

Kathy D Melendez

American Federation of Teachers Leadership School

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Action Research: Certification and Endorsement of Computer Science/Computer Technology
Degree Holders as STEM Teachers

ABSTRACT: Action research has been completed regarding the determination of which endorsements are qualified to teach STEM classes, and recommendations to rectify the issue in New Mexico. STEM teacher endorsements are not equal, or are course descriptions equal across all states departments of education. The literature review found that most states determine only endorsements in science and math for STEM classes. Because of this computer science/computer technology endorsed teachers are not allowed to teach STEM classes. Surveys of professionals in education supports the literature findings.

Science, Technology, Engineering and Math, known as STEM, is not one single subject that should be taught by teachers certified in only math and/or science. STEM education is intended to be integrated and taught by educators who have an interest in all four disciplines, and who may only be certified in one of the four. However, the State of New Mexico Public Education Department (NMPED) does not have any description of nor does it have any specific information regarding endorsements of educators who teach STEM. States across the U.S. do not agree on what STEM should be or the teacher qualifications outside math and science. The question remains; how can states and the U.S. Department of Education set criteria for endorsing teachers for STEM who are qualified in at least one of the four disciplines? In this case, specifically, the research tackles the question; "How can state departments of education

and the U. S. Department of Education allow Computer Science/Computer Technology educators to be endorsed to teach STEM classes, without having a degree in math or science?"

Every Student Succeeds Act (ESSA) defines stem as "a school, or dedicated program within a school, that engages students in rigorous, relevant, and integrated learning experiences focused on science, technology, engineering, and mathematics, including computer science which includes authentic school wide research." (Jolly)

This definition is also in line with the recommendations from the National Academy of Engineering (NAE) and the National Academy of Science (NAS), which emphasize STEM as an integration of the four STEM subject areas involved.

Paige Prescott, President, of the Computer Science Teachers Association of New Mexico, answered my inquiry regarding STEM in New Mexico in this manner:

"My current understanding of licensure - CS specific a CTE license is what is recognized and in the past few years there was pressure to have all CS classes taught by a CTE teacher. However, they now recognize that this is causing districts to either do less CS classes or to hide the CS classes under different codes.STEM licensure-I have not heard of a 'STEM educator' endorsement nor have I heard of anyone at PED talking about it. However, I agree with you on STEM courses, especially in middle school, being taught by anyone with a science, math, engineering or technology credits/license. " (Prescott)

STEM does not have commonality in all 50 states. Many states assume that science and math teachers should be the primary teachers of STEM. However, according to Scott

Garofala, in his article *Computer Science: The Ignored Science*, "the gaping hole left out in student learning? Computer Science." (Garofala)

STATES SURVEY RESULTS:

STATE	STEM PROGRAMS	ENDORSEMENTS
Massachusetts	Yes	math, science; in process of adding computer science endorsement
Ohio	Yes	Math, science, computer science
Maryland	Yes	No information
Washington	Yes	STEM renewal in 2019
Michigan	Yes	Areas in which content they teach (e.g. math)
New Mexico	No course descriptions	Math, science

Figure 1 Results of Literature review of States Department of Education and Surveys of same

New Mexico PED does not have either STEM teacher descriptions, or course descriptions in the Student Teacher Accountability System (STARS) manual. The category listed as science technology engineering and mathematics has course listings; some without any designated endorsement, such as in the International Baccalaureate Computer Science class and the AP Computer Science A class. (NM PED Licensure). Should these high school courses not have endorsements attached, such as Technology Education?

EDUCATOR SURVEY RESULTS: Eight questions were asked of educators on a survey with 23 responding. 73.9% teach in middle school, 8.7% in elementary the remainder in high school. 43.48% teach STEM. 60% offered as math or science, 40% elective. Computer science is offered as math credit in 70% of the respondents' schools. Importance of computer technology endorsement as follows:

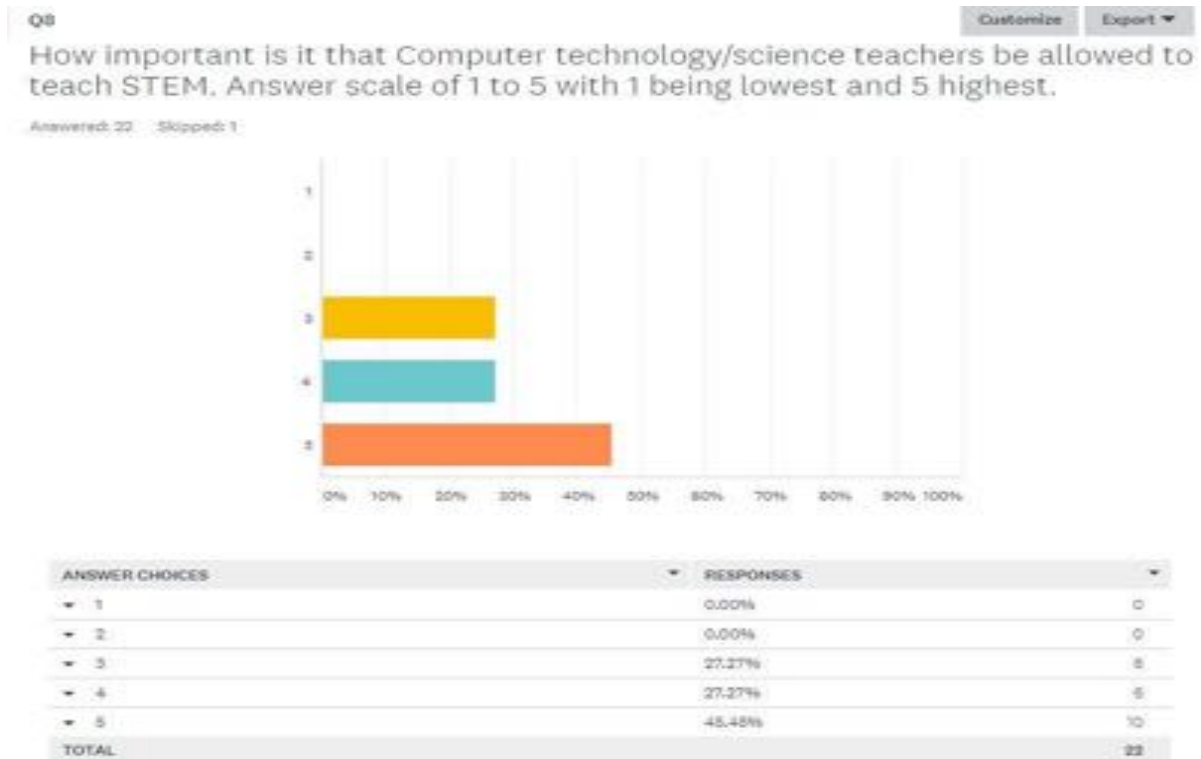


Figure 2 Question 8 of Survey of Educators

The outcomes of this research are to bring awareness to the U.S. Department of Education, New Mexico PED, and school districts that STEM is an integrated program, and educators with qualifications for each discipline in the word STEM should be able to teach the subject, STEMt. Problem based learning or inquiry learning is not exclusive to science, or math. Computer technology and engineering design are a vital part of the equation, and any state department of education, that either has developed or is in the process of developing STEM programs as stand alones of science and math, do not have a full understanding of STEM. Therefore, the desired outcome of this research is to show evidence that computer science/computer technology endorsed educators have the same expertise to teach STEM courses that math and science teachers have. The next step is to work with a senator or

representative in the New Mexico Legislature to develop a memorial to study this issue further and move it to legislative action.

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