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EVALUATING EFFICACY OF ENVIRONMENTAL EDUCATION PROGRAMMING

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CLARK FORK WATERSHED EDUCATION PROGRAM

MONTANA TECH

MONTANA

Evaluating Efficacy of Environmental Education Programming

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ABSTRACT:

The Clark Fork Watershed was declared a Superfund site in 1983 and the State of Montana filed its complaint against Atlantic Richfield Company (ARCO) shortly thereafter for recovery of damages to the watershed. The series of settlements from this suit marked the beginning of the era of Superfund in the Clark Fork Watershed, which has resulted in major changes in the landscape and ecosystems of the areas surrounding the Clark Fork River (Connole (Brandl), 2016).

Founded in 2005, the Clark Fork Watershed Education Program (Cfwep.Org) was formed to help students and local citizens better understand the nature of the Superfund status of the watershed, and to create a legacy of environmental stewards who would ensure that the clean-up was not only successful in the short-term, but sustained for the long-term. In environmental education programming, evaluations that meet the gold standard for education research are limited. Most program evaluations have small sample sizes and do not have statistical power that allows researchers to draw firm conclusions about the effect of the programming. While most environmental education proponents argue that programming is not only effective, but also critical to the health and well-being of students, the data to support this claim are somewhat lacking as there are few large-scale studies available (Coertjens, et. al 2006; Duvall & Zint 2007; Liebermann and Hoody 1998; Semken & Freeman 2008; Sobel, 2004; West 2015). While the Cfwep.Org program evaluation is still limited, the large data set and long-term look at program efficacy provides an intriguing study.

Cfwep.Org staff visit with students for 4 days to provide background information and mining-related science lessons; a couple of days later, students are taken on a fieldtrip to assess the health of a restored stream, tour remediated sites, and then brought to Montana Tech's campus to review the data and draw conclusions. Since 2008, student data outcomes were collected in the form of a test administered by teachers prior to the 4-day classroom visit (pre-test) and the same test administered a few days after the fieldtrip (post-test). The test has been modified over the years, therefore, only data from 2012-2016 were analyzed for this paper, since the test is comparable during this 4-year period. The 2012-2016 test consists of 18 questions. Eight of those questions are attitudinal survey questions – four about stewardship and four about the science process. Analysis of the attitudinal items is completed by calculating Cohen's *d* effect sizes (Cohen, 1977). The remaining ten questions test for knowledge about the background issues and science-related questions. The tests are completed by students using Scantron answer sheets and are scored using the Apperson Grademaster 600 scanner.

Results indicate that Cfwep.Org effectively reaches the program goals of increasing students' understanding of the nature of the ecological impacts within their watershed as related to historic mining damage and to increasing stewardship of newly restored landscapes. Data sets from 2012-2016 were evaluated for student knowledge gains and include 2,272 students' pre-tests and 2,251 students' post-tests. Data sets from 2013-2106 were evaluated for attitudes toward science and disposition toward caring for the environment and include 1,479 students' pre-test surveys

and 1,460 students' post-test surveys. The results of this study indicate that the program's goals are being achieved. Students gain significantly on knowledge surveys, with a 30% overall gain pre- to post-test. The student knowledge gains were strongly statistically significant ($p < 0.001$). Students also move toward greater positive responses in both attitudes toward science and disposition toward caring for the environment with Cohen's d effect sizes of *medium effect* for caring toward the environment ($d = 0.52$) and *small effect* of positive disposition toward science ($d = 0.24$).

Cfwep.Org programming has a positive impact for students' attitudes and disposition as well as their understanding about the issues related to the Superfund status of the Clark Fork. Programming like Cfwep.Org's requires a time commitment from teachers and school districts. The essential question for administrators and teachers is whether or not the programming is effective. In other words, do students benefit from the programming or is the programming a waste of time in terms of knowledge gain? The results of this study indicate that not only is the programming effective in terms of knowledge gains about science topics, but also effective in helping students develop a positive attitude toward science overall. Because students are engaged in meaningful, relevant, data collection related to something they already care about (the environment), they begin to display more positive disposition toward collecting and analyzing that data. The context of the environment and their local community is powerful for engagement and interest (Sobel, 2005). The National Research Council has recommended that students be engaged in relevant and meaningful projects that relate to their environment and society (NRC, 2012). Engagement ensures that students will spend greater effort learning materials and are less likely to give up on learning a new topic.

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