engage parents in the culturally relevant instruction that is occurring in their children's classrooms. Teachers and CAP members recommended the use of at-home science kits with hands-on materials to provide parents and students with an opportunity to engage in schoolwork within the home. In developing these types of materials, curriculum developers should consider opportunities for a two-way flow of information between the child's classroom and the child's home. That is, the activities should not only provide opportunities to engage parents in the work that is going on in their children's classrooms, but should also encourage parents to exchange cultural information that can be shared with the class. This approach would make use of the cultural knowledge that parents can contribute to the classroom, and would provide parents an empowering role within the classroom setting, thereby enhancing the element of community collaboration for the CEP program.

Key Considerations for Engaging Parents

1) Increase awareness among teachers as to barriers to parental involvement;
2) Explore ways to address barriers to parental involvement:
   - Tie science and mathematics activities to well attended family and community events (e.g. host Family Science Nights)
   - Develop take-home materials to involve parents in classroom activities
3) Explore opportunities to involve parents as cultural resources to the school and classroom.

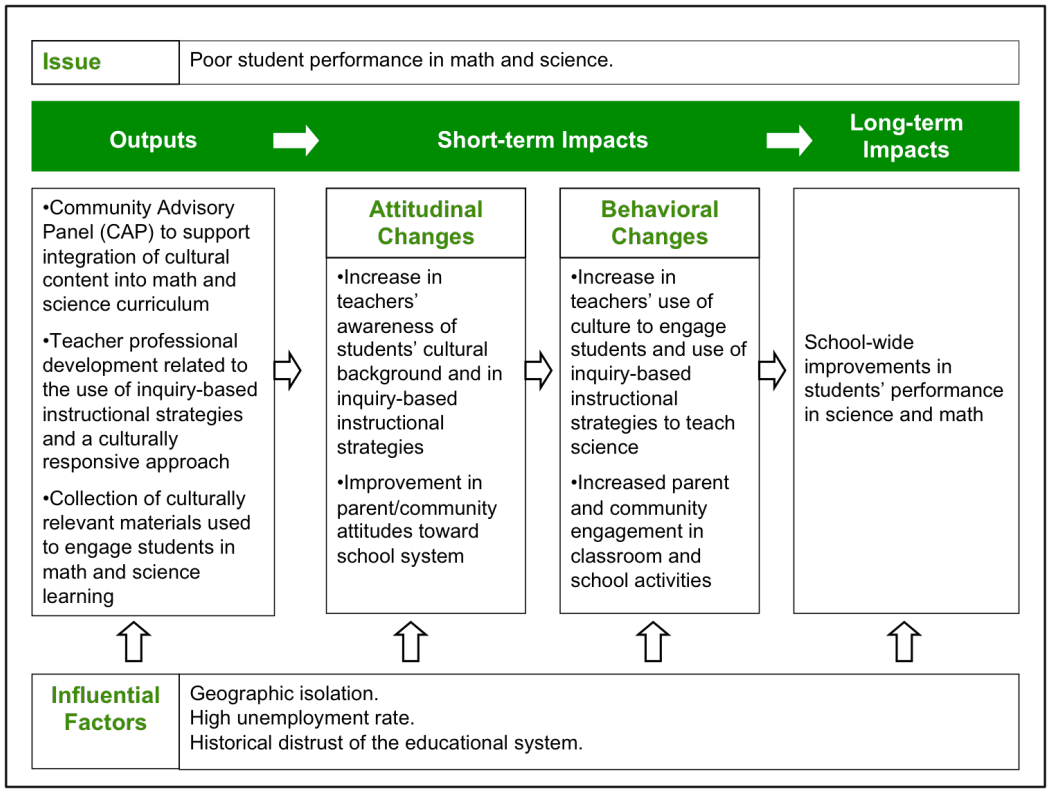
Summary

The implementation of the CEP project has allowed both Todd Elementary and Mexican Hat Elementary to explore and self-reflect on their abilities to meet the scholastic needs of their American Indian students. However, perhaps the most important impact of the CEP project is that it has revealed the cultural factors that influence the progression of the project within the community and clarified the order and distinction of the project's goals for future implementation. Results from the three-year proof-of-concept project suggest that it is essential to identify the contextual factors within a CEP community and to implement activities

designed to foster attitudinal changes (e.g. interest and awareness) before implementing those that are designed to foster behavioral changes (e.g. instructional strategies and engagement).

The experiences at the Mexican Hat and Todd Elementary sites suggest that adequate time must be invested in addressing the attitudinal changes during the early phase of the project – through the development of the CAP team and efforts to gain teacher support – before behavioral changes can be expected (e.g. changes in teacher instructional strategies and parent involvement). Figure 8 below provides a revised CEP logic model that is designed to highlight both the important influential factors that impact the design and progress of a CEP project and the distinction between attitudinal and behavior changes for teachers, parents, and community members. Future CEP projects should recognize that a significant time investment is required to build relationships within and between teachers, schools, and the broader community. It is only with this investment that stakeholders in these communities may begin to see the changes in both teaching practices and community involvement that will ultimately contribute to improvements in student performance in math and science.

Figure 8. Revised CEP Logic Model



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