EXAMINING THE RELATIONSHIP BETWEEN SCIENCE TEACHERS’ EPISTEMOLOGY AND SELF-EFFICACY ON SCIENCE INSTRUCTIONAL PRACTICES AND CONCEPTUALIZATION OF STUDENT RESEARCH EXPERIENCES ROOTED IN THE NEXT GENERATION SCIENCE STANDARDS

Nicole J. Griffin
Science Teacher, Carmel, New York
Dissertation Chairperson: Catherine O’Callaghan, Ph.D.
Dissertation Committee Members: Harry Rosvally, Ed.D., Wes DeSantis, Ed.D.

Abstract & Introduction

Teachers’ values, beliefs, and self-confidence are critical components of decisions educators make every day, especially as they implement the Next Generation Science Standards. The purpose of the study is to examine the relationship between secondary science teachers’ epistemology and self-efficacy on science instructional practices and conceptualization of student research experiences rooted in the Next Generation Science Standards. A mixed methods explanatory sequential design will be utilized to examine the variables: The Science Teachers’ Beliefs about Science Survey (STBAS), Self-Efficacy to Teach Science in Integrated STEM Framework (SETIS), and the Science Instructional Practice Survey (SIPS) will be administered to secondary science teachers. A follow-up semi-structured interview will be administered to secondary science teachers, chosen based upon STBAS scores, to gather an understanding of the conceptualization of science instructional practices related to student research experiences.

Science, Technology, Engineering, and Mathematics (STEM) is integral to our lives (National Research Council, 2012). It requires a workforce equipped to tackle the problems of the future. Science instruction is critical to the development of a scientifically literate society (National Academies of Sciences, Engineering, and Medicine, 2015). The Next Generation Science Standards (NGSS) were developed to address this critical need. NGSS calls for teachers to be proficient in teaching practices, crosscutting concepts, and science and engineering practices (National Academies of Sciences, Engineering, and Medicine, 2015). The purpose of this study is to examine the relationship between secondary science teachers’ epistemology and self-efficacy on science instructional practices and conceptualization of student research experiences rooted in the Next Generation Science Standards.

Rationale

- Teacher’s beliefs more predictive than content knowledge or instructional strategies (Huling, 2014)
- Perceived self-efficacy strong predictor of behavior (Bandura, 1997)
- Changing instructional practices and beliefs related to student learning can improve participants’ self-efficacy (Mara, 2015)
- Science Instructional Practices and Conceptualization of Student Research Experiences Rooted in the Next Generation Science Standards. The purpose of the study is to examine the relationship between secondary science teachers’ epistemology and self-efficacy on science instructional practices and conceptualization of student research experiences rooted in the Next Generation Science Standards. A mixed methods explanatory sequential design will be utilized to examine the variables: The Science Teachers’ Beliefs about Science Survey (STBAS), Self-Efficacy to Teach Science in Integrated STEM Framework (SETIS), and the Science Instructional Practice Survey (SIPS) will be administered to secondary science teachers. A follow-up semi-structured interview will be administered to secondary science teachers, chosen based upon STBAS scores, to gather an understanding of the conceptualization of science instructional practices related to student research experiences.

Further study is needed to understand teacher epistemologies, perceived self-efficacy, and how they influence science instructional practices.

Theoretical Framework

Constructs
- A perspective that acknowledges that knowledge lies in the minds of individuals, who construct what they know based on their own experiences.
- Five assumptions of constructivist conditions for learning are: embody learning in complex realistic and relevant environments, provide for social negotiation as an integral part of learning, support multiple perspectives, the use of multiple modes of representation encourages ownership in learning, and nurture self-awareness of scientific knowledge.

Epistemology
- A branch of philosophy related to the study of knowledge and beliefs that has been shown to influence instructional practices.
- Four epistemological themes that could influence scientific inquiry and science teaching and self-efficacy to teach science in an Integrated STEM framework, impact science instructional practices rooted in the Next Generation Science Standards and Science Teaching Practices.
- Non-directional. There will be a significant correlation between the predictor variables of personal epistemology regarding science and science teaching and self-efficacy to teach science in an Integrated STEM framework, impact science instructional practices rooted in the Next Generation Science Standards and Science Teaching Practices.

Research Questions

1. To what degree and in what manner does a science teacher’s epistemology regarding science and science teaching and self-efficacy to teach science in an Integrated STEM framework, impact science instructional practices rooted in the Next Generation Science Standards and Science Teaching Practices?

2. How do science teachers conceptualize science instructional practices in the classroom in terms of student research experiences in relation to underlying science teachers’ epistemology regarding both science and science teaching?

Research Design

Explanatory sequential mixed method design
- Quantitative component (Hayes et al., 2016; Mobley, 2015; Payne, 2007)
- Qualitative component (Mobley & Clark, 2011)

Analysis

- Quantitative Analysis: Multiple Regression
- Qualitative Analysis: Conceptualization, Self-Efficacy

Limitations

- Inability to manipulate the independent variable
- Difﬁerential selection

Instrumentation

- Measure of science teacher’s personal epistemology
- Measure of self-efficacy of science teachers
- Total of 24-items with 6 subscales assessed by a four-point Likert scale survey instrument (Payne, 2007)
- Demonstrates acceptable validity and reliability