EXPLORING TEACHERS' PERSPECTIVES ON THE IMPACT OF OUT-OF-SCHOOL SCIENCE-BASED PROGRAMS FOR SECONDARY LEVEL PHYSICS CLASSROOMS IN NEBRASKA

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This exploratory phenomenological study investigates the lived experiences of six high school physics teachers in Nebraska regarding their perceptions on the impact of participating in a science-based out-of-school program.

By exploring the research question, we discover how this experience relates to these teachers' self-concept and professional growth. Open-ended, semi-structured, one-on-one interviews are used as the data collection method to explore teachers' perceptions. Responses reveal that teachers participating in the Cosmic Ray Observatory Project (CROP) as a means of exploring advanced, extracurricular physics projects perceive their participation as an opportunity for enrichment, collaboration, helping their students, and empowerment. Intertwined in the presented narratives, teachers refer to their schools' limited administrative support as a source of struggle tied to the challenge of balancing school and teaching responsibilities with CROP participants' responsibilities.

This study proposes teachers must feel confident with their specific subject area to achieve a progressive view of self, and that supplemental professional development opportunities are crucial to physics teaching.

DEDICATION

I dedicate this dissertation to CROP physics teachers. The experience of exploring multiple realities is a unique, lifelong, ongoing journey. It is my hope that I can empower and validate their perceptions and experiences to design better research, strategies, and assistance for our teachers.

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CHAPTER I

INTRODUCTION

Context of the Study

Teaching, like many professions (such as medical and legal), requires constant and ongoing learning. Teachers receive extensive formal training, including four years of college classroom work, in many cases one year of apprenticeship, and post-BA credits to maintain certification. All of this training is necessary because students need more than planned curricula and substantial classroom time to succeed.

Out-of-school programs have long been known to engage students and teachers with exciting experiences that will help them enrich their academic skills in a number of fields. Many out-of-school programs are also considered to be high-quality teaching development opportunities. Some of these out-of-school opportunities are: engaging in conferences, hands-on training, mentoring, and even college coursework to strengthen participants' learning experience and deepen their understanding of research.

Universities and colleges are well-suited to participate in or sponsor out-of-school programs with their local school districts. For example, college educational outreach programs can staff these programs with students from their respective departments, allowing participating teachers to enhance their teaching methods, classroom management skills, and content understanding. These experiences could support teachers working with students in a smaller, less formal setting, thus providing them with insight into building student-teacher relationships during the regular school day. Teachers who participate in out-of-school programs with their students could be given the latitude to

experiment with delivering content in fun, engaging and interesting ways, which can be more difficult to do during the regular school day.

In my experience, programs that directly work with K-12 science teachers often report that the flexibility and creativity that they bring to an out-of-school program can directly transfer to their teaching during the regular school day, which strengthens their teaching methods; however, a deeper exploration into teachers' experiences and perspectives about participating in science-based out-of-school programs is needed to understand the role that this experience plays on their self-concept as educators and their content knowledge development. If we are to improve the way science (i.e., physics) is shared, we ought to understand teachers' viewpoints.

This study looks to explore teachers' perceptions in regard to their participation in UNL's Cosmic Ray Observatory Project (CROP). Understanding teachers' experiences, and the potential educational and professional effects of their participation in a concept-specific physics-based program such as CROP, may help us gain a deeper understanding of teachers' perceptions in terms of their self-concept and content knowledge enhancement, as well as identify CROP training activities that serve as professional development opportunities for participating physics teachers.

In addition, examining teachers' in-depth reflections on this topic will provide a more transparent understanding of how a science-based out-of-school program phenomenon is viewed.

Purpose of the Study

Building on the limitations of the existing research, this qualitative, exploratory phenomenological study is designed to explore perceptions of high school physics teachers with regards to their participation in UNL's Cosmic Ray Observatory Project (CROP). A total of twelve CROP high school physics teachers were invited to participate in this study. Of interest are the teachers': self-concept and professional growth in terms of experiences, knowledge enrichment, perceived motivations provided by CROP (professional development), and impact on teaching.

Research Question and Sub-questions

The research question for this study is *what meaning do teachers participating in CROP ascribe to that experience?* Three sub-questions will guide this study:

(1) How does teachers' participation in CROP affect their development in terms of professional growth?

(2) How does teachers' participation in CROP affect their self-efficacy in terms of self-concept?

(3) How do teachers' life experiences influence their participation in science-based out-of-school programs?

The research design of this exploratory, qualitative phenomenological study will follow a social constructive approach in order to explore and develop an in-depth understanding of teachers' views and perceptions. As in any exploratory

phenomenological study, this study will describe the meaning of the teachers' life experiences about this phenomenon and relate them to a social constructivism paradigm.

Definition of Key Terms

In this section, I provide a glossary of key terms and their definitions. For the most part, concepts that are commonly used in the research of out-of-school programs and teachers' perceptions will be listed and defined. Additionally, terminology used in qualitative research will also be provided for readers who are less familiar with this methodological approach. For more information on any term or topic, please refer to the associated citation.

Out-of-school programs refer primarily to activities before, and after school hours, as well as summer educational activities that take place when the regular school schedule allows and are housed in either a school, university, or community organization. The term *out-of-school* will encompass a comprehensive effort that responds to the needs of program participants during out-of-school times by offering non-curricular activities and project-related assistance that helps participants develop and/or enhance physics content knowledge. The National Institute on Out-of-School Time (NIOST) defines out-of-school time as encompassing "a wide range of program offerings for young people that take place before school, after school, on weekends, and during the summer and other school breaks" (NIOST, 2000a, p. 1). Typically these programs are designed to offer opportunities for experiencing consistent relationships with peers and educators, and to help participants develop skills, explore interests, and strengthen academic skills.

Out-of-school science-based programs for this study will generally be defined as any extracurricular activities designed to further explore the more complex concepts in physics, including some not usually covered in the traditional high school curricula. Furthermore, out-of-school science-based programs for this study relate to a series of activities serving high school physics teachers and their students in an effort to contribute to extracurricular physics knowledge attainment tied to state and national science standards.

Out-of-school science-based project workshops often involve science coursework, hands-on experience, or demonstration and training by experts over short blocks of time. These are courses aimed at providing teachers with specific scientific knowledge and skills that can be incorporated into their regular teaching practices at school. Workshops may typically be short events of one day; however, summer events involve longer-term learning experiences at universities or colleges around the same specific science topics of interest, in-depth scientific concepts, new technologies, and/or new advanced subject matter when appropriate.

Type of schools in this research study will refer to teachers working in the public and private school systems. Public schools, according to the U.S. Department of Education (2015), are operated or funded by the state, federal, and local governments from which they get their funds. In most cases, they admit all students who live within the borders of their district. These schools must follow the basic academic curricular requirements set by the state, federal, and local governments.

Private schools rely on tuition payments and funds from nonpublic sources such as religious organizations, endowments, grants, and charitable donations. Since private

schools receive little or no money from state and local governments, they usually cost the same whether you live in or outside of the state (USDOE, 2015). In some cases, private schools may be coed or single sex. Although they follow the academic curriculum set by the state, this may be supplemented with required daily religious instruction and prayer (USDOE, 2015). About a third of the elementary and secondary schools in the United States are private (USDOE, 2015).

Type of school campus by location (urban, suburban and rural), based on the National Center for Education Statistics' (NCES) location categories, released in 2006 (IES, 2012) identifies the type of school campuses by location as follows:

Location	**Definition**
	Urban
Large	Territory inside an urbanized area and inside a principal city with population of 250,000 or more
Midsize	Territory inside an urbanized area and inside a principal city with population less than 250,000 and greater than or equal to 100,000
Small	Territory inside an urbanized area and inside a principal city with population less than 100,000
	Suburb
Large	Territory outside a principal city and inside an urbanized area with population of 250,000 or more
Midsize	Territory outside a principal city and inside an urbanized area with population less than 250,000 and greater than or equal to 100,000
Small	Territory outside a principal city and inside an urbanized area with population less than 100,000
	Rural
Fringe	Census-defined rural territory that is less than or equal to 5 miles from an urbanized area, as well as rural territory that is less than or equal to 2.5 miles from an urban cluster
Distant	Census-defined rural territory that is more than 5 miles but less than or equal to 25 miles from an urbanized area, as well as rural territory that is more than 2.5 miles but less than or equal to 10 miles from an urban cluster
Remote	Census-defined rural territory that is more than 25 miles from an urbanized area and is also more than 10 miles from an urban cluster
SOURCE: Office of Management and Budget (2000). Standards for Defining Metropolitan and Micropolitan Statistical Areas; Notice. Federal Register (65) No. 249.	

Table 1. *Type of school campuses by location based on the NCES' location categories (IES, 2012).*

Professional development refers to the professional development experiences that out-of-school programs offer to participating teachers. These will encompass all types of facilitated learning opportunities including workshops, conferences, hands-on activities, and informal learning opportunities given by the program. Professional development in this study refers to ongoing learning opportunities available to teachers through a science-based out-of-school program.

Self-efficacy, in the context of this study, relates to self-concept and will be defined as one's beliefs in his/her performance in certain settings, or how effective they feel in being able to accomplish specific activities. Bandura (1977) noted that "people's perceptions of their efficacy influence the types of anticipatory scenarios that they construct and reiterate" (p. 279).

According to Myers (2009), self-concept is a descriptive component of one's self, a set of one self's beliefs; it is made up of one's memories, and interacts with self-esteem, self-knowledge, and the social self to form the "self" as a whole. It includes past, present, and future selves where future or possible selves represent individuals' ideas. Thus, teacher self-efficacy within the context of this study refers to the perception or beliefs physics teachers have of their own teaching capabilities to bring out the desired outcomes of student motivation and learning (Myers, 2009, p. 35-68). It can also be described as teachers' self-beliefs about their own teaching performance. Teachers with high self-efficacy may feel they can successfully teach, and will approach a challenge with proficiency believing they will make a difference for their students. Bandura (1986)

suggests that teachers adapt their own behaviors and efforts in accordance with "the effects they expect their actions to have" (p. 129).

Qualitative research is conducted for the purpose of understanding and explaining participant meaning through studying the "lived experiences" of the participants and allowing researchers to explore variables that may be unclear or ambiguous. This approach is a situated activity that locates the observer in the world (Creswell, 2013).

Phenomenology is defined as a qualitative approach that describes several individuals' common meaning of their lived experiences of a phenomenon. The focus of this method is "to describe what all participants have in common as they experience this phenomenon" (Creswell, 2013, p. 76). Phenomenology allows the researcher to go back "to the things themselves" (Moustakas, 1994, p.26) and ask the participants how they make meaning of their experiences in connection to a phenomenon.

STEM is an acronym that refers to the academic disciplines of science, technology, engineering, and mathematics. This term is typically used when referring to education policy and curriculum choices in schools to improve competitiveness in an array of sciences and/or technology development.

Secondary science teacher, in the context and purpose of this study, is an individual who teaches physics to high school students (grades 9-12).

Delimitations

The delimitations of this study are:

- This study focuses on a group of individuals who have all experienced the phenomenon and looks to explore it. These individuals are part of a group of high school physics teachers participating in UNL's Cosmic Ray Observatory Project (CROP) in the Midwestern state of Nebraska.
- Since all recruited individuals for this study shared a common lived-experience and are an active part of a particular group (CROP), sampling is considered purposeful. Criterion sampling, a much more narrow range of sampling, has also been considered since participants studied represent people who have experienced the same phenomenon and meet the same criterion in every case (Creswell, 2013). Recruitment of study participants is further described in Chapter III, p.53.
- All of the participants in this study must have participated in CROP for at least one year, and must live in Nebraska and teach high school physics in rural, urban and/or suburban private and/or public high schools. Although the number of years teaching varies, as does the type of teaching endorsement, the required criterion is participation in CROP.
- More than one teacher per school may participate, since each participant may give a unique perspective on their experiences (multiple realities).

Having set these delimitations, it is important to address issues of credibility and transferability in this study. An important distinction should be made regarding the traditional indicators typically used to assess the boundaries of a quantitative study.

Because this dissertation study builds on the qualitative tradition, the concepts used in quantitative research such as internal validity, external validity, generalizability, and reliability are not applicable in this project. Instead, I will focus on the following qualitative research standards of validation: credibility, transferability, dependability, and confirmability. These concepts parallel the evaluation criteria in quantitative inquiry, with credibility corresponding to internal validity in quantitative research, transferability to external validity or generalizability, dependability to reliability, and confirmability to objectivity (Lincoln & Guba, 2000).

Briefly defined, credibility has to do with the internal consistency of a study, namely, how the research findings match reality. Merriam (2009) has described credibility as answering questions such as "how congruent are the findings with reality? Do the findings capture what is really there?" (p. 213). Credibility can be achieved through an array of validation strategies including being immersed in the field being studied, having prolonged association with the participants, and using peer debriefers or reviews. In terms of this latter strategy, Creswell (2007) has described peer debriefing as "an external check of the research process…" (p. 208). Peer debriefing requires the researcher to work together with one or several colleagues who hold impartial views of the study. The impartial peers examine the researcher's transcripts, final report, and general methodology. Afterward, feedback is provided to enhance credibility and ensure validity. To achieve this, I met with colleagues who helped me discuss and navigate issues having to do with my research methods, conceptual frameworks, and interpretations. My peer reviewers are knowledgeable in the field of qualitative research, physics topics, and science-based out-of-school programming.

Transferability has to do with the extent to which a person can transfer the findings of the study to another population or context. In this project, the sample size chosen was not designed to represent all physics teachers in the U.S.; the findings may apply only to teachers participating in this particular out-of-school project and their specific experiences in this context. Thus, the findings of this qualitative inquiry are to provide readers with an in-depth understanding of the participants' experiences so that they can decide for themselves what information is transferable to other populations and contexts (Creswell, 2013).

Dependability denotes the consistency with which the research is conducted so that others can repeat the process. I followed a study conceptual framework and maintained field notes and memos throughout this project so that others can track the procedures and progress of my study. This way, other researchers can understand the process in which I implemented this study, and can follow the same or similar procedures. I will also provide explanations of, and examples from, my data analysis.

Confirmability is grounded in the recognition that research is not objective and that researcher bias is inevitable throughout the process (Lincoln & Guba, 2000). Because each person has his/her own subjective worldview, recognizing one's predisposition is important in qualitative inquiry. To address this phase, bracketing (epoche) may be done to set aside, as much as possible, all preconceived experiences in order to best understand the participants' experiences in the study. I will "bracket" myself by discussing my personal experiences with the phenomenon to partly set them aside. This does not take the researcher completely out of the study, but it does serve to identify personal experiences and put them aside.

". . . bracketing does not mean forgetting what has been experienced, but not letting past knowledge be engaged" while exploring others' experiences" (Creswell, 2013, p. 78).

Significance of the Study

The findings from this study may have implications for research and practice on out-of-school science-based programs. First, teachers' perceptions may play a critical role in influencing instructional practices. These may include views on teachers' self-concept, professional growth, and content knowledge enrichment. Therefore, if we are to improve the way science (i.e., physics) is taught, we must first understand teachers' educational experiences and how these impact the ways in which teachers implement instructional strategies in their lessons. According to Tschannen-Moran, Hoy, and Hoy (1998), educational experiences have been consistently suggested to be related to teachers' instructional practices in a variety of educational fields; however, although a positive relationship is generally accepted between the level of teacher self-efficacy and effective science teaching practices, other evidence suggests that this is not necessarily always the case. A clearer understanding of their perceptions and the connection to the impacts of their participation in out-of-school science-based programs is needed in order to effectively grasp the phenomenon from the teachers' point of view.

Second, this investigation is unique in its methodology, as it is a qualitative, exploratory phenomenology that follows a social constructive approach designed to explore high school physics teachers' perceptions regarding their participation in a particular science-based out-of-school program, CROP. Based on Moustakas (1994), this qualitative approach allows participants to describe their own lived experiences related to