

Summary of evidence review: Interventions with positive outcomes for American Indian learners

Handout 2

Hilberg, R. S., Tharp, R. G., & DeGeest, L. (2006). The efficacy of CREDE's standards-based instruction in American Indian mathematics classes. *Equity & Excellence in Education, 33*(2), 32–40.



INTERVENTION: “Two versions of a mathematics unit on fractions, decimals, and percents were developed jointly by the researcher and the teacher. The experimental unit was taught incorporating CREDE’s Standards for Effective Pedagogy” (p. 34).



POPULATION: Thirty-one grade 8 American Indian students from two mathematics classes at a middle school located in a Southwestern tribal nation.



OUTCOMES: Students who received mathematics instruction incorporating CREDE’s Standards for Effective Pedagogy had statistically significantly higher scores on posttest administered three weeks after the conclusion of the unit than students in the comparison group. Measures of attitude and enjoyment of mathematics also showed significantly higher scores for the treatment group.

Link to study

<https://www.tandfonline.com/doi/abs/10.1080/1066568000330206>

Key takeaways

- This study meets the ESSA tier “Promising Evidence” for the intervention.
- The [CREDE standards for Effective Pedagogy](#) may support engaging instruction for Native American learners.
- Teacher training on CREDE standards supports an emerging instructional practice grounded in the CREDE standards, which may have a positive impact on Native American learner outcomes.

Lipka, J., & Adams, B. (2004). *Culturally-based math education as a way to improve Alaska Native students' math performance* (Working Paper No. 20). Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics.



INTERVENTION: By connecting a common Yup'ik activity based on the salmon summer fishing season, students were encouraged to learn physical proofs of the properties of a rectangle as they attempted to solve a practical problem—how to determine they have a rectangular base—related to building a structure” (p. 9).



POPULATION: The study included 258 grade 6 Alaska Native students in 15 Southwestern Alaskan classrooms.



OUTCOMES: Students who received the Building a Fish Rack curriculum had statistically significantly higher scores on the measure of mathematics achievement.

Link to study

<https://files.eric.ed.gov/fulltext/ED484849.pdf>

Key takeaways

- This study meets ESSA tier Promising Evidence for the intervention.
- The curriculum innovation utilizes a “cultural storyline” and employs an inquiry- or problem-based approach grounded in the regional American Indian culture (Yup'ik).
- The curriculum unit was developed in collaboration between classroom teachers and American Indian community members.

Kisker, E. E., Lipka, J., Adams, B. L., Rickard, A., Andrew-Ihrke, D., Yanez, E., & Millard, A. (2012). The potential of a culturally-based supplemental in mathematics curriculum to improve the mathematics performance of Alaska Native and other students. *Journal for Research in Mathematics Education*, 43(1), 75–113.



INTERVENTION: Mathematicians and educational researchers collaborated with Yup'ik elders and classroom teachers to develop and implement a culturally based supplemental curriculum series supported with professional development component and classroom materials. Two modules (units) were examined in this study.



POPULATION: The study involved Alaska Native (45 percent) and Caucasian (33 percent) grade 2 students in 52 schools from urban and rural settings. There were 694 students included in the analyses for the *Picking Berries* module, and 703 students included in the analyses for the *Going to Egg Island* module. A total of 67 teachers who were new to the modules had participated.



OUTCOMES: The results indicate a statistically significant and favorable effect of the modules on mathematics assessments. The study reported a statistically significant and positive effect for the Alaska Native students.

Caveat: Analytic sample sizes were not reported separately for treatment and comparison subgroups of Alaska Native students, so the subgroup findings cannot be determined to meet What Works Clearinghouse (WWC) standards.

Link to study

<https://www.jstor.org/stable/10.5951/jresmetheduc.43.1.0075?seq=1>

Key takeaways

- This study meets ESSA criteria for “Strong Evidence” and is rated *Meets What Works Clearinghouse Standards Without Reservations*.
- The curriculum innovation utilizes traditional activities of local Alaska Native communities as the lens through which mathematical concepts are introduced and explored by students.
- Teachers were provided with professional development workshops, during which they were introduced to the curriculum and instructional approach, and learned how the curriculum connected to the local American Indian culture (Yup'ik).

Key intervention components described in evidence review studies

Modeling and Demonstration

Hilberg, Tharp, and DeGeest (2006) asserted that “including modeling as an integral aspect of instruction increases students’ understanding of explanations and performance success, especially students with limited [academic English proficiency]” (p. 33). Kisker et al. (2012) organized classroom activities “around expert-apprentice modeling” (p. 80). In many American Indian communities, a learner will watch and observe a new skill and then practice it before publicly demonstrating.

Student-Directed Activity

Hilberg et al. (2006) described this strategy as “activities that are generated and directed by individual students or small groups” (p. 33). The researchers explain the cultural connection to American Indian learners by noting the high levels of autonomy for children is characteristic of some American Indian communities and families (Hilberg et al., p. 33). For all three studies in the Evidence Review, teachers used small groups as one strategy for structuring student-directed activities. Other examples of student-directed activities identified in the studies include peer instruction (Lipka & Adams, 2004), student generated-questions, small groups rotating through activity centers (Hilberg et al., 2006), and inquiry-based approaches (Kisker et al., 2012; Lipka & Adams, 2004). Kisker et al. (2012) described how cooperative and collaborative classroom structures were used in the mixed-age, mixed-ability classrooms to promote students engaging the material at their own level while still learning and progressing in the topics (p. 82).

Content-Related Dialogue

One pedagogical standard described by Hilberg et al. (2006) is instructional dialogue. Lipka and Adams (2004) described how “the disjunction between communication processes in school and out of school within indigenous communities [sic] can lead to miscommunication and barriers to in-school learning” (p. 6). All three studies describe how teachers incorporated communication styles and structures characteristic of local Native American communities into instructional conversations. For example, Kisker et al. (2012) “adapted [typical] mathematical discourse to include expert–apprentice modeling” (p. 77). Lipka and Adams (2004) also used this approach.

Academic Language and Literacy Across the Content Areas

Hilberg et al. (2006) addressed the importance of learners developing competence in academic language skills across the content areas (p. 33). Lipka and Adams (2004) underscored the need for learners to practice and use terms central to the module content (p. 27). The pedagogical standards applied in the Hilberg study are defined by the Center for Research on Education Diversity & Excellence (CREDE) and include the following indicators:

1. Responding to student talk about familiar topics such as home and community.
2. Developing written and oral language through modeling, eliciting, probing, restating, clarifying, questioning, and praising in purposeful conversation and writing.
3. Interacting with students in ways that respect students’ preferences for speaking that may be different from the teacher’s, such as wait-time, eye contact, turn-taking, or spotlighting.
4. Connecting student language with literacy and content-area knowledge through speaking, listening, reading, and writing activities.
5. Encouraging students to use content vocabulary to express their understanding.
6. Providing frequent opportunity for students to interact with each other and the teacher during instructional activities.
7. Encouraging students’ use of first and second languages in instructional activities.

Teachers and Students Producing Knowledge

Hilberg et al. (2006) asserted that learning is most effective when experts and novices engage in a dialogue while working together and when “teachers and students work jointly to solve practical, real-world problems” (p. 33). Kisker et al. (2012) defined this as a “joint productive activity, a collaborative structure in which the teacher works in parallel with the students” (p. 80).

Connecting to Students' Lives Through a Cultural Context

Hilberg et al. (2006) defined this as contextualizing teaching and curriculum in the experiences and skills of each student's homes and communities (p. 33). Each study sought to link out-of-school mathematics knowledge in traditional American Indian activities to school mathematics (Hilberg et al., 2006, p. 37; Kisker et al., 2012, p. 77; Lipka & Adams, 2004, p. 8).

Lipka and Adams (2004) listed traditional and contemporary American Indian stories, games, and visuals as ways to connect content to a local American Indian context (p. 8).

Kisker et al. (2012) described how curriculum developers engaged in everyday activities with local American Indian elders, discussed the mathematics embedded in the activities, and then developed school-based mathematics activities (p. 79).

Kisker et al. (2012) and Lipka and Adams (2004) described how they incorporated a culturally responsive approach by using storytelling to frame content (Kisker et al., 2012, p. 81).

Cognitive Challenge

All three studies in the evidence review described how a culturally responsive approach was used to support students in meeting high standards and developing “cognitive complexity.” Hilberg et al. (2006) underscored the importance of challenging instructional activities by stating, “[Students], particularly those of limited standard English proficiency, as is oftentimes the case with American Indian students, are often not held to the same high standards as mainstream or majority culture students, thus hindering achievement” (p. 33).

References

- Hilberg, R. S., Tharp, R. G., & DeGeest, L. (2006). The efficacy of CREDE’s standards-based instruction in American Indian mathematics classes. *Equity & Excellence in Education, 33*(2), 32–40.
- Kisker, E. E., Lipka, J., Adams, B. L., Rickard, A., Andrew-Ihrke, D., Yanez, E., & Millard, A. (2012). The potential of a culturally-based supplemental in mathematics curriculum to improve the mathematics performance of Alaska native and other students. *Journal for Research in Mathematics Education, 43*(1), 75–113.
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