The Impact of a Science Fair on High School Students’ Feelings of Self-Efficacy in STEM

Abstract

The purpose of this present action research study was to describe secondary students’ feelings of self-efficacy in science, technology, engineering, and mathematics (STEM). Through a curriculum linked to a science fair project, the teacher-researcher focused on student-participants’ perceptions of perseverance and task completion linked to STEM courses and postsecondary STEM careers. A Likert scale pretest (n=44) and posttest (n=33) based on Bandura’s model of four categories of self-efficacy (mastery experience, vicarious experiences, verbal/social persuasion, and emotional/psychological states) was administered to middle to low income students at a high school in Pennsylvania in the fall of 2018.). Data was also collected data through semi-structured interviews, informal interviews, teacher journal entries, observational field notes, and concept maps. Findings revealed that there was a 3.19% decrease across the cumulative average of all participants in STEM self-efficacy, and a 0.25% increase in the cumulative average of the economically disadvantaged group.

Three domains were measured in this action research: social, academic, and emotional. For the social domain, there was a 0.84% decrease in scores across the entire population, with scores of 33.75 on the pretest and 33.47 on the posttest. Within this domain, average scores for the economically disadvantaged population increased by 5.81% pretest to posttest from 33.83 to 35.8, respectively. Academic domain scores decreased by 3.27%, from 33.18 pretest to 32.10 postest. In the same domain, economically disadvantaged students decreased from 3.61%, from 33.75 pretest to 33.54 posttest. Lastly, emotional scores dropped 5.99% among the entire population, from 31.09 pretest to 29.23 posttest and emotional scores in the economically disadvantaged decreased by 4.79%, from 30.25 pretest to 28.8 posttest. This data was
polyangulated through semi-structured interviews, informal interviews, teacher journal entries, observational field notes, and concept maps.

To improve participation of economically disadvantaged students in STEM science fairs, an action plan of researching, developing, and sharing strategies for self-efficacy in learners will be developed. This data is helpful as it provided a platform for an action plan to be facilitated to improve the Science Fair preparation process to promote STEM self-efficacy.

KEYWORDS: Bandura self-efficacy, Bloom Taxonomy; metacognition, secondary education, STEM education, science fairs and self-efficacy