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Autonomous Professional Learning through Practitioner Inquiry: A Study of Growth Plan System Experiences

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Autonomous Professional Learning through Practitioner Inquiry:

A Study of Growth Plan System Experiences

by

Daina Kelly Gaputis

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
with a concentration in Teacher Education
Department of Teaching and Learning
College of Education
University of South Florida

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Dedication

To George and Chanley, you make every day better.

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Abstract

The need for quality science education has long been established, but despite reform after reform, it remains a current concern. What we know as good teaching is not happening, perhaps because there is an increase in science teachers using alternative certification programs to enter the field. This lack of formal training causes teachers to have a reliance on professional learning opportunities to learn about reform-based science education. Unfortunately, traditional forms of professional learning are often inadequate, so newer professional learning designs have been established. Some of these newer designs, such as practitioner inquiry, offer teachers autonomy over how they assess and try to improve their practice. It is worthwhile to study these models, but it is not enough to solely look at these models externally; it is necessary to understand what happens within the professional learning itself. The problem is we cannot achieve that understanding until we know what the teachers actually experience as they engage in professional learning. How teachers conceptualize their professional learning experience is a critical voice.

The purpose of this qualitative multiple case study was to uncover this critical voice of secondary science teachers engaging in the Wilcox Science Education Fellowship (SEF), a professional learning program that provides an opportunity for teachers to rethink their practice and become leaders in their education community. In the second year of this program, fellows engage in autonomous practitioner inquiry through the design and implementation of a Growth Plan System (GPS) project. This study addressed one major research question regarding how Wilcox SEF fellows understand their experience designing and implementing their GPS project.

Three sub-questions were also answered regarding understanding how the fellows came to identify and articulate their GPS goals, what barriers prevented the fellows from investigating their GPS goals prior, and how their processes designing and implementing their GPS work contributed to an understanding of their work as practitioner inquiry. Addressing these research questions resulted in nine assertions. Each assertion was discussed in relation to the theoretical framework, existing literature, and implications. Suggestions were also made for future research.

Chapter 1: Introduction

Statement of the Problem

The deep need for quality science education has long been established (Darling-Hammond & Youngs, 2002), and despite reform after reform (Pitot & Balgopal, 2021), it remains a concern (Reimers, 2022). What we know as good teaching is not happening (Darling-Hammond et al., 2009; Stigler & Hiebert, 1999; Popova et al., 2021), perhaps because many science teachers have not had formal training in the teaching of science, instead receiving their credentials through alternative certification programs (Rushton et al., 2017). In the absence of formal training, science teachers must rely on professional development to learn about reform-based science education (Allen & Heredia, 2021; Somekh & Zeichner, 2009). Unfortunately, traditional forms of professional learning are often inadequate (Darling-Hammond et al., 2009; Eylon et al., 2020), so new forms are necessary (Clarke & Hollingsworth, 2002; Darling-Hammond et al., 2017). Newer professional learning designs, such as continuous professional development (CPD) and practitioner inquiry, afford teachers the opportunity to take charge in the way they assess and try to improve their work (Ciampa et al., 2017; Feldman et al., 2022; Mamlok-Naaman et al., 2016). One model of a professional learning design where teachers propose inquiry projects and receive support is the Wilcox Science Education Fellowship (Wilcox SEF) program[1]. To improve the quality of teaching and learning in science education, we must truly understand what happens in professional learning, and we cannot achieve that

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[1] For the purposes of confidentiality and anonymity, all names, locations, and institutions mentioned in this study have been replaced with pseudonyms.

understanding until we know what the teachers actually experience. In this dissertation study, I uncovered and how the Wilcox SEF fellows understood their experience designing and implementing an autonomous professional learning plan.

In teaching, professional learning refers to a variety of educational experiences ultimately designed to improve practice and outcomes (Darling-Hammond & McLaughlin, 2011; Patton et al., 2015). When professional learning enables teachers to improve their practice and increase student learning, it is deemed effective (Garet et al., 2001). Providing teachers with effective professional learning can improve their practice, help them remain more confident and effective in the classroom and reduce some of the challenges they face daily (Guskey, 2000, 2002), and effective professional learning is needed now more than ever due to a current climate of increased teacher anxiety coupled with substantial student learning loss (Kraft et al., 2021). Darling-Hammond et al. (2017) described seven tenets of effective professional learning: (a) being sustained, or continuous, in duration; (b) having a content focus; (c) incorporating active learning and adult learning theory; (d) including collaboration typically via job-embedded contexts; (e) offering coaching and expert support; (f) providing opportunities for feedback and reflection; and (g) using effective practice models. In autonomous professional learning, teachers are placed in the center of their own professional development and growth meaning they are responsible for choosing the topic for their professional learning which caters to their individual learning style and needs (Ciampa et al., 2017). Autonomous professional learning enables teachers to act purposefully and constructively to direct their professional growth and contribute to the growth of their colleagues (Calvert, 2016). Despite the knowledge that beneficial outcomes are common when teachers intrinsically seek and engage in autonomous professional learning (Darling-Hammond et al., 2017), there could be more literature pertaining

to the way teachers conceptualize the autonomous professional learning experiences they engage in.

The Wilcox SEF is a professional learning program that provides an opportunity for science teachers to rethink their practice and become leaders in their education community. In the second year of the Wilcox SEF program, fellows engage in autonomous practitioner inquiry through the design and implementation of a Growth Plan System (GPS) project. The program handbook describes the GPS project as an opportunity for teachers to perform inquiry based on a personal and district goal of their choice (Feldman et al., 2020). Thus, the professional learning the Wilcox SEF fellows engage in is autonomous in nature with each participant being empowered to establish GPS goals that best suit their needs as opposed to engaging in a scripted professional learning experience.

While it is important to look at the content a professional learning opportunity offers, it is equally as important to look at the way the professional learning opportunity is conducted and the process teachers undergo as they navigate their professional learning (Patton et al., 2015). However, reflecting on how a professional learning program is conducted from an outside or administrative lens leaves much unknown about the science teacher's actual experience as they go through the program. It is important to investigate this as we cannot fully understand what happens in professional learning without knowing what it is that the science teachers experience.

As a veteran science teacher, I often sat through mandated professional learning experiences that felt irrelevant to my personal practice and ineffective at accomplishing their articulated intention. As my doctoral studies allowed me to understand the tenets of effective professional learning and the variety of ways effective professional learning opportunities occur, I wondered why I had not been exposed to programming that reflects these tenets and sought to

identify opportunities where they may occur. Reflecting now, I realize that I never shared my personal experiences going through professional learning events outside of commiserating with other participants during post-event social meetups. If I had formally shared my personal experiences, the developers and facilitators would have had a more complete understanding of the professional learning experience, and that may have affected future program designs. It is useful to know how participants in my local Wilcox SEF program conceptualize their experience as they design and implement their GPS projects.

Studying the way fellows in my local Wilcox SEF program conceptualized their experience, specifically as it relates to the GPS project component, generated new knowledge on (a) the professional learning content science teachers desire and need; (b) how obtaining that learning has impacted their practice or knowledge; (c) what incorporating the tenets of effective professional learning, assuming their presence, looked like in a post-COVID-19 professional learning setting; and (d) barriers, if any, the fellows experienced that prohibited them from previously engaging in their GPS work.

Purpose of the Study and Research Questions

The purpose of my study was to investigate how fellows in the Wilcox Science Education Fellowship program conceptualized their professional learning experience, including how their prior lived experiences may have played a part in the development and implementation of their autonomous growth plan systems. In this study, I addressed the following questions:

1. How do Wilcox SEF fellows understand their experience designing and implementing an autonomous professional learning plan?

   a) How did the fellows come to identify and articulate their growth plan system (GPS) goals?

b) What barriers, if any, prevented the fellows from investigating their GPS goals

prior?

c) Did the fellows' processes designing and implementing their GPS work contribute

to an understanding of their work as practitioner inquiry, and, if so, how?

Through answering these research questions, I generated new knowledge on how

participants experienced their journey designing and implementing a personal growth plan

system and shed new light on professional learning. It is also important to note that the teacher

experiences I studied occurred during the COVID-19 pandemic, so I was attentive to any way in

which their experiences were impacted by the pandemic.

Significance of the Study

For nearly forty years, research has sought to clarify the ways in which reflective practice

can occur and its importance in education (Schön, 1983). Reflective practice, discussed in more

detail in Chapter 2, occurs when teachers use their self-awareness and pedagogical skills to

reflect on problems that arise during teaching (Benade, 2015). The ability for teachers to engage

in reflective practice to better their craft has long been documented (Clift et al., 1990; Schön,

1983). When immediate reflection occurs in the midst of teaching it is termed *reflection-in-*

action, and when reflection occurs after an event it is termed *reflection-on-action* (Schön, 1983).

When reflection on prior reflections allows for forward planning it is termed *reflection-for-action*

(Reid, 2004). Reflective practice through practitioner inquiry is valuable and increases student

learning (Zubizarreta, 2009), specifically in the science discipline (Feldman et al., 2022; Kyburz-

Graber, 2006). Bonner (2006) shared, "leaders in educational reform [are] declaring that teacher

learning is critical for student learning" (p. 29). Perhaps as a result of its effectiveness, we see

both preservice (Rutten, 2021) and established teachers engage in practitioner inquiry to better their practice and understanding of themselves as teachers (Aster & Bouwma-Gearhart, 2021).

The field of education is "uncertain and emotionally demanding" (Roeser et al., 2012, p. 168), and, as a result of that climate, many teachers experience feelings of stress in the workplace (Roeser et al., 2013). One way to reduce teacher stress is to empower the teachers to become more confident and better in their practice through effective professional learning (Pas et al., 2012). As the stressors teachers face in their workplace are causing many to leave the profession (Rumschlag, 2017), it is possible that reducing even a small part of the stress teachers experience may help reduce this attrition.

Throughout this study, science teachers engaged in interviews that offered them the ability to reflect on their teaching experiences and professional learning experiences while they were actively engaged in both teaching and professional learning (Tarrant, 2017). I describe this position as two-stance reflection during two-stance engagement. Understanding their experiences and assessing them through a lens of practitioner inquiry unveiled current professional learning needs of science teachers in my immediate community. It was valuable to do this work within my local community as there was an inherent "we-ness," (Bender, 1978, p. 7) with closer relationships binding the work. Community work is valuable; it has been a baseline for historical change (Bender, 1978), so considering the scalability of this program to one day make a larger impact was also beneficial. In answering the research questions in this study, I generated new knowledge regarding the professional learning of science teachers and contributed to improving teaching and learning in my local community.

Ethically, there was also significance to this work. Reflection allows for individuals to "mature as moral and ethical thinkers" (Cave & Vaccaro, 2010, p.3), and this study was

conducted through a methodology that required participant reflection. Understanding teacher thoughts and beliefs is necessary to "contribute to the ongoing, global goal to improve the quality of teaching and learning in conjunction with the experiences of what it is to be a teacher and a learner, or, hopefully, both" (Northcote, 2009, p. 78). Through providing an opportunity for individual participants to reflect during interviews as well as offering a cross-case analysis of those reflections and other data sources, this study unveiled how participants experience being a teacher and a learner simultaneously and offers insights that can be used to improve the quality of professional learning to benefit future teachers and students.

One way to assess validity is through workability; in essence, something is true because it is useful (Heikkinen et al., 2007). This study was significant because it generated knowledge that is useful. The knowledge produced by this study: (a) helped understand the ways teachers conceptualize their professional learning experiences; (b) provided insight on a professional learning opportunity science teachers in my local community may use to better themselves; (c) considered if the relatively small Wilcox SEF program may be scalable to make a greater impact; and (d) allowed each of my participants the opportunity to engage in additional reflective practice to better their craft and, in turn, increase student learning.

Researcher Reflexivity Statement

Reflexivity was defined by Simons (2009) as reflecting on how "your actions, values, beliefs, preferences, and biases influence the research" (p. 13). While I am currently a full-time doctoral student and mom of two young children, I have over a decade of experience teaching science, ranging from 4th grade to Advanced Placement (AP). I grew up in a suburban, middle-class neighborhood attending school through my local public school system, always looking forward to the "teacher workday" inscription that would sporadically annotate our family

calendar. As I graduated college with a Chemistry degree and decided to get into teaching, I found that my local school system favored applicants who had a degree in education and required those who did not to undergo certification testing. At that same time, a small independent day school offered me a position teaching fourth through ninth grade science. I accepted that position with a joy that I now only attribute to my youthful energy and naivete of the realities of needing to be prepared to teach five separate classes every day, two of which had joint grade levels (fourth and fifth grade were combined in one class, and I had one physical science student in my eighth-grade biology class). After that year, I was recruited by a prestigious, out-of-state independent school where I would have slightly fewer preparations and be able to teach specialty electives such as microbiology and organic chemistry, but with larger class sizes. After teaching at that school for six years, and earning my master's degree in secondary science education, I was recruited to teach at one of the most prestigious independent schools in my home state. This opportunity afforded me fewer preparations, smaller class sizes, ample planning time, supportive administrators, dedicated office space, and a larger salary. I taught there for three years until I became engaged and relocated so my fiancé and I could finally live in the same state. Truthfully, I still yearn for the amazing working environment I had in that school. In a twist of fate, my department chair's son attended a boarding school near where I was moving, and she mentioned me to their principal during parent weekend. I was once again recruited to an independent school, teaching all levels of chemistry, including AP, and it was while I was teaching at this school that I began my doctoral career.

I mention this journey because all the participants in my study are public school teachers, and while I began my career with the intent to teach in the public school system, my career organically evolved to only include faculty positions at independent schools. I have only

experienced the public school system from the student perspective. Throughout over a decade of serving on the faculty at four schools, day and boarding, large and small, one thing remained true: I dreaded the days when "teacher workday" was annotated on our family calendar.

I have always had a growth mindset and enjoyed learning new things. However, most professional learning experiences offered by my schools were mandatory, pre-designed events that left me feeling frustrated with their ineffective nature. I acknowledge this as these frustrations likely seeped into my doctoral research focus. My hope is that if better professional learning is offered to science teachers, their jobs may become less stressful and more enjoyable which may in turn increase student learning and reduce teacher attrition. It was not coincidental that I decided to embark on a journey to study participants as they engage in professional learning through designing and implementing autonomous growth plan systems.

Delimitations

The delimitations of this study are that the participants are all secondary science teachers in the public school systems of three neighboring counties: Pier County, a coastal county in the southeastern United States, Mountain County, bordering Pier County to the east, and Plains County, bordering Pier County to the north. All participants received training and mentorship through a program that is indirectly affiliated with their school, and they were financially compensated. Furthermore, as mentioned earlier, the professional learning the participants engaged in was autonomous in nature. Each participant was empowered to establish a growth plan system that best suited their needs as opposed to engaging in a scripted professional learning experience. A final delimitation of this study is that all the participants knew each other to varying degrees, as the professional learning program had a cohort-style structure.

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Limitations

One limitation of this study is that the participants belonged to a fellowship program where they are being paid a stipend. The fact that the participants applied for and entered into a fellowship program as well as agreed to take part in this research study demonstrates that the study participants may have had a predisposition and willingness to bettering themselves through both engaging in a professional learning fellowship program and an independent professional learning research study. However, it is worth noting that the stipend for the fellowship program was sizable, so it is possible that their motive for applying to the fellowship program was financial. Also, despite being informed otherwise, they may have felt a subconscious obligation to participate in my study since this study is about a program they belonged to that paid them a financial incentive.

I also volunteered with the Wilcox SEF for a few years, attending both in-person and virtual meetings. This means that over the course of their participation in the program, the participants may have noticed my presence whether in person or during a Zoom meeting. The fact that a potentially familiar face recruited them for a study may have made them feel a subconscious obligation to participate in the study.

Another limitation of this study is that by the nature of being involved in the Wilcox SEF program, all the participants were science teachers, and because of the parameters set forth by this study, all the participants were secondary school science teachers teaching in either the Pier County, Mountain County, or Plains County public school system. All the participants have had life experiences that have caused them to work in the same field and geographic region.

The small size of this study is another limitation. While the number of participants was selected purposefully, based on Creswell's (2018) suggestion to not employ more than four to

five cases in a multiple case study methodology, having a small sample size implies other perspectives, beliefs, and thoughts remain unknown. I addressed this limitation by engaging in transferability (Lichtman, 2013) and writing this dissertation in a detailed enough manner that it is possible to apply the knowledge gained in this study to other situations in a different context (Anney, 2014).

A final limitation is that I am the sole researcher in this study, so my personal beliefs, thoughts, and biases are inherently part of the process. To address this limitation, I utilized participant feedback, or member checking, to ensure I accurately captured the participants' perceptions, thoughts, and beliefs. I also engaged in peer debriefing with multiple colleagues, my dissertation committee, and other educational researchers to discuss my findings and interpretations. Finally, I kept a researcher journal to address my researcher reflexivity and document my beliefs, biases, and decisions that arose through the study. Member checks, peer debriefing, and the researcher journal are discussed in more detail in Chapter 3.

Definition of Terms

The need to have a common lexicon in the field of education has long been established, yet it remains an issue (McDonald et al., 2013; Zeichner, 2005). In effort to support the identified need for "clear and consistent definition[s] of terms" (Zeichner, 2005, p. 740), I have provided definitions for the following terms used in this this study:

- Wilcox Science Education Fellowship (Wilcox SEF) – a teacher-leadership program for established science teachers to learn, collaborate, and reflect on their classroom practice
- Fellow – a person who was enrolled in the Wilcox SEF program at Peninsula University
- Growth Plan System (GPS) – an autonomous practitioner inquiry project designed and implemented by second-year Wilcox SEF fellows to address both a professional goal

related to their district needs and a personal goal designed to address their individual professional learning needs

- Collaborative Coaching and Learning of Science (CCLS) – a specialized community of practice where teachers engaged in lesson study protocols during their first year of the Wilcox SEF

- Vertical Collaborative Coaching and Learning in Science (V-CCLS) – a specialized community of practice designed so that there was a focus on the vertical articulation of science content, meaning elementary, middle, and secondary science teachers are teamed together

- Horizontal Collaborative Coaching and Learning in Science (H-CCLS) – a specialized community of practice designed so that there was a focus on the horizontal alignment of science content, for example when all secondary chemistry teachers are grouped together

Chapter Summary

In this chapter, I stated the problem of the study and described the purpose and research questions of the study. Next, I explained the significance of the study and detailed my subjectivities and biases through a researcher reflexivity statement. Then, I described the delimitations and limitations of the study. Finally, I provided a definition of terms and abbreviations I use throughout the dissertation.

Chapter 2: Literature Review

I begin this literature review with a broader discussion on professional learning in the field of education. I then slightly narrow its scope with a dedicated focus on practitioner inquiry and professional learning in the science discipline. Finally, I narrow the scope once more to discuss a particular professional learning program in the science discipline that incorporates practitioner inquiry, the Wilcox Science Education Fellowship (Wilcox SEF) program. To begin the discussion on professional learning, I examine the difference between professional development and professional learning lexicon and review literature examining what it means for professional learning to be effective, covering common professional learning opportunities, professional learning benefits, barriers, and needs of adult learners. I also begin the discussion of practitioner inquiry by reviewing lexicon, purpose frameworks and modes of practitioner inquiry, theoretical frameworks for researching practitioner inquiry, and practitioner inquiry as a stance. In the next section, I explore characteristics of professional learning and practitioner inquiries in the science discipline, and I share vignettes to showcase how practitioner inquiry may look in secondary science classrooms. Finally, I review the Wilcox SEF program and the professional learning tenets and methods associated with the program.

Professional Learning

Once teachers are practicing in the field, they may continue their education through professional learning to study and improve their practice. It is important to understand how effective professional learning may be defined and how it may occur since many professional learning experiences are inadequate (Eylon et al., 2020). It is also necessary to discuss both

traditional and evolving methods of professional learning to understand what professional learning opportunities may be available to teachers seeking to better their practice.

Professional Development versus Professional Learning

In teaching, professional development refers to a variety of educational experiences ultimately designed to improve practice and outcomes (Darling-Hammond & McLaughlin, 2011; K. Patton et al., 2015). These opportunities may be mandatory or voluntary, collaborative or individual, and formal or informal (Desimone, 2011). Professional development and professional learning lexicon are often used interchangeably, but it is important to establish "clear and consistent terms" (Cochran-Smith & Zeichner, 2005, p. 740).

Engaging in professional development tends to be relatively inactive when compared to engaging in professional learning (Scherff, 2018). Specifically, Scherff (2018) wrote that professional development often refers to what "happens to" a teacher whereas professional learning sees teachers taking on an active responsibility to put what they are learning into practice (p. 1). However, this perspective does not account for the format in which the professional learning occurs and can be challenged by Lave's (2019) concept that, since learning and everyday life are intertwined, teaching itself can be conceptualized as learning (Lave, 2019). Professional learning can also be comprised of both formal and informal activities (Vaessen et al., 2014). If Teacher A reads an article and decides to implement a new lesson technique based on what she read, she would be engaging in professional learning through an informal activity, and if Teacher B registered to attend a specific workshop and then implemented the techniques learned in that workshop, he would be engaging in professional learning through a formal activity. Whether formal or informal, effective professional development creates the opportunity for professional learning to occur.

Over $2.5 billion is spent annually for professional development programs to serve public education teachers with some large, urban districts annually spending $18,000 per teacher to improve instructional practice (Noonan, 2019; Scherff, 2018; "Teachers Know Best," 2014). Much of the federal funding for professional learning in public education was previously to offer one-time workshops, seminars, or lectures generally facilitated with a one-size-fits-all approach (Guskey, 2003). A review of U.S. math professional development found that out of 643 published studies, only 32 were conducted with an research design that included effective professional learning practices and only two of the studies increased student outcomes (Gersten et al., 2014). The 2015 Every Student Succeeds Act (ESSA) required professional learning opportunities to be sustained, collaborative, and practice-based in order to be eligible for federal funding (Sims & Fletcher-Wood, 2021). Regardless, the default framework in which many teachers earn continuing education credits or attempt to grow in their field are single-event experiences where information is simply disseminated, treating teachers as inactive learners (Thomas, 2016).

Understanding what constitutes effective and ineffective professional learning can be done by problematizing professional development (Cochran-Smith & Fries, 2005; Zepeda, 2015). When the problem of professional development and professional learning is mentioned, this is not in a pejorative sense but rather considering professional learning as a problem that social science research addresses through analysis of issues, questions, and conditions pertaining to this area (Cochran-Smith & Fries, 2005). In this dissertation, I identified effective professional development opportunities as those which enable effective professional learning to occur, so the problem became redefined as what constitutes effective professional learning and

what are benefits, barriers, examples, and other factors that contributed to allowing effective professional learning to occur.

Effective Professional Learning Tenets

Historically, teacher professional learning has been the recipient of strong criticism (Derrington & Brandon, 2019), referred to as consisting of a "hodgepodge of incompatible workshops and courses" (McLaughlin & Berman, 1977, p. 191) and "superficial, episodic sessions" (Feiman-Nemser, 2012, p. 135). To understand the tenets of effective professional learning, we first must define what constitutes an experience as being effective. Effective professional learning occurs when teachers play a sustained, active role in constructing their knowledge, collaborate with colleagues, and gain knowledge directly related to their daily teaching practice and the diverse developmental needs of both themselves and their students Zepeda (2015). Furthermore, professional learning is effective when it focuses on active learning and specific teaching practices (Thomas, 2016). Darling-Hammond et al. (2017) supports this, stating that effective professional learning: "is content focused, incorporates active learning utilizes adult learning theory; supports collaboration in job-embedded contexts; models effective practice; provides coaching and expert support; offers opportunities for feedback and reflection; and is of sustained duration" (p.1). Coldwell (2017) elaborates on this declaring effective professional learning is that which allows teachers to feel confident in their abilities as educators; this includes professional learning that helps teachers demonstrate their skills and attributes or validates their knowledge.

Effective Professional Learning Tenets Through an Outcome Lens. Effective professional learning leads to enhanced teacher self-efficacy causing positive impacts on teacher behavior and eventually on student achievement (Lakshmanan et al., 2011; Zepeda, 2015).

Bandura (1977) defined self-efficacy as a person's belief regarding their ability to organize, execute, and complete a course of action to achieve a goal. When relating this definition of self-efficacy to teaching, it makes sense that the more a teacher believes in his or her own abilities, the more confident, resilient, able to solve problems, and learn from past experiences that person will be (Bangs & Frost, 2012), and in gaining these strengths, students will also benefit (Zepeda, 2015).

When determining if professional learning is effective by looking at student outcomes, it is important to ensure that positive student learning is not indicated solely by standardized test scores (Badiali, 2018) since the best predictor of high test scores is parental income and zip code (Berliner & Glass, 2014). Additionally, an overreliance on test scores as a measure of successful student achievement encourages teachers to narrow curriculum and eliminate what is not directly related to their students' test which does an overall disservice to the students and lessens the credibility of the teaching profession (Badiali, 2018; Sergiovanni & Starratt, 2007). However, when professional learning is shown to produce more productive and equitable student learning outcomes, such as collaboratively designed lessons that allow for high-quality differentiation for students of various learning levels, establishing social skills that will be vital to conflict resolution and democracy, and fostering a sense of community, it is deemed effective (Badiali, 2018; Burns et al., 2013). One math teacher commented: "I [used to view] teaching as an 8:30 – 4:30 job that only involved teaching mathematics. Now I have learned the true purpose of teaching – the students" (Ellerbrock et al., 2019, p. 122). When the goal of teaching is reaching students, one way to define effective professional is that which produces positive student outcomes (Zepeda, 2015).

Effective Professional Learning Tenets Through a Design Lens. Professional learning can also be determined to be effective based on the design of the structure and content in the professional learning curriculum. Effective professional learning has content that is inclusive and discusses equity, not only for student learners but also with respect to the teachers engaging in the learning (Carter Andrews & Richmond, 2019; Jacobs & Burns, 2021). The subject matter each teacher desires to learn may vary from individual to individual, so professional learning needs to ensure that teachers are able to meet the academic and social needs of a culturally diverse student population and enable teachers to refine their pedagogies and practices appropriately (Carter Andrews & Richmond, 2019; Prenger et al., 2017). While this is discussed in more detail later in this paper via literature focused on adult learners, effective professional learning must take into account the fact that the teachers who are participating in professional learning are adults, each bringing their own personal and professional identities and beliefs with them to their professional learning experiences (Noonan, 2019). The design of the professional learning experience needs to account for the in-service context as well as teacher identity (Carter Andrews & Richmond, 2019). With regards to teacher identity, teachers need to be aware and willing to critically reflect on the ways in which their personal and professional identities may influence their ability or inability to meet the needs of diverse student populations. Effective professional learning must provide a safe space for this vulnerable reflection to occur (Carter Andrews & Richmond, 2019; Larrivee, 2000).

It is also important to note that a teacher's personal career stage or goals may alter the effectiveness of any one professional learning experience. As Guskey and Huberman (1995) discuss, a second-year teacher will have different preoccupations than a teacher who has been teaching for 30 years. Also, teachers who have more perceived intentions to stay in the

profession are frequently associated with a higher level of engagement in the professional learning (Coldwell, 2017). In the event that a teacher does not necessarily have a perceived intention to remain in the field or is newer to the profession, the quality of training, knowledge outcomes, and the opportunity to meet teachers from other institutions may increase their engagement in professional learning (Coldwell, 2017).

The process in which professional learning occurs is as important as the content it provides (Patton et al., 2015). Professional learning is most likely to increase student learning when it occurs through an ongoing and systematic process (Lakshmanan et al., 2011), and it is important to acknowledge that change does not happen overnight (Glusac, 2008; Ratcliffe & Millar, 2009). The professional learning experience should be designed so that teachers buy-in and view it not "as something being done to them, but instead as something being done for them and with them." Teachers need to truly believe that what they learn "produces changes for their students and their classrooms" (Thomas, 2016, p. 6). Even in 1995, this sentiment was already present when Guskey & Huberman wrote:

> simply some of the best conditions for conduction professional development [are] collaborative work with one's peers; assistance and training from experts; access to new materials and technologies; intensive experimentation in which all novices are allowed to fail and each success can be celebrated (p. 207).

Achieving this is easier said than done; one study asked teachers about the impact of their past three years of professional learning experiences, and less than 25% of the participants reported that their professional learning had affected their instruction (Hill, 2009; Hudson et al., 2002).

Common Professional Learning Methods

The unfortunate reality is that the traditional professional learning opportunities commonly presented to teachers often do not reflect the tenets of effective professional learning. One teacher reflected that professional learning is usually a "1-day deal, and you usually walk away from it feeling very guilty because, you know, you've just found out about 20 things that you don't do" (Goodnough, 2010, p. 930). These "one-shot" (Knight, 2009, p. 18) workshops used to be the most frequent professional learning opportunities presented to teachers by administrators (Darling-Hammond et al., 2009; DiPaola, 2018; K. Patton et al., 2015) despite being "notoriously unproductive" (Nieto, 2009, p. 10). Utilizing a school's already-scarce resources on them has even been referred to as malpractice (Sparks, 2013; Zepeda, 2015).

Thankfully, a plethora of effective professional learning opportunities exist for teachers to engage in such as participating in professional learning communities, performing action research, teacher research, or practitioner inquiry, completing coursework or reading literature to generate new knowledge, presenting at or attending at conferences, serving as a co-teacher, mentor, or mentee, and seeking out partnerships with schools, universities, or other private professional learning programs and fellowships (Dana & Yendol-Hoppey, 2020).

Professional Learning Communities. Professional learning communities (PLCs) typically consist of six to twelve teachers who connect and network with each other using structured agendas to ensure "focused, deliberate dialogue by teachers about student work and student learning" (Yendol-Hoppey & Dana, 2010, p.118). Participating in a PLC is one way to achieve professional learning that focuses on collaboration and pedagogical innovation related to shared, student-centered goals (Carter Andrews & Richmond, 2019; Cochran-Smith, 2015; DuFour, 2004; Hord, 1997). A PLC will maximize its value if it: (a) includes a shared, practice-

centered goal; (b) focuses on concrete outcomes; (c) initiates reflective dialogue, active

participation, and collaboration; (d) facilitates activities to develop trust, stakeholder support, and

motivation; and (e) promotes the identification and sharing of individual prior knowledge (Carter

Andrews & Richmond, 2019; Garet et al., 2001; Hord & Sommers, 2008; van Veen et al., 2012).

Lesson Study. Originating and practiced widely in Japan, lesson study has colloquially

been referred to as an approach to improving pedagogy through "understanding what works well,

what does not and why" (Tarrant, 2017, p. 34). There are six steps in the lesson study process:

(1) collaboratively planning the study lesson; (2) seeing the study lesson in action; (3) discussing

the study lesson; (4) revising the lesson; (5) teaching the new version of the lesson; and (6)

sharing reflections about the new version of the lesson (Fernandez & Yoshida, 2004).

Ultimately, lesson study offers a systematic and collaborative way for teachers to examine and

improve their teaching practice.

Like most forms of professional learning, lesson study has not been exempt from

criticism. Some argue that the excessive examination of lesson plans can cause a decrease in

teachers' motivation (Hargreaves & O′Connor, 2018). Lesson study is often implemented

ineffectively due to infrequent meetings (Sato, 2012; as cited in Chichibu, 2019) and teachers

resistance to change "habituated practices" (Sako et al., 2015; as cited in Chichibu et al., 2019,

p.300). Teachers also argued that doing lesson study at their school stifled their opportunities for

creativity by attempting to standardize the lesson plan and resulted in unnecessary criticism or

superficial praise (Chichibu et al., 2019).

Despite these criticisms, when school leaders introduce lesson study with a desire for

teachers to focus on bettering their practice, and not for the sole purpose of increasing

standardized test scores, they see great benefits (Lim-Ratnam et al., 2019). The collaboration

associated with lesson study helps to contradict the typically isolating teaching culture, where teachers spend their days in their own classrooms with the doors closed (Stigler & Hiebert, 1999). In addition to the benefits of induced collaboration and "socio-constructivist learning" (Lim-Ratnam et al., 2019, p. 275), lesson study provides teachers with a greater insight into the needs of their students, curriculum, and teaching strategies (Chassels & Melville, 2009).

Inquiry Based Professional Learning. Inquiry based professional learning will be discussed in detail later in this chapter as practitioner inquiry is a key component of this study. Engaging in action research, which at times is used synonymously with classroom research, teacher research, teacher inquiry, and practitioner inquiry, is another professional learning opportunity teachers can utilize to transform their practice working as individuals or in groups, alone or in partnership with university groups, and on a fixed or flexible schedule (Capobianco & Feldman, 2010). Deeney (2008) describes the recursive steps of classroom research: (1) observe what is going on in your classroom; (2) research in literature about what you have noticed, why it is important to student education, and how it relates to instruction; (3) narrow your inquiry question to a specific area; (4) make a plan to implement instruction and collect data; (5) actually implement the plan and begin data collection; (6) analyze the data; and (7) reflect on what the data means for your instruction. A key part of this inquiry cycle is reflection, so it is important to distinguish between the constant reflection that occurs almost subconsciously amongst teachers (throughout the school day, in planning lessons, in the act of teaching, after the school day is over, etc.) and intentional, planned reflection. When reflection is reduced to "superficial, task-oriented processes" (McIntosh 2010, p. 57), it does not reach its full potential as a tool for professional learning.

Job-Embedded Professional Learning. Job-embedded professional learning is another type of professional learning opportunity that can occur in a variety of modalities throughout the context of a normal work day (Zepeda, 2015). Some examples of these opportunities include: (a) embracing opportunities to view others who have a greater expertise or model new approaches in their classroom; (b) opening your own lessons up to being observed and requesting feedback; (c) engaging in coaching or mentorship; (d) sharing strategies and resources; and (e) discussing professional readings, beliefs, ideas, theories of practice, and implications for teaching, learning, and assessment with colleagues (Hargreaves et al., 2002; Poskitt & Taylor, 2008; Timperley et al., 2007).

Coaching and Mentorship. Working as or with a mentor is another way to engage in professional learning. Atkinson et al. (1996) defines mentors as "schoolteachers who are identified as having a specific responsibility for one or more teachers" (p. 433). The responsibilities of a mentor may include: (a) supervising teaching practice; (b) observing lessons and offering constructive feedback; (c) offering guidance with respect to methods, course planning and design, curricula and syllabus requirements or procedures; or (d) tutoring or assessing the teaching competence of student teachers (Atkinson et al., 1996). To explain it casually, an ideal mentor relationship is one in which a more experienced mentor "sends the elevator down" to bring the mentee "up" (Hansman, 2016, p. 39).

Peer coaching is another professional learning structure in which colleagues are encouraged to have learning conversations with each other. This typically occurs when one teacher, who has an established technique in their teaching repertoire, helps a peer develop a similar technique or when two teachers want to embark on learning a new instructional practice together (Swafford, 2000). Through cooperation, sharing, reflection, and feedback, peer

coaching powerfully develops teaching practice and improves student learning (Hsieh et al., 2021).

Administration-Led Professional Learning. Administrators can positively influence teachers' longevity, resilience, and success in the classroom through making their teachers aware of professional learning opportunities, placing new teachers in deliberate environments to reinforce a collegial support system, and ensuring school-level teacher leadership opportunities are available and encouraged (Tricarico et al., 2015). When administrators design professional learning experiences, they have a responsibility to enable teachers to openly discuss their teaching and build their existing knowledge of teaching and learning (Thomas, 2016). Since a great variety of professional learning experiences available, when administrators offer specific professional learning opportunities through differentiation and distributed leadership, they are more likely to meet teacher needs (Glickman and Burns, 2020).

In addition to designing professional learning experiences, administrators should model engaging in professional learning and ultimately be the "head learner" (Barth, 1990, p. 46). Yendol-Hoppey and Dana (2010) translated that phrase to mean that the principal has the ultimate responsibility of ensuring that leadership opportunities are shared with the professional staff within the school and that the school community has a common purpose of reaching shared goals with professional learning allowing the school to be viewed as a learning organization for all, not just for students.

Effective Professional Learning Benefits

The many benefits individual teachers receive from engaging in effective professional learning, such as increasing confidence levels and content knowledge and improving their practice, were intrinsically discussed through the prior descriptions of effective professional

learning tenets. However, engaging in effective professional learning also offers advantages on school-wide, district-wide, state-wide, and even national levels. Two of these broader benefits include reducing teacher attrition and improving school grades through bettering student outcomes (Bonner, 2006; Gul et al., 2022; Tricarico et al., 2015).

Career Cycle Benefits. Perhaps one reason a great variety of professional learning opportunities exist is that effective professional learning is highly valuable to the teaching profession as a whole (Sawchuk, 2015). In a climate of decreased enrollment in teacher preparation programs (Sawchuk, 2015), it is important to retain the teachers in our profession. Teaching is emotional work (Day & Gu, 2007), and teachers are more likely to remain committed to their careers if they receive high quality professional learning (Coldwell, 2017). Modeling constructivist and distributive leadership inspires teachers to improve their instructional practice (Lambert, 2000; Spillane, 2008). Similarly, teacher engagement in responsive and differentiated professional learning may lead to a greater sense of career satisfaction and encourage teachers' professional commitment (Day & Gu, 2007).

Environmental interference and pressures can negatively impact the career cycle, so addressing the personal needs and problems of teachers through effective and encouraging professional learning can reduce teacher attrition (Guskey & Huberman, 1995). A study by Tricarico et al. (2015) described "staying power" as the completion of five years in the same urban, Title I school district and "impact power" as the ability to positively influence student learning (p. 239). Tricarico et al.'s (2015) study identified that access to professional learning tools that were tailored to meet individual needs was one of the factors that determined an increase in staying power and impact power among educators. This same study found that when administrators trusted that teachers were acting in the students' best interest, allowing teachers

the freedom to meet their students' needs as they deemed best appropriate and helping teachers

become familiar with resources available to them for professional learning, teachers had

increased staying power and impact power (Tricarico et al., 2015).

Student Outcome Benefits. Bonner (2006) shared, "leaders in educational reform [are]

declaring that teacher learning is critical for student learning" (p. 29). Described previously as

"impact power" (Tricarico et al., 2015), perhaps the most important benefit of effective

professional learning for teachers is the ability for teachers to use their newly gained knowledge

to better serve the students in their charge. As previously discussed, when describing effective

professional learning tenets through an outcome lens, it remains important to remember that the

achieving positive student outcomes does not strictly mean increasing standardized test scores

for students.

Effective Professional Learning Barriers

With clear benefits to engaging in effective professional learning, it is necessary to

address the barriers in place that prevent effective professional learning opportunities from being

available to teachers. As with the benefits, the barriers in place fall across both an individual and

larger spectrum. These barriers range from inadequate resources to the absence of a climate that

welcomes teacher vulnerability (Tooley & Connally, 2016) to external variables, such as national

educational mandates (Buczynski & Hansen, 2010).

Inadequate Resources. There are a myriad of reasons that the implementation of

effective professional learning is not carried out by school administrators (Darling-Hammond,

Hyler, et al., 2017). First, to address the absence of professional learning opportunities, we must

acknowledge that schools often suffer from inadequate resources ranging from financial issues to

personnel and expertise shortages to lacking curriculum materials needed for teachers to engage

in professional learning (Tooley & Connally, 2016). Also, if the state and local policies towards a particular set of instructional practices do not align, schools may be unable to receive funding or other support to implement professional learning opportunities due to grant restrictions or other limitations (Tooley & Connally, 2016). If funding is offered to provide a professional learning experience, immediate results are often expected, and if ample evidence of teacher or student improvement is not immediately available, that previous support may be withdrawn, ceasing future professional learning opportunities (Buczynski & Hansen, 2010).

Vision Misalignment. Similarly, when looking within the school itself there may not be a shared vision of what high-quality instruction entails. This conflict may preclude the necessary resources from being allocated to implement an effective professional learning experience. However, even if policies and visions align and tangible resources are present, schools often lack the physical ability to dedicate time for their teachers to engage in professional learning experiences (Tooley & Connally, 2016). Many schools have very few designated professional development days, and the typical school day schedule lacks intentional time for teachers to work on their practice collaboratively outside of a dedicated professional development day (Tooley & Connally, 2016).

Dysfunctional Culture. Ineffective professional learning opportunities are typically assumed to be conventionally-taught, mandated in a top-down approach, and too isolated from the school and classroom realities teachers are managing to have much impact on their practice (Buczynski & Hansen, 2010). However, even if effectively designed professional learning opportunities can be physically implemented, they may fail to produce their desired outcome if the overall school culture is dysfunctional. Teachers need to feel that they are in a safe place to be vulnerable, whether to admit insecurities in their own teaching or to try something new

(Tooley & Connally, 2016). For implementation that involves collaboration, collegial personalities must also be considered so that personnel dynamics do not prevent teachers from showcasing their strengths (Tooley & Connally, 2016).

External Variables. Teachers may not be able to implement the tools and techniques learned in a professional learning experience due to obstacles beyond their control; this contradicts a common assumption that professional learning is only as effective as the teacher's willingness to apply knowledge gained through a professional development experience (Buczynski & Hansen, 2010). Pressures to stay on-track with standardized testing content and timeline mandates, a lack of access to the tangible resources needed to implement a newly learned activity, or a failure to take teachers' or students' existing knowledge, beliefs, and attitudes into account are all barriers that prevent the proper implementation of effectively designed professional learning opportunities (Buczynski & Hansen, 2010).

If teachers are not able to gain effective professional learning opportunities from their place of employment, they may take the initiative to seek it out autonomously, seeking out external programs, fellowships, or university partnerships to fulfill their professional learning desires. As stated before, however, a willingness alone to participate in professional learning experiences does not equate to the physical ability to gain the sought-after skills or training. To understand the barriers preventing teachers from autonomously seeking out professional learning experiences, we must first understand the characteristics and needs of adult learners.

Adult Learners

When people typically read the term learners or students, they may immediately visualize children in the K-12 school setting. However, in the age of lifelong learning, adults are often learners, whether formally, such as being enrolled in university coursework, or informally, such

as engaging in professional learning or seeking out instruction to learn a new skill (Lave, 2019).

As the teachers engaging in professional learning are adults, it is important to discuss the needs

adults have when they engage in learning (Knowles, 1984).

Needs of Adult Learners. As adult teachers engage in professional learning, it is

important to acknowledge that, while adults as learners have some parallels with children as

learners, adults have distinct needs (Galbraith, 2004; Glickman & Burns, 2020; Jacobs et al.,

2015; Knowles, 1984). The great variety in ages, life stages, and educational experiences among

adults means that all adults arrive at learning experiences with different levels of preparedness

and curiosity. The degree of learning challenges perceived by adults depends on personal

characteristics including age, gender, knowledge, skills, and context, and these challenges can

typically be categorized as either job-related, domestic, program-related, tutor-related, or

institutional (Kara et al., 2019).

Knowles (1984) defined the term andragogy as the ability to meet teachers where they are

to foster their learning, but this definition has been generally adapted to more commonly refer to

the art and science of teaching adult learners (Galbraith, 2004; Glickman & Burns, 2020;

Knowles, 1984). Keeping in mind the purpose of educating adults, Tough (1985) wrote "people

learn best when treated as human beings, and the ultimate purpose of all of education is to

empower individuals through a process of lifelong learning" (p. 708).

Adult Learner Needs and Professional Learning. Glickman & Burns (2020) wrote,

"bringing out the best in teachers involves understanding teachers as adult learners and designing

professional learning to meet their diverse needs" (p.8). The job-related challenges facing adults

are likely to most directly impact their ability to engage in professional learning; these challenges

include work overload, lack of organizational support, schedule conflicts, financial problems, and a limited time to study (Kara et al., 2019).

When considering life-stage, adults who are looking to prioritize a family over their career needs, end their career, or see their current role as the same as where they would end their career are naturally less engaged in professional learning than adults who are motivated to develop their careers (Coldwell, 2017). However, establishing professional learning opportunities that allows adults to have autonomy in their learning may increase this engagement (Derrington & Brandon, 2019). Adult learners want to see their past educational backgrounds, goals, and experiences reflected in their professional learning experiences, and the ideal setting for adult learning allows them to "dig down into the reservoir of their own experience before resorting to texts and secondary facts" (Lindeman, 1961, p. 7).

Despite the benefits of adults having autonomy in their learning, teacher professional learning frequently lacks teacher agency, defined as the ability for teachers to have a voice in their own professional learning (Zepeda, 2019). Reasons teachers desire to deliberately select their own professional learning topics range from fulfilling a personal desire to learn about a certain topic to needing to attain updated knowledge to develop new topics in their own teaching (Atkinson et al., 1996). When teachers feel that the professional learning they are mandated to receive does not align with the interests of their personal practice, they have self-reported that their professional learning is "something they must endure and get out of the way" (Guskey, 2000, p. 15). While historically most professional learning opportunities were, at best, partly self-directed and partly directed by others and occurred both within and outside normal in-service training courses (Atkinson et al., 1996), a "new view" (Derrington & Brandon, 2019, p. 187) of professional learning has emerged that showcases how supporting personalized

professional learning plans enables sustained, reflective, and transformative learning and progressive growth (Liu et al., 2016).

Improving the implementation of professional learning enables it to become more effective, yet the fact remains that the teachers undergoing professional learning are adults bringing their life's worth of personal and professional experiences, and the privileges and prejudices that have accompanied them, to their professional learning opportunities. While a teacher's professional identity may emerge from their experience, the inverse is also true (Noonan, 2019). A teacher's identity can also contribute to the way in which they interpret their experiences (Noonan, 2016; Schultz & Ravitch, 2013). It is therefore essential that professional learning experiences are facilitated in a manner that enables critical self-reflection related to how their social positions inform their relationships with students and pedagogical practices (Carter Andrews & Castillo, 2016; Carter Andrews & Richmond, 2019).

Autonomy and Teacher Agency. In a professional learning context, teacher agency is the "capacity of teachers to act purposefully and constructively to direct their professional growth and contribute to the growth of their colleagues" (Calvert, 2016, p. 51). This means that teacher agency occurs when teachers have autonomy over their professional learning and are empowered to choose (a) what they would like to learn, such as classroom management skills or content knowledge; (b) how they would like to learn it, perhaps through a lesson study or through practitioner inquiry; and (c) how much time they are able to devote to their professional learning, such as attending a conference or participating in weekly or monthly opportunities. When professional learning opportunities are presented that allow for teacher agency and ownership, intrinsic motivation primarily drives attendance which enables the professional learning to be more effective than when participation occurs via extrinsic motivation, such as

attending solely to fulfill mandatory attendance requirements (Patton et al., 2015; Zepeda, 2013).

Having autonomy over their professional learning allows teachers to seek out opportunities

which address the specific needs of either their students or their teaching and creates an

environment where effective professional learning can occur (Darling-Hammond et al., 2017).

Teacher agency does not have to exclude administrative mandates. Calvert (2016)

suggests that ideal professional learning opportunities are created from a healthy balance where

teachers have agency within an umbrella of instructional practice. For example, new or

struggling teachers may be required to participate in specific, more intensive coaching and

development opportunities whereas veteran teachers may choose to participate in independent

learning sessions (Calvert, 2016).

In addition to having autonomy over the types of professional learning opportunities

teachers engage in, teacher agency may also be present when teachers are empowered to tailor a

predetermined professional learning activity to fulfill their own needs. Charteris and Smardon

(2015) have shown that being afforded this "intellectual space to think" (p. 121) will promote

deep learning and empowered decision making, making the professional learning opportunity

increasingly effective and beneficial to themselves, their practice, and their students. Ultimately,

having leaders who believe in quality professional learning and establish a culture of continuous

learning promotes teacher agency, which in turn reinforces the effectiveness of professional

learning in a cyclical nature (Calvert, 2016).

Practitioner Inquiry

Practitioner inquiry is a particularly effective method of professional learning due to its

sustained, reflective, and autonomous nature (Cochran-Smith & Lytle, 2009; Jacobs et al., 2015).

Practitioner inquiry occurs when classroom teachers take on the role of knowledge generators

and engage in design, data collection, and data interpretation around a question that focuses on a concern of teachers as opposed to outside researchers (Dana & Yendol-Hoppey, 2020).   As I am seeking to understand the experiences of teachers as they engage in practitioner inquiry, it is necessary to understand the lexicon and theoretical frameworks associated with practitioner inquiry as well as its role within the larger professional learning umbrella.

Practitioner Inquiry Lexicon

With a demonstrated importance to use "clear and consistent terms" (Cochran-Smith & Zeichner, 2005), it is necessary to understand the lexicon associated with practitioner inquiry. The term 'practitioner inquiry' has been used interchangeably with other terminology including 'teacher inquiry,' 'teacher research,' 'classroom research,' and 'action research,' however there are some differences in the historical and epistemological roots of each of the terms as well as subtle differences in their focus (Cochran-Smith & Lytle, 2009; Cochran-Smith & Zeichner, 2005; Jacobs et al., 2015).

'Action research' is defined as a form of self-reflective inquiry undertaken by participants in social situations in order to "improve the rationality and justice of their own practices, their understanding of these practices, and the situations in which their practices are carried out" (Carr and Kemmis, 1986, p. 162). This definition has evolved to emphasize its personal and highly contextualized nature; Feldman & Minstrell (2000) defined action research as an inquiry by teachers "into their teaching and their classrooms" (p.2). Action research also has a responsibility to address social change issues (Jacobs et al., 2015).

'Teacher research' is defined as a "systematic, intentional inquiry by teachers about their own school and classroom work" (Lytle & Cochran-Smith, 1993, p. 7). That original definition has evolved to include a collaborative focus (Jacobs et al., 2015). Teacher research occurs when

teachers "work in inquiry communities to examine their own assumptions" and "develop local knowledge by posing questions and gathering data (Cochran-Smith & Lytle, 2009, p. 40).

'Classroom research' is defined by Deeney (2008), through an adaption of Lytle and Cochran-Smith (1993), as "systemic, intentional inquiry by teachers and other school/classroom professionals about their own school and classroom work" (p.3).

'Practitioner inquiry' is defined by as "systematic and intentional study of an educator's own professional practice" (Jacobs et al., 2015, p. 375). Cochran-Smith & Lytle (2009) used practitioner research and practitioner inquiry terminology interchangeably, and as Capobianco & Feldman (2010) discussed, the goal of this was to broadly conceptualize inquiry as a way to challenge current school arrangements and outcomes.

Ultimately the terms 'classroom research', 'teacher research,' 'practitioner research,' and 'action research' share features, such as including the practitioner as the researcher and professional practice as the context of the study (Dana & Yendol-Hoppey, 2020; Jacobs et al., 2015), and share an overall similar five phase structure: (1) identifying a question; (2) developing a research plan; (3) collecting and analyzing data; (4) making evidence-based claims; and (5) evaluation, reflection, and sharing results (Glickman & Burns, 2020).

When looking at teachers studying their practice in this paper, I intentionally used the term 'practitioner inquiry' in an effort to promote clear and concise language. While Dana and Yendol-Hoppey (2020) suggest that a nondiscerning reader may interpret the term 'research' to imply a process-product paradigm with an emphasis on having one manipulated variable in an otherwise controlled setting or the ability to compare an experimental group to that of a control group, I am not applying this rationale. Furthermore, I am not suggesting that the teachers studying their practice in this study are doing so with a primary goal of problem-solving as

opposed to constructing knowledge with a primary goal of "coming to understand" (Feldman,

2017, p. 139). I appreciate that term 'inquiry' is reflective of the inherent classroom

environment complexities and the diverse student needs that are present when a teacher may be

trying to address a question regarding their practice. Glickman and Burns (2020) further notes

the term 'research' has traditionally been associated with universities studying schools, teachers,

and children whereas 'inquiry' does not traditionally have the same university-level association.

It is necessary to note that despite selecting to use the term 'inquiry,' I agree that discussions

regarding how the teacher's work can contribute to educational research on teaching and

teaching inquiry are necessary and crucial to a teacher's overall professional learning (Feldman,

2017). I selected the term 'practitioner' to reflect a teacher in the act of their practice, teaching

their students in their classroom. I intentionally used this term to delineate from an inquiry

performed to address school or district related issues that do not directly relate to the

practitioner's immediate teaching practice.

Frameworks for Practitioner Inquiry

This dissertation study researched individual practitioner inquiry projects, so it is

important to understand methodology, theoretical frameworks, and purpose-based frameworks

for researching practitioner inquiry.

Methodology for Practitioner Inquiry. Qualitative research understands the world

from the perspectives of those living in it (Hatch, 2002) and enables the unveiling of deep

meaning from the way people make sense of their experiences (Merriam, 1998). Case study is a

useful methodology for examining current and past lived experiences (Saldana, 2018) and can be

explanatory, exploratory, or descriptive in nature (Yin, 2014). When a multiple case study is

employed, there is a benefit to investigating a Quintain, or subject of interest (Stake, 2006),

through a collaborative lens of multiple perspectives and experiences (Baxter & Jack, 2015).

When seeking to conceptualize the experience of multiple teachers engaging in an autonomous practitioner inquiry, it is ideal to conduct a qualitative, multiple case study.

      Theoretical Frameworks for Practitioner Inquiry. Bandura's (1977) self-efficacy theory is an ideal theoretical framework for investigating practitioner inquiry. Related to Bandura's (1963) broader social cognitive theory, self-efficacy theory refers to an individual's belief in their capability to organize and execute the courses of action necessary to manage prospective situations (Bandura, 1977). Self-efficacy theory has five key components: (a) performance outcomes; (b) vicarious experience; (c) verbal persuasion; (d) physiological and emotional states; and (e) setting challenging goals (Bandura, 1997). Performance outcomes is the most influential component of self-efficacy; it refers to the notion that if someone has succeeded in the past, they tend to believe in their ability to succeed in the future (Bandura, 1977). Similarly, repeated failures erode self-efficacy. The second component, vicarious experience, explains that people can develop self-efficacy by observing others successfully completing a task (Bandura, 1977). Also, a person's belief in their ability to succeed is further enhanced if someone identifies with whoever they are observing. Verbal persuasion, the third component, articulates the belief that if others express confidence in someone's capabilities, it can boost their self-efficacy (Bandura, 1977). This is connected to the strong impact created by positive reinforcement. Physiological and emotional states, the fourth key component, explains the premise that individuals often gauge their competence based on their emotional and physical state; this means that if a task causes them stress, nervousness, or similar negative emotions, they are more likely to doubt their capabilities which reduces their self-efficacy (Bandura, 1977). In 1997, Bandura added a fifth component, setting challenging goals, to the four components he

previously identified in his 1977 self-efficacy theory. This final component suggests that by setting and accomplishing challenging goals, individuals strengthen their self-efficacy beliefs, and suggests that people who have a high self-efficacy routinely set and maintain a strong commitment to challenging goals (Bandura, 1997). Overall, Bandura's (1997) self-efficacy theory states that a person's belief in the ability to perform certain tasks or behaviors plays a crucial role in how they act, think, and feel. An elaboration on self-efficacy theory and its use as the main theoretical framework guiding this study will be covered in Chapter 3.

Somekh and Zeichner (2009) detail that when studying practitioner inquiries through an action research lens, it is important to use an analytical framework based on dimensions of variation. The eight dimensions of this framework include (a) the purpose for which the inquiry is conducted; (b) the contextual conditions surrounding the inquiry; (c) the practitioner's philosophy towards teachers and their learning; (d) who sponsors the inquiry; (e) incentives for doing the inquiry; (f) forms of inquiry; (g) the relationship of practitioner inquiry to other research; and (h) ways of representing practitioner inquiry to others (Somekh & Zeichner, 2009).

Purpose Frameworks for Practitioner Inquiry. While many educational research practices hope to develop and deepen the understanding of educational practice, practitioner inquiry sets about changing practice both in order to understand it and as a result of study (Feldman, 2017). Teachers also have different purposes for engaging in practitioner inquiry (Noffke, 1997).

Zeichner and Noffke (2001) detailed ways that practitioner inquiry can have a personal emphasis. First, the research may involve a careful study of the participants, detailing what and how they learn. Second, the practitioner may have a heightened sense of self-awareness as they grapple with "clarifications of assumptions about education and the recognition of contradictions

between espoused ideas and actual classroom practices" (Zeichner & Noffke, 2001, p. 307). Finally, practitioner inquiry acts as an individual learning process for the researcher.

In addition to offering individual development, practitioner inquiry also allows for contributions to local and broad educational and societal improvements. A practitioner may engage in inquiry to contribute to the knowledge base of the broader educational profession, their immediate practice, or to enhance their profession's status (Zeichner & Noffke, 2001). Broad societal improvements may be the result of the social justice focused practitioner inquiry as studies embarked on with a politically-minded purpose of addressing power, privilege, and equity are "explicitly tied to developing more humane and just teaching" (Zeichner & Noffke, 2001, p. 310).

Modes of Practitioner Inquiry. Practitioner inquiry can occur thorough three modes: terchnical, interactive, and teacher-centered (Feldman et al., 2022). In technical inquiry, an external researcher designs the focus of the study while the teacher conducts the study, collects data, and offers feedback (Feldman et al., 2022). In interactive inquiry, the external researcher and the teacher determine the focus of the study together, and they engage in in the study together with the outsider taking the role of co-teacher and co-researcher (Feldman et al., 2022). In teacher-centered inquiry, the teacher acts as the primary researcher, deciding on the topic and conducting the study with minimal involvement from external researchers (Feldman et al., 2022). More detail about these modes is provided later in the chapter when practitioner inquiry for science teachers is discussed.

Practitioner Inquiry as Professional Learning

Elliott (1991) observed two distinct patterns of information handling in classrooms: "(1) read – understand – discuss, and (2) read – discuss – understand" (p. 19). Drawing from

these two patterns, he discussed two ways for teachers to reflectively develop their practice:

(1) The teacher undertakes research into a practical problem and on this basis changes some aspect of his or her teaching. The development of understanding precedes the decision to change teaching strategies.

(2) The teacher changes some aspect of his or her teaching in response to a practical problem and then self-monitors its effectiveness in resolving it. Through the evaluation the teacher's initial understanding of the problem is modified and changed. The decision to adopt a change strategy therefore precedes the development of understanding (Elliott, 1991, p. 23).

When teachers engage in this first structure, it is their reflection that initiates action, and engaging in inquiry does not ever have to occur. However, when the second method is enacted, inquiry and practice cannot be separated, and it is not until the action of changing their practice is carried out that reflection occurs. This seamless integration of inquiry and practice is the essence of professional learning through practitioner inquiry.

Despite the natural, deep connection between practice and inquiry, practitioner inquiry has faced challenges with being respected as a form of educational science. In the late 1950s, Hodgkinson (1957) pushed back on the notion of allowing classroom teachers to perform research citing a concern for exploiting teachers and noting that their lack of credentials would undermine the quality of their educational inquiry. He stated, "If the teacher becomes a researcher, there is no reason why she should not be made to become a guidance counselor, nurse, musician, or psychiatrist, in the name of responsibility" (Hodgkinson, 1957, p. 77). Thankfully, the great value afforded to sustained research that is connected to everyday practice and occurs as part of a community of practice has since been documented (Fullan, 2010; Hawley

& Vallie, 1999; Manfra, 2019; Putnam & Borko, 2000), and many resources and workbooks exist to assist teachers in their research journeys (Houff, 2008).

Practitioner inquiry is an effective method for professional learning due to its sustained, reflective, and autonomous nature (Cochran-Smith & Lytle, 2009; Jacobs et al., 2015). It has long been shown that the power of experience (Dewey, 1938) is effective at increasing the quality of instruction (Elliott, 1991). Practitioner inquiry showcases how experience fosters teacher empowerment and allows for teachers to deepen their understanding of and improve on their practice (Bonner, 2006; Esposito & Smith, 2006; Merino & Holmes, 2006).

Effective professional learning has characteristics that are consistent with practitioner inquiry structures. To summarize the effective professional learning tenants that were discussed earlier in this chapter, effective professional learning is inquiry-based, focused on student thinking, collaborative, job-embedded, teacher-driven, content-and pedagogy-focused, and sustained over time (Hill, 2004). In Mertler's (2019) Wiley Handbook of Action Research, Flynn & Bruce (2019) describe the classic action research process to be: "(i) finding the problem and developing research questions; (ii) collecting baseline data and selecting intervention strategies; (iii) trying out the intervention(s) and collecting data; (iv) measuring the impacts; and (v) mobilizing findings and resources" (p. 277). When teachers engage in an inquiry process within a community of practice to improve student learning, we see these effective professional learning tenets represented. To elaborate, if a community of practice is conducting individual practitioner inquiry projects to increase student learning, sharing observations of student learning with each other is essential to reminding their community of practice of their shared purpose – student learning (Rowell, 2019).

Practitioner inquiry as professional learning is happening globally and for a variety of purposes. Somekh and Zeichner (2009) looked at practitioner inquiry through a global action research lens and identified five variations of when inquiry via professional learning is conducted: (a) during periods of political upheaval and transition, such as when a radical change of government has occurred; (b) when state-sponsored schooling reforms occur, for example, when growing economic competition cause policies to be implemented to encourage greater creativity and entrepreneurship in the workforce; (c) when governments and school systems try to control teachers, such as when all staff in a school are required to conduct action research and teachers do not have ownership in the process; (d) during university-led reform movements, such as in school-university partnerships when graduate students who are also teachers carry out their inquiries as part of a higher degree study; and (e) through locally-sponsored systemic reform sustained over time, which can be seen when teachers themselves engage in inquiry for personal professional development but share their findings and become a bellwether for broader reform efforts.

Practitioner Inquiry as a Stance

As teachers engage in practitioner inquiry as a professional learning tool, they have the opportunity to create an inquiry stance (Cochran-Smith & Lytle, 2009; Jacobs et al., 2015). Cochran-Smith & Lytle (2009), who coined the term in the 1990s, define inquiry stance as:

> A worldview and a habit of mind—a way of knowing and being in the world of educational practice that carries across educational contexts and various points in one's professional career and that links individuals to larger groups, and social movements intended to challenge the inequities perpetuated by the educational status quo (p. vii).

Similar to how stance refers to a physical position in everyday language (Cochran-Smith & Lytle, 2012), inquiry as a stance essentially refers to teachers taking a stance of being a working member of a community that collaborates together to problematize (a) the current arrangements of schooling; (b) how knowledge is constructed, evaluated and used to collectively bring about change; (c) how to envision and theorize practice; and (d) how to interrogate the theory and research of others (Cochran-Smith & Lytle, 2009). When teachers engage in practitioner inquiry within the first three years of their teaching career or during their time as preservice teacher, they are more likely to develop an inquiry stance, and when science teachers adopt an inquiry stance, they appear to change their teaching towards integrating more inquiry-based approaches to instruction (Manfra, 2019).

Professional Learning for Science Teachers

Teaching in the science discipline requires different qualifications when compared to teaching in other disciplines; in fact, even at the preservice teacher level, universities have created STEM-specific programming to prepare teachers to enter science fields (Ellerbrock et al., 2018). The influence of professional learning on science teaching and student learning is well documented (Buczynski & Hansen, 2010; Loucks-Horsley et al., 2009; McDermott & DeWater, 2000; Stein et al., 1999). When science teachers engage in effective professional learning their content knowledge, pedagogy, self-efficacy, and confidence improve (Radford, 1998; Supovitz et al., 2000; Zepeda, 2015) which may also develop positive attitudes about the nature of science teaching and student learning (Buczynski & Hansen, 2010; Stein et al., 1999).

Practitioner Inquiry for Science Teachers

Science teachers engaging in practitioner inquiry face distinct challenges. Decades ago there was even a declared "gap" between research and teaching in the science professions (De

Jong, 2000, p. 31). In addition to issues of restricted time and differences of expectations (De

Jong, 2000; Taber, 2001), science teachers and science education researchers have been shown to

have incompatible styles of thought as they grapple with whether to value teacher experiences

more, less, or equally when compared to research outcomes (Stuckey et al., 2013). Hohloch et

al. (2007) elaborated on the differences that exist between science teaches and science education

researchers to include views, identities, and values. Despite these challenges, there are numerous

examples of science teachers engaging in practitioner inquiry to better their practice.

Grundy (1982) distinguished between technical, teacher-centered, and interactive

practitioner inquiry through the label of action research. While practitioner inquiry in the

science classroom can occur within each of these modes, teacher-centered inquiry provides the

teachers with the most autonomy as the research interest, classroom actions, data collections,

evaluation, and implications for action are all solely performed by the teacher (Laudonia et al.,

2018). Technical practitioner inquiry is the opposite of this, where the teacher is minimally

involved in the classroom action and data collection process, but the research interest and

implications for action come from external, expert sources (Grundy, 1982; Laudonia et al., 2018;

Mamlok-Naaman & Eilks, 2012). Bridging these two extremes of teacher involvement is

interactive practitioner inquiry, also referred to as emancipatory and participatory action

research. Science teachers engaging in this inquiry find themselves to be solely responsible for

the classroom action while they jointly participate in all other components of the study with

external experts (Chevalier, 2019; Eilks & Ralle, 2002; Grundy, 1982; Laudonia et al., 2018;

Ledwith, 2017).

Science teachers have engaged in practitioner inquiry throughout all school levels:

elementary, secondary, university, as well as special needs and inclusive schools, and the

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purpose for the inquiries are various (Laudonia et al., 2018; Rowell et al., 2017). One documented purpose of engaging in inquiry is to foster the integration of science fields within the learner's everyday environment, including socio-scientific issues such as environmental, health, and political concerns, as well as scientific literacy (Eilks & Marks, 2010; Laudonia et al., 2018; Stolz et al., 2013). Another way science teachers engage in practitioner inquiry is through assessing knowledge development and attitude changes that occur among learners (Sukhontapatipak & Srikosamatara, 2012). However, when science teachers engage in practitioner inquiry for professional learning the impetus is often professional change (Briscoe & Wells, 2002) or professional growth (Zeichner, 2006).

Practitioner Inquiry Vignettes in Secondary Science Education

Practitioner inquiry has been shown to increase teachers' knowledge and understanding of students, encourage growth and change in teaching practice, and promote attention to social justice and diversity issues (Jacobs et al., 2015). Science teachers, and specifically secondary science teachers, are more likely to perceive that effective professional learning has positively influenced their likelihood of staying in teaching through validating their professional knowledge, making them feel more confident and capable as science educators, and improving their motivation and job satisfaction (Coldwell, 2017). With such strong positive outcomes, it is important to understand how effective professional learning looks in secondary science classrooms. While I have intentionally used the terminology *practitioner inquiry,* when established literature discusses examples of professional learning that fulfill the tenets of practitioner inquiry under a different terminology, such as *teacher research* or *action research*, those vignettes are also included in this literature review.

Confronting Gas Law Assumptions. Four chemistry teachers in a California high school felt their student's understanding of the gas laws were somewhat limited, so they engaged in a practitioner inquiry to determine if their incomplete conceptual understandings arose from a deficit in algebraic skills, specifically manipulating equations, which they assumed to be the case (Robins et al., 2009). They formed a teacher research group and developed a review packet for students covering multiplication, division, and algebraic proficiencies. They taught their units in an experiential format and then gave the students newly designed written assessment with questions covering five competencies: (a) algebra; (b) variables; (c) unit; (d) plug-in; and (e) concept application.

The results from their assessment showed that the students had minimal algebraic difficulties, but they experienced a *"compounding effect"* (Robins et al., 2009, p. 39) where a lack of understanding with respect to gas law variables and associated units of measurement made it difficult for students to comprehend plug-in problems and gas law concepts. As a result, students showed lowered proficiency as soon as the algebraic problems were integrated with conceptual knowledge. In their research group, the teachers located and read literature to support this finding and designed a plan to focus on units and variables in the gas law curricula to mitigate the compounding effect present in the study. The teachers also wrote about their experience and submitted it to a journal for science teachers.

A Tale of Two Labs. Greg, a New York biology teacher, wanted to determine whether students would benefit more from inquiry-based labs or traditional "cook-book-type" labs (Booth, 2001, p. 58) through using assessments and surveys to measure student proficiency and student and teacher attitudes. First, he modified two traditional labs to reinforce the concepts of diffusion and osmosis, named the "Egg Lab" and the "Potato Lab" (Booth, 2001, p. 58). Greg

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taught four biology classes, so he gave two classes the inquiry-based Egg Lab and the other two classes the traditional Egg Lab. Then, students took a five-question quiz to assess their basic understanding of diffusion and osmosis. The following day, the two classes that completed the inquiry-based Egg Lab completed the traditional Potato Lab, and the two classes that completed the traditional Egg Lab completed the inquiry-based Potato Lab. Next, the students took a second quiz that assessed concepts reinforced through both labs. Then, Greg asked the students which lab style they enjoyed more and which lab style they felt they learned more from. Finally, he sent a brief survey to 14 faculty members to gain insight into how often the teacher used inquiry-based labs, whether they felt their students were learning more from these types of labs, and whether they felt their students enjoyed these types of labs.

The data showed that the students earned higher quiz scores when they completed traditional style labs, but a higher percentage of students felt they learned more from the inquiry-based labs, and students enjoyed completing the inquiry-based labs more than the traditional labs. The teacher survey showed multiple perspectives, but one resounding complaint was that the teachers felt they lacked time to incorporate inquiry-based labs within the New York States Regents curriculum. After analyzing the results of his inquiry, Greg found and read relevant literature, identified the need for future inquiries, wrote about his experiences and summitted it to a journal for science teachers.

Flipping Magnetic Fields. A Wisconsin physics teacher, Dave, studied the impact of using a flipped classroom approach for a unit on magnetic fields (Brunsell & Horejsi, 2013). Over two-weeks, he found or created 16 videos and transformed his use of class time to increase active learning experiences; specifically, he almost doubled the time devoted to hands-on and small group problem solving activities. He collected data including unit tests, surveys, and

interviews, and he also kept a teaching journal. He found the majority of students found the video lectures helpful and enjoyed how watching them freed up class time for activities, and he also found an increase in students using "peer-friendly" language to explain the concepts to each other (Brunsell & Horejsi, 2013, p. 8). Identified struggles included students not watching the videos and being unprepared as well as prepared students feeling frustrated. As a result of this data, Dave began giving regular online and in-class quizzes over video content, a brief reading assignment that accompanied the video, and a preview of the assigned video at the end of class to raise student interest, and a "movie ticket" formative assessment at the beginning of each class (Brunsell & Horejsi, 2013, p. 8). After completing his inquiry, Dave wrote about it and submitted it to a journal for science teachers.

Electrochemistry Interviews. Sarah and Deborah were part of a group of 22 secondary school chemistry teachers that were introduced to practitioner inquiry through a series of workshops (Feldman et al., 2018). They selected nine students to interview about their electrochemistry content knowledge, making sure to evenly select three students each that were identified as low, intermediate, and high achievers. They analyzed their interviews to determine what concepts the students had difficulty with and redesigned the way they taught their lessons using models, videos, educational software, and computer animations. Then, they gave the students a content post-test and conducted follow-up interviews. They found that the students gained electrochemistry content knowledge but held on to some prior misconceptions, which spurred Sarah to engage in another cycle of inquiry.

The Wilcox Science Education Fellowship Program

My research involves teachers who belong to the Wilcox Science Education Fellowship (Wilcox SEF) program, so it is necessary to discuss the intricacies of this program. The Wilcox

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SEF program is a science teacher-leadership program for established science teachers to learn, collaborate, and reflect on their classroom practice (Feldman et al., 2020). This nation-wide, grant-funded professional development program trains educators to build leadership skills and teaching excellence within science, technology, engineering and mathematics (STEM) disciplines through research-validated expertise from a partnering university (Gasper & Das, 2018). Through a two-year, cohort structure, teachers engage in 250 hours of "intense capability development training" (Gasper, Adam & Das, Prathibha, 2018, p.1); this professional learning is focused around the three program pillars: "reflective practice, leadership to peers, and adult learning" (Feldman et al., 2020, p. 2).

One of the program site locations is in the southeastern United States through a university partnership with the Peninsula University. In each cohort at this site, approximately 20 Pier, Plains, and Mountain district science teachers, invest in increasing the quality of teaching and leadership in science by improving their own teaching practices and effectiveness in the instruction of science (Feldman et al., 2020).

This professional learning is carried out through vertical and horizontal collaborative coaching and learning of science (CCLS) protocols as well as through the creation and implementation of an individual growth plan system (GPS) (Feldman et al., 2020). Year 1 of the Wilcox SEF program guides teachers through lesson studies in a specialized learning community through the Collaborative Coaching and Learning of Science (CCLS) model.

The Collaborative Coaching and Learning in Science (CCLS) Model

The Wilcox SEF program is a community of practice that was structured according to a model developed in Boston Public Schools and iteratively revised through a Boston Science Partnership program; this structure is termed "Collaborative Coaching and Learning in Science"

or CCLS model (Gunning et al., 2020, p. 706). The original design of the CCLS consisted of a group of three to eight science teachers who met once or twice a week or for an eight or sixteen session cycle (Hamos et al., 2009). A full CCLS cycle consisted of a "course of study about science teaching and learning chosen by the participants, research, observations and debriefs, a review of student work, and reflective documentation" (Hamos et al., 2009, p. 17).

When this community of practice focuses on the vertical articulation of science content, meaning elementary, middle, and secondary science teachers are teamed together, this is called Vertical Collaborative Coaching and Learning in Science (V-CCLS) and when community of practice members are arranged so that they focus on the horizontal alignment of science content, for example when all secondary chemistry teachers are grouped together, this is referred to as a Horizontal Collaborative Coaching and Learning in Science (H-CCLS) team (Gunning et al., 2020).

Vertical Collaborative Coaching and Learning in Science (V-CCLS). There are many documented benefits offered to teachers who are teamed up vertically. As secondary science teachers typically teach multiple courses in the same discipline, their educational background tends to have a deep focus on science content courses with numerous collegiate courses in a specific background area, such as chemistry or biology. Similarly, as elementary school teachers are responsible for teaching all disciplines to a certain group of students, their training is indicative of more pedagogical and cognitive strategies for teaching learners of a young age as opposed to being focused on content. One side effect of these traditional teacher training methods is that elementary school teachers frequently do not have the strong level of coursework in science content knowledge that secondary school teachers have, and prior studies have shown that when elementary teachers lack this understanding of science content, their

confidence suffers, and they avoid teaching it (Epstein & Miller, 2011; Gunning et al., 2020; Harlen, 1997; Harlen & Holroyd, 1997).

Horizontal Collaborative Coaching and Learning in Science (H-CCLS). Teachers also benefit from collaborative coaching and learning in science teams that are aligned horizontally (Hamos et al., 2009). Commonly referred to as "grade level-based" teams (Trabona et al., 2017, p.4), H-CCLS teams facilitate discussion among teachers from the same grade level to allow for a deeper inquiry into teaching practices and content that is specific to that grade level (Rahman et al., 2018). The benefits of horizontally aligned professional learning include (a) increased feelings of belonging and social responsibility; (b) greater self-efficacy; (c) elevated feelings of competency; and (d) enhanced professional and organizational identity, commitment, and climate (Klein, 2016).

CCLS Benefits and Critical Factors. Through the adaptive V-CCLS and H-CCLS models, teachers are provided a context and culture to support sustained, research-based, and in-depth conversations about science teaching and learning (Hamos et al., 2009). While it is possible to use this model to address any particular mission of a program, school, or district, in Boston, the CCLS model was shown to expand teachers' "knowledge of the science curriculum, advance an atmosphere of professionalism, and raise awareness among teachers and administrators of the resources available from the districts' science department" (Hamos et al., 2009, p. 18). There are three main critical factors that enable a CCLS group to be successful: (a) the presence of administrative support; (b) a trained facilitator who can lead the CCLS group effectively; and (c) a preexisting science program that functions moderately-well (Hamos et al., 2009). In addition to these critical factors, the CCLS program can be enhanced through (a) at least one participant having an understanding of what dictates high-quality instruction; (b)

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maintaining a level of trust among members that allows for peer feedback of both praises and challenges; (c) having the chosen course of study align with the school's mission; and (d) including connections between the mission and observed lessons (Hamos et al., 2009).

The Growth Plan System (GPS) Model

The structure of the second year of the Wilcox SEF program provides its fellows with the opportunity to engage in autonomous practitioner inquiry. In the Wilcox SEF program, teachers are encouraged to engage in practitioner inquiry through designing and implementing an individual Growth Plan System (GPS). To design an individual GPS, teachers reflect and identify a personal goal and a district goal that will address their professional learning needs (Feldman et al., 2020). The personal goal and district goal often address the same professional learning need, but the district goal, sometimes referred to as the professional goal, allows teachers to articulate this need using dialogue that supports a current initiative present in their school district whereas the language surrounding the personal goal can be more intimate.

Chapter Summary

This literature review began with a broader discussion on professional learning in the field of education; it then narrowed slightly with a dedicated focus on practitioner inquiry and professional learning in the science discipline, and then narrowed once more to discuss a particular professional learning program in the science discipline that incorporates practitioner inquiry, the Wilcox SEF Program. To begin the discussion on professional learning, I examined the difference between professional development and professional learning terminology and reviewed literature examining what it means for professional learning to be effective, focusing on outcome-based and design-based tenets.

Next, I covered common professional learning opportunities including professional learning communities, lesson study, inquiry-based methods, job-embedded methods, coaching and mentorship, and administrative-led professional learning methods. I then reviewed professional learning benefits relating to career cycle and student outcomes. Next, I discussed barriers for implementing effective professional learning including inadequate resources, vision misalignment, dysfunctional cultures, and external variables. Then, I discussed the needs of adult learners with a focus of how those are reflected in effective professional learning.

The next focus of this chapter was practitioner inquiry, including a discussion on terminology and frameworks to study practitioner inquiry. I then explored what practitioner inquiry looks like in science classrooms. Finally, I reviewed the Wilcox SEF program and the professional learning tenets and methods associated with the program, specifically the Collaborative Coaching and Learning in Science and Growth Plan System models.

Chapter 3: Methods

I begin this chapter by revisiting the purpose of the study and research questions, and then I provide a description of the context surrounding my research and its participants. Next, I detail the purpose of the study, research questions, study frameworks, setting, and participant selection process. Then, I present the data collection, data management, and data analysis methods. Last, I discuss the criteria used to ensure the quality of the research, ethical considerations, and provide a timeline of the study.

Purpose of Study and Research Questions

The purpose of my study was to investigate how fellows in the Wilcox Science Education Fellowship (Wilcox SEF) program experienced effective professional learning, including how their prior lived experiences played a part in the development and implementation of their autonomous growth plan systems, and how their growth plan systems may offer insight on current professional learning realities in my local community. I addressed the following questions:

1. How do Wilcox SEF fellows understand their experience designing and implementing an autonomous professional learning plan?

    a) How did the fellows come to identify and articulate their growth plan system (GPS) goals?

    b) What barriers, if any, prevented the fellows from investigating their GPS goals prior?

c) Did the fellows' processes designing and implementing their GPS work contribute to an understanding of their work as practitioner inquiry, and, if so, how?

Through answering these research questions, I generated new knowledge on how participants experienced their journey designing and implementing a personal growth plan system and shed new light on professional learning. It is also important to note that the teacher experiences I studied occurred during the COVID-19 pandemic, so I acknowledged any way in which their experiences were impacted by the pandemic.

Context of Study

This study was conducted in the Spring, Summer, and Fall of 2022 with participants in the Peninsula University (PU) Wilcox SEF program, known as "fellows." The Wilcox SEF program is a teacher-leadership program for established science teachers to learn, collaborate, and reflect on their classroom practice (Feldman et al., 2020). This nation-wide, grant-funded professional development program assisted science educators in building leadership skills and teaching excellence in science through research-validated expertise from a partnering university, PU (Gasper & Das, 2018). Through a two-year, cohort structure, science teachers engaged in 250 hours of "intense capability development training," (Gasper & Das, 2018, p. 1) obtaining professional learning focused around the three program pillars: "reflective practice, leadership to peers, and adult learning" (Feldman et al., 2020, p. 2).

One of the program site locations was in Sunshine City through a university partnership with Peninsula University. In each cohort at this site, approximately 20 Pier County, Plains County, and Mountain County district science teachers, participated in the Wilcox SEF program (Feldman et al., 2020). This professional learning was carried out through vertical and horizontal collaborative coaching and learning of science (CCLS) protocols as well as through

the design and implementation of an individual growth plan system (Feldman et al., 2020; Trabona et al., 2017). The design of the science teacher's GPS allowed them to fulfill both a professional goal related to their district needs and a personal goal that was individualized for their professional learning needs while the design of the CCLS protocols allowed teachers to engage in lesson study.

Study Frameworks

To address my research questions, I engaged in qualitative research through multiple-case study methodology (Creswell, 2018; Stake, 2006; Yin, 2014). I interpreted my data through the ontological and epistemological paradigms of constructivism (Honebein, 1996; Lincoln & Guba, 2016) and interpretivism (Crotty, 1998). I used Bandura's (1997) self-efficacy theory as the theoretical framework guiding this study.

Qualitative Research

Qualitative research "seeks to understand the world from the perspectives of those living in it" (Hatch, 2002, p. 7), and it is an effective tool to gain insight and understanding from personal perspectives (Merriam, 1998). Qualitative research is especially useful for educational research (Stake, 1995), and it is particularly valuable when seeking to understand the social interactions of humans in their natural setting (Lichtman, 2013). Rich dialogue presented through interviews and story-telling narratives can provide insightful data to reveal how people make sense of experiences they have had and unveil deep meaning (Merriam, 1998). In this study, I sought to gain insight and understanding from science teachers' personal perspectives regarding their professional learning in the field of education, so using qualitative research was an appropriate research design. I now detail the qualitative research methodologies I employed to uncover this rich data.

Case Study

Case study is a particularly useful methodology for examining current real-life experiences and past lived experiences (Saldana, 2018; Stake, 1995). The data from case studies may be analyzed based on a variety of variables; the many analysis possibilities is a great benefit of this methodology (George & Bennett, 2005). Despite Yin (2014) being associated with the post-positivist paradigm and this study employing constructivism, I appreciated his declaration of case study to be an ideal methodology when investigating *why* and *how* a phenomenon may occur as it is not possible to manipulate the actions and behaviors of the participants (Yin, 2014). He elaborated to categorize case studies as explanatory, exploratory, or descriptive or as overlapping among those categories (Yin, 2014). Based on those categories, this study is both descriptive and exploratory. It is exploratory as there is not much known about the professional learning opinions, needs, and desires among teachers in my immediate, local community (Yin, 2014). Similarly, this study was descriptive as I developed a rich understanding of how local teachers conceptualize their experience designing and implementing an individual growth plan system (Baxter & Jack, 2015; Yin, 2014).

Multiple Case Study

Stake (2006) describes multiple case study methodology as analyzing more than one case pertaining to a defined phenomenon. Engaging in a multiple case study approach provides a more comprehensive understanding, as it allows for the analysis of a range of cases and drawing comparisons and contrasts among them (Baxter & Jack, 2015). By examining multiple cases, researchers gain a broader view of the phenomenon under investigation, enhancing the generalizability and transferability of findings. Additionally, the inclusion of multiple cases enables researchers to identify patterns, trends, and variations across different contexts, leading

to a more robust and nuanced analysis. Consequently, employing a multiple case study methodology may yield more beneficial insights compared to relying solely on a single case for data collection. Stake (2006) created the term Quintain to refer to an object, phenomenon, or condition that is the subject of interest in a multiple case study. In this research, the Quintain was the growth plan systems and professional learning experiences within the particular context of Wilcox SEF fellows who teach science at the secondary school level in either the Pier, Plains, or Mountain school district (Stake, 2006).

The unit of a case study may be a single person, event, or program while a multiple case study may look at multiple individuals in a shared experience (Pearson et al., 2015; Stake 2006). In this study, the primary unit of the case was the autonomous professional learning experience of Wilcox SEF fellows as they designed and implemented an individual growth plan system. A secondary unit of the case is the experience of participating in affinity groups throughout their GPS project year, and a tertiary unit of the case are shared experiences. Since this research involved the experiences of multiple people as they developed and implemented a growth plan system while part of the Wilcox SEF program, it made sense to employ a multiple case study research design using interviews and artifacts as the data sources (Stake, 2006).

Stake (2006) declared a multiple case study design to be especially useful for cross analysis as it allows a deeper understanding to be gained from multiple individual cases. While a disadvantage to this methodology is the time required per case and vast amount of data (Baxter & Jack, 2015), I used NVivo, a qualitative analysis software, to help overcome this drawback; the details of how I used this software will be discussed later in the chapter.

In this study, I navigated the landscapes of interpretivism and constructivism, two closely related paradigms that focus on understanding the subjective human experience. Interpretivism emphasizes the unique experiences of individuals and the meanings they attach to their interactions with the world (Crotty, 1998). It underscores the importance of exploring the complexities of the world from the perspective of those living it. Complementing this, constructivism recognizes that individuals actively construct their own understanding and knowledge of the world through their experiences and their reflection on those experiences (Colburn, 2000). I will now discuss each paradigm individually, and then explain how I strengthened my study through a dual paradigm approach.

Constructivist Paradigm. Stake (1995) wrote "most contemporary qualitative researchers nourish the belief that knowledge is constructed rather than discovered" (p. 99). While it would have been possible to investigate these research questions through other paradigms, I personally agree with constructivist beliefs, and I am empowered to autonomously select my investigative lens (Stake, 2005). It is fitting to mention that the participants in this study were similarly empowered by the autonomous nature of their growth plan systems which will be discussed later. One of the ways I analyzed the data from this multiple case study was through a constructivist lens (Creswell, 2018; Lincoln & Guba, 2016; Stake, 2006).

Constructivists argue that we "construct" our own truths, world views, and knowledge base (Colburn, 2000). Especially relevant in this study, the science teacher participants experienced professional learning through designing and implementing their growth plan system through their own lens of past experiences (Gill, 2015). Phillips (1995) acknowledged that a person's past experiences influence the way they learn new knowledge and encounter new

experiences. Similarly, as teachers recalled challenges and moments of ease, it was important to remember what they hold true will be what "works" for each person individually (Colburn, 2000).

   Interpretivist Paradigm. Interpretivism, as a research paradigm, places emphasis on the ways people interpret and make meaning of their experiences in the world (Crotty, 1998). Interpretivism advocates the necessity of understanding the subjective world of human experience and rejects the notion that an objective reality that can be observed and measured in a straightforward way (Crotty, 1998). Interpretivism emphasizes the socially constructed nature of reality, and instead of desiring to uncover universal laws or principles, interpretivism seeks to understand the complex world of lived experience from the point of view of those who live it (Paul, 2005).

   Since interpretivism views reality as something constructed and interpreted by individuals in their interactions with the world, research under this paradigm frequently employs qualitative methods, including in-depth interviews and observations, to gather rich, detailed data on individuals' perspectives, feelings, and experiences (Crotty, 1998). Using an interpretivism approach in this study allowed for an in-depth understanding of autonomous practitioner inquiry experiences while respecting the subjective experiences and interpretations of the individuals involved as well as researcher reflexivity.

   Dual Paradigm Approach. Although each paradigm has its distinctive emphasis, they overlap significantly. Both interpretivism and constructivism reject the idea that there is an external, objective reality to be discovered. Instead, both paradigms emphasize the subjective construction and interpretation of reality. They both appreciate the complexity and context-dependency of human experience and advocate for the use of qualitative methods that allow the

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richness of this experience to be captured. My use of a multiple case study with interviews as two of the ten data sets enabled this valuable qualitative work to occur.

In this research, I harnessed the strengths of both paradigms. The interpretivist lens guided me in exploring the subjective meanings and interpretations individuals attached to their experiences, including my own researcher reflexivity. Meanwhile, the constructivist lens illuminated how these interpretations are shaped by the participants' broader understandings of their world.

Self-Efficacy Theory

The theoretical framework that guided this study was Bandura's (1997) self-efficacy theory, which fundamentally influences the understanding of teacher learning and efficacy. As detailed in Chapter 2, Bandura's theory states that individuals, in this study, secondary science teachers, are guided by their beliefs in their own capabilities to accomplish specific tasks or attain certain goals, which is referred to as "self-efficacy" (Bandura, 1977). This theoretical framework is particularly pertinent to examining practitioner inquiry, as it suggests that a science teacher's belief in their ability to conduct meaningful inquiry and adapt instruction based on the findings can significantly impact the implementation and the efficacy of the inquiry process itself as well as instructional practices and teacher development.

Setting

As previously mentioned, the participants for this research were Pier, Plains, and Mountain district secondary school science teachers who were enrolled in the Wilcox SEF program at Peninsula University. Pier County is a coastal county located in the Southeast United States; Plains County borders Pier County to the north, and Mountain County borders Pier

County to the east. The demographic information of these counties and their schools is found below in Table 1.

Table 1

Demographic Information by District for the 2021-2022 School Year (Florida DOE, 2021).

Demographic Category	Pier	Plains	Mountain
Number of Total Students	95,466	81,142	224,149
Number of 9th-12th Grade Students	30,133	24,377	66,071
Number of 9th- 12th students who identify as Male	15,255	12,420	33,452
Number of 9th- 12th students who identify as Female	14,778	11,957	32,619
Percent of students who identify as White	52.1%	58.3%	31.2%
Percent of students who identify as Black	19%	24.6%	21.2%
Percent of students who identify as Hispanic	19.1%	7.9%	38%
Percent of students who do not identify as White, Black, or Hispanic	9.8%	9.2%	9.8%
Percent of students that are classified as English Language Learners	6.4%	4.9%	9.4%
Percent of students that are classified as economically disadvantaged	48.6%	51.2%	55.1%

Participant Selection

Participants in the Wilcox SEF program voluntarily applied to and were accepted to the two-year program and were paid a stipend of $8,000.00 upon successful completion of the program; the funding for the participants was provided by a private foundation (Feldman et al., 2020). All participants were in their second year of the two-year program and were members of the program's third cohort when the study was conducted. All participants were secondary school science teachers in either the Pier, Plains, or Mountain County public school systems. My interest in studying secondary science teachers was based on three reasons. First, elementary and

middle teachers tend to be generalists while secondary teachers tend to be specialists (Anderson & Clark, 2012; Gess-Newsome, 1999; Helms, 1998; Wilkins, 2009). Next, secondary teachers tend to identify more with the subject they teach where primary teachers tend to identify more with children and child development (Beijaard, 1995, 2019; Beijaard et al., 2004). Finally, I have a biased interest in experiences of secondary science teachers as I personally taught secondary science for over a decade.

To recruit participants for my study, I attended a Wilcox SEF monthly meeting, shared about my study, and invited any secondary science teachers interested in participating to sign up. I also sent an email inviting the fellows to participate (Appendix A). Seven participants expressed interest in participating in the study, but only five formally accepted their invitation to participate in the study. Having five participants was ideal based on Creswell's (2018) suggestion that researchers not include more than four to five cases in a multiple case study as doing so could jeopardize the integrity and quality of analysis and understanding of each case.

Once the participants were selected, I initiated email correspondence with each of them and scheduled a meeting using Microsoft Teams video conferencing software. Given the nature of the ongoing COVID-19 pandemic, combined with the fact that at the time of the interviews I had an unvaccinated infant and toddler at home, I exercised caution and conducted all meetings and interviews remotely using Microsoft Teams. In this first meeting, I explained the purpose of the study, participant expectations, obtained verbal consent to participate in the research, and conducted the first interview. Table 2, on the next page, provides demographics on the five participants in this study.

Data Collection

This study used multiple researcher-generated and researcher-collected data sources for triangulation and to ensure trustworthiness.

Researcher-Generated Data

The researcher-generated data included: (1) a semi-structured interview; (2) an artifact-elicitation, semi-structured interview; and (3) a researcher journal.

Table 2

Participant Demographics

Name	Highest Degree	Certification Pathway	Family Care Context	Age Range	Teaching Experience
Georgette	B.S. Biology	Alternative Certification Program	Lives with husband and young child	30-40	4 - 10 years
Izabella	M.A.T.	Degree Program	Lives with wife No children	30-40	4 - 10 years
Shari	B. S. Biology	Alternative Certification Program	Lives with husband and two young children	30-40	4 - 10 years
Chanley	M.Ed.	Degree Program	Lives with husband Has 2 grown children	40-50	15 + years
Elise	J.D.	Alternative Certification Program	Lives with adult dependent No children	40-50	4 - 10 years

Interviews. This study involved the use of semi-structured interviews to offer the participants an opportunity to reflect on their prior and current professional learning experiences (Bearman, 2019; Tyson, 1991). The semi-structured interview has become the most common method of data generation in the social sciences (Burwell, 2017). Following Burwell's (2017) methodology, the interview protocol consisted of a series of prompts, allowing for further questions and the elaboration of topics as they arose. The interviewee responded through recall,

telling the researcher of situations, feelings, and experiences associated with the prompts (Sparkes & Smith, 2014). Engaging in semi-structured interview methodology enables the following: (a) "the candidate [to] provide fuller answers than would be the case if the responses were to be written;" (b) "the interviewer [to] probe partial or ambiguous responses to elicit more information;" and (c) "responses [to] be judged on both the content and the depth of the responses" (Tyson, 1991, p. 88).

Seidman (2013) suggests conducting three interviews for each participant to build rapport, establish trustworthiness, and elicit the richest data from each participant. My two-interview protocol was drawn from his model. The question prompts for the semi-structured interviews were designed with a goal of unveiling the personal beliefs, thoughts, and perspectives of each participant relating to their professional learning and their individual Wilcox SEF Growth Plan Systems. The questions I composed were divided into two interviews. The first interview questions, as seen in Appendix C, inquired about the participant's demographics, personal teaching and professional learning history, and experience deciding on their GPS project goals.

The second interview questions, located in Appendix D, inquired about the participant's experience completing their GPS project, overall Wilcox SEF experience, and final thoughts on professional learning. In this interview, I sought to understand the participant's preconceived notions, if any, relating to the GPS project and their goal selection process. Then, I shared an image of the of the GPS poster they created to elicit more information regarding the details of their GPS project journey. Finally, I asked about any barriers they experienced that prohibited them from performing their inquiry prior to the Wilcox SEF experience. These interviews allowed me to understand: (a) factors which led to the participant selecting their GPS goals;

(b) specific challenges or celebrations encountered in implementing their GPS project;

(c) perspectives, beliefs, and thoughts pertaining to completing their GPS project;

(d) experiences sharing the knowledge gained through completion of their GPS project; and

(e) their general perspective on the second year of the fellowship and overall engagement in the Wilcox SEF program.

Both interviews were solely between myself and the participant, taking place via Microsoft Teams software which allowed for the interviews to be recorded and later transcribed. Transcripts of the interviews were provided to each participant, and they were asked to review the transcripts for accuracy. These member checks aided the trustworthiness of the study (Seidman, 2013) and are detailed in the data analysis section of this chapter.

Researcher Journal. Dana and Yendol-Hoppey (2020) describe reflective journals as a data collection strategy and emphasize reflective journaling as an effective tool for capturing thinking. Borg (2001) identified seven benefits of keeping a researcher journal:

1) It serves as a reminder of past ideas and events which guided subsequent action

2) It provides a record of plans and achievements which facilitated evaluation

3) It supplies an account of events and procedures which allow a more detailed write up of the study

4) It allows the researcher to recall and reproduce the thinking behind key decisions in the work

5) It comprises an instructive narrative of the researcher's professional growth

6) It provides physical evidence of progress which gives the researcher a sense of achievement and motivation

7) It provides an account of experiences and ideas which, when returned to, often spark

further insights (p. 171-172).

It is crucial for all researchers to maintain a researcher journal (Hatch, 2002). Dedicating

time and space to capturing my thoughts to "openly reflect on what is happening during the

research experience" and monitoring my "personal reactions to what is being discovered"

assisted me in remaining more objective as I viewed and assessed the data (Hatch, 2002, p. 88).

Journal entries primarily took place in digital format, either through typed reflections or

audio recordings that were later transcribed. I used the same protocol, detailed later in this

chapter, to transcribe the two interviews as well as any researcher journal entries that were audio-

recorded or video-recorded.

Researcher-Collected Data

Research artifacts are physical materials collected by researchers for obtaining additional

data (Dana & Yendol-Hoppey, 2020; Merriam, 1998). The researcher-collected data, or

artifacts, include the participant's: (1) Wilcox SEF Program Application; (2) GPS Brainstorming

Document; (3) GPS Proposal; (4) GPS Monthly Reflection; (5) GPS Poster; (6) GPS Poster

Presentation; and (7) GPS Portfolio.

The artifacts collected in this research study were named with terminology that is specific

to the Wilcox SEF program. Because many may not be familiar with this particular terminology,

and there is a need for "clear and consistent definition of terms" (Zeichner, 2005, p. 740), I have

provided explanations for the following researcher-collected artifacts used in this study:

- Wilcox SEF Program Application – This artifact was the participant's application to

be a part in the Wilcox SEF program. In addition to providing demographic

information, this document contained open-ended responses relating to how the participants have taught challenging science concepts in the past.

- GPS Brainstorming Document – The brainstorming document was a Microsoft Word template where the fellows answered seven questions. The first three questions were more conceptual and inquired about issues they may have wanted to investigate for their GPS project, including goals for themselves and others. The remaining four questions inquired about specifics relating to executing their GPS project, including who would be involved in their project, how they would address project issues, what evidence or artifacts may be generated, as well as proposed timeline for completion. When feedback on the brainstorming document was provided by a program mentor, I also collected that data.

- GPS Proposal – The GPS project proposal document was a Microsoft Word template the fellows completed with five sections. The sections included: (a) Background & Vision; (b) Goals; (c) Plan to Achieve Your Goal; (d) Data and Evidence; and (e) What Would Help You Achieve Your Goal. In the Background & Vision Section, the fellows described the background pertaining to why they are setting each of their two goals as well as their vision for what they will ultimately accomplish. In the Goals section, they described a personal goal they wished to achieve and a district-aligned goal. Achieving a district goal allowed them to fulfill a need in their school district. In the Plan to Achieve Your Goal section, fellows described each thing they would do to complete each goal, when they planned to do it, and what their benchmarks were. In the Data and Evidence section, fellows listed any evidence they planned to collect for each goal and described how that evidence allowed them to know they have met

benchmarks and ultimately achieved their goal. The final section allowed fellows to note anything they would like to learn to help them achieve their goal as well as any purchases they wanted to make for tangible (books, materials) or intangible (conferences) resources.

- GPS Monthly Reflection – Each month, the fellows completed a reflective survey via Qualtrix software. This survey allowed for open-ended responses to questions inquiring about any successes, challenges, changes made to their project, and the focus of any meetings with their mentor that occurred in the past month. Additionally, it allowed the fellows a dedicated space to identify any needs they had from the program facilitators or district science coordinators.

- GPS Poster – The fellows made an academic poster to use in their GPS Poster Symposium Presentation. While a physical poster used for a presentation fits this example of an artifact, I expanded this definition to include the fellow's poster in its digital form prior to printing. At the culmination of each Wilcox SEF fellowship, fellows created a poster to present their growth plan systems. The completed growth plan system poster served as an artifact for this study. For trustworthiness, it should be noted that the participants were required to complete this poster to receive their final financial stipend, and they had access to a poster template as well as example posters completed by previous fellows.

- Poster Presentation – As the Wilcox SEF program culminated, fellows used a provided template to make a poster to showcase their GPS projects. In prior years, fellows presented their posters in an open poster session and a select few showcased their work in a poster session at a national conference. When COVID-19 began, the

fellows used software to record their poster presentations for remote audience viewing. Cohort 3 was the first Wilcox SEF cohort to have an in-person presentation at a poster symposium since the start of the COVID-19 pandemic. This in-person presentation, along with notes I took while watching it, constitute what I refer to as the 'poster presentation' in terms of data collection.

- GPS Portfolio – The fellows cataloged and reflected on their work through creating a digital portfolio. This digital portfolio captured the specific work done on each goal, provided artifacts and evidence of that work, the impact of their work, and the specific successes and challenges faced while implementing their GPS project. This portfolio also included reflections on their growth through the two-year Sunshine City Wilcox SEF program.

Table 3, on the next page, details which data sources I used to investigate each research question.

Data Management

All data was kept confidential, only being accessed through Box by the researcher and study advisors. The online transcription service, Maestra, was used to assist with interview transcriptions, but to ensure accuracy I personally listened to all audio recordings to check and edit the transcriptions. Once the transcriptions were complete, I deleted them from the Maestra software. Study artifacts, transcripts, my researcher journal, and all other study-related information was stored in Box, a secure password protected cloud management service, and the data will remain there for a period of five years. I will destroy all data five years after the completion of the study.

Table 3

Data Source Application to Research Question

Research Question	Application	Brainstorming Document	Proposal	Monthly Reflection	GPS Poster	Poster Presentation	GPS Portfolio	Semis-structured Interview	Semi-structured, Artifact-elicitation Interview	Researcher Journal
1. How do Wilcox SEF fellows understand their experience designing and implementing an autonomous professional learning plan?		X	X	X	X	X	X	X	X	X
a) How did the fellows come to identify and articulate their growth plan system (GPS) goals?	X	X					X	X	X	X
b) What barriers, if any, prevented the fellows from investigating their GPS goals prior?	X	X					X	X	X	X
c) Did the fellows' processes designing and implementing their GPS work contribute to an understanding of their work as practitioner inquiry, and, if so, how?		X	X	X	X	X	X		X	X

Triangulation

Triangulation (Carter et al., 2014) refers to the use of multiple data sources in qualitative research to develop a comprehensive understanding of phenomena that increases the validity of the study (Patton, 1999). While I used the artifacts, questionnaires, and researcher journal as data sources, the most rich data sources were the semi-structured interviews (Bearman, 2019). Still, the artifactual data and researcher journal provided support for interpretive analysis and enabled triangulation (Baxter & Jack, 2015; Carter et al., 2014).

Data Analysis

This multiple case study research produced a great deal of data to be analyzed (Creswell, 2018; Stake, 2006). I used inductive analysis and cross-case analysis (Denzin & Lincoln, 2011; Stake, 1995) to analyze the study data.

Inductive Analysis

I first performed inductive coding on all data sources (Denzin & Lincoln, 2011; Grbich, 2013; Lichtman, 2013). Beginning with the recorded Microsoft Teams interview, I extracted the audio file. The interview audio file was initially transcribed via a transcription software, Maestra, and further edited by myself for accuracy. Considering environmental and security responsibilities, the transcription was not printed, highlighted, and sorted during document analysis (Dana & Yendol-Hoppey, 2020). Rather, the transcription was uploaded to a qualitative analysis software, NVivo, where I performed open coding on the text.

The first data set I performed open coding on was the semi-structured interview, which I refer to as "Interview 1." I went through this interview and created codes for every potential theme that emerged. I did this for each of the participants' first interviews. At this point I realized that some of my codes were outside the scope of this study, so I made a conscious decision to eliminate those codes should they appear in the future. Then, I went through and openly coded the semi-structured, artifact-elicitation interview, or what I refer to "Interview 2."

Interview 2 was conducted roughly a month after Interview 1. Interview 1 was conducted as participants were nearing the end of the Wilcox SEF program, but they had not yet presented their GPS work at the poster symposium or completed their portfolios. Interview 2 occurred around a month after Interview 1. At this point, the participants had presented their GPS work at a poster symposium, and, as previously described, the poster they created was used

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for elicitation in the interview. After coding each of the participants' second interviews, I did a preliminary analysis of my codes and identified potential themes. I then deductively coded each of the remaining eight data sets for the codes identified in the interview data sets.

Once initial coding was complete, member checks and peer debriefing with colleagues occurred (Birt et al., 2016). Regarding member checks, I e-mailed each of the participants a copy of their transcript. I asked them to reply if there was anything in the interview they wanted to clarify, elaborate on, or have omitted and provided them with my contact information. I ultimately did not receive a response from any of the five participants. For peer debriefing, I spoke on the telephone and held Microsoft Teams meetings to share my research process, data, and findings with critical friends. I received great feedback, and through this feedback I eliminated and added codes, searched deductively for codes in other data sets, and reformatted some of my codes to directly associate with my research questions.

Once this phase of the analysis was scrutinized, the identified open codes were organized into categories, and then those categories were grouped into higher order headings, following a protocol by (Elo & Kyngäs, 2008). In organizing the codes, I was attentive to the self-efficacy framework guiding this study. I was able to identify evidence supporting performance outcomes (GPS results), vicarious experiences (collaborative experiences), verbal persuasion (feedback from support structures), physiological and emotional states (mindset, moments of ease and frustration), and setting challenging goals (goal selection process). From the interpretation of the openly coded categories and identified themes (Vaismoradi et al., 2013), implication questions were asked of the data (Dana & Yendol-Hoppey, 2020). The results of this inductive analysis was reported through models, conceptual maps, and story lines (Vaismoradi et al., 2013) as seen in Chapters 4, 5, and 6.

Individual Case Analysis

This study collected data from the participant's perspectives through one-on-one, semi-structured interviews and artifacts. Each participant's stories, words, and artifacts were first analyzed independently from other participants through the inductive analysis protocol described above. The findings from the individual case analysis are presented in Chapter 4.

Cross-Case Analysis

After this first analysis was complete, a cross analysis (Stake, 1995) occurred to benefit the understanding of the aggregate (Stake, 2006). In performing a cross-case analysis, this study's Quintain of growth plan systems and professional learning experiences was better and differently understood as a result of the unusual features, particular activity, and contexts of each case (Stake, 2006) across all the triangulated data sources (Carter et al., 2014).

To convey the findings, I used tables, models and conceptual maps including word clouds which were generated by the NVivo software (Heimerl et al., 2014). For the word clouds, the most frequently used words were displayed with the larger the word indicating the greater the quantity of times it was referenced; I eliminated words used in colloquial settings such as 'like' and 'you know,' so the word cloud accurately displays the proportionality of key terminology (Heimerl et al., 2014).

Quality Criteria and Trustworthiness

I employed Tracy's (2010) eight criteria for quality research to ensure the overall quality, credibility, validity, and reliability. The application of these eight quality criteria to this study are detailed in Table 4 on the next page. For trustworthiness (Guba, 1981), it is important to address bias that may have occurred in the interview. First, by agreeing to participate in my study the participants exemplified a predisposition and willingness to dedicate their time to bettering

Table 4

Tracy's (2010) Quality Criteria Applied to This Study

Quality Criteria	Application to Current Study
Credibility	I used data triangulation methods including interviews, artifacts, and journaling; in addition to member checks and peer debriefing, my data collection process was scrutinized by my doctoral committee.
Ethical	I obtained informed consent from the participants prior to their involvement in the study and I ensured anonymity for the participants, programs, and educational institutions.
Meaningful Coherence	I ensured that my methods embodied a constructivist paradigm and adjusted throughout the research process as needed.
Resonance	I used vignettes to present stories in the literature review and continued that in the data analysis process.
Rich Rigor	I used multiple data sources to address the research topics.
Significant Contribution	This study was significant as it addressed a current gap in the literature, as detailed in the literature review.
Sincerity	I was transparent about my research process and kept a researcher journal throughout the study, acknowledging any biases as they arose.
Worthy Topic	I demonstrated this study is a worthy topic in the literature review by addressing its relevance and timely nature as well as significance to fulfilling gaps in the current literature.

themselves through both engaging in a professional learning fellowship program and an independent professional learning research study.

It cannot be assumed that interviews, or any method of data collection, can offer direct and unproblematic access either to the respondent's views or to the subject that may be under discussion (Madill, 2011). Ambiguity in interview data may have arisen from attitudes to the situation itself, particularly with an interviewer who may be an academic in the same institution, and who may be regarded as representative of it (Denzin and Lincoln, 2005). However, as a

researcher who has over a decade of previous teaching experience in the high school science settings and has volunteered with the Wilcox SEF, it is worthwhile to acknowledge that my position as an "insider teacher-researcher" provided access to interview participants and an opportunity to cultivate a degree of understanding and trust (Gaunt, 2010, p.181).

Once the initial coding of the interviews was completed, peer debriefing (Hail et al., 2011; Janesick, 2015) occurred; this is essential to establishing credibility, a key component of trustworthiness, in the study process (M. Patton, 1999; Roulston & Shelton, 2015; Tracy, 2010).

Ethical Considerations

Throughout the study, ethical considerations remained at the forefront of the study as the nature of this work and educational practice may influence others (Feldman, 2007). As Tinkler (2013) impressed, researchers are responsible for preparing participants to work within ethical frameworks and legal stipulations. I engaged in dialogue regarding ethical considerations with all participants. Consent by all parties was obtained prior to interviews, and the anonymity of program locations, partnership schools, and individuals was maintained.

It is important to reflect on the digital afterlife of the recorded interviews, transcripts, and analysis and to acknowledge that a digital afterlife of a mp4 formatted video, such as a Microsoft Teams recording, may be different than a still jpg image due to storage, transmission, and editing capabilities for these formats (te Riele & Baker, 2016). Thus, the recorded interviews are stored securely in their original formats as described prior until they are deleted after five years' time.

IRB protocols were completed, and this study did not occur until after it received IRB approval. The constructivist paradigm of this study also contributes to the ethical components of this study. Lincoln & Guba (2016) wrote "the moral imperative for the constructivist is to be not only open to new information or levels of sophistication that challenge the construction currently

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held, but actively seek them out and take them into account" (p. 78). In performing this study, I actively sought out new information on the perspectives, beliefs, and thoughts of secondary science teachers in my immediate community with the intent to share any new knowledge gained to empower science educators and better my local community through transferability (Lichtman, 2013).

Data Collection and Dissertation Timeline

I spent two months obtaining IRB approval and recruiting participants followed by three months collecting data. The data collection process included conducting two interviews, compiling seven artifacts, ranging from brainstorming documents and GPS portfolios, as well as recording my researcher journal entries. Once the data was collected, I spent six months analyzing the data and articulating my findings. At the end of the six months, I presented my findings at the 2023 ASTE International Conference Work in Progress Poster Session. After reflecting on feedback gained at the conference, I began writing Chapters 4, 5, and 6 of my dissertation. I spent five months writing and revising these chapters. In May 2023, I defended my dissertation and continued to revise the dissertation until its publication in August 2023. My data collection and dissertation timeline can be viewed in Table 5 on the next page.

Chapter Summary

In this chapter, I described the context, participants, purpose, and research questions of my study. I detailed the frameworks guiding this study including qualitative research, multiple case study, paradigms, and self-efficacy theory. I explained the setting and participant selection process as well as detailed the data collection protocols. The data collection process description

Table 5

Data Collection and Dissertation Timeline

Time Period	Milestone
March – April, 2022	Received IRB Approval, Recruited Participants
April – June, 2022	Conducted Interviews, Collected and Compiled Artifactual Data
July – December, 2022	Analyzed Data
January, 2023	Presented Findings at ASTE Work in Progress Poster Session
January – May, 2023	Completed Dissertation Writing
May, 2023	Defended Dissertation
May – June, 2023	Revised Dissertation, Submitted to ETD
July, 2023	Revised Dissertation based on ETD feedback
August, 2023	Published Dissertation

included data types, data management, data analysis, and triangulation with the advantages and disadvantages of each method interspersed throughout. Finally, I addressed this study's quality criteria, trustworthiness, subjectivity and bias, and ethical considerations.

Chapter 4: Individual Case Findings and Analysis

In this study, I investigated how fellows in the second year of the Wilcox Science Education Fellowship (SEF) program conceptualized their professional learning experience through the design and implementation of an inquiry-based Growth Plan System (GPS) project. As described in detail in Chapter 3, this study employed a multiple case study with inductive analysis and cross-case analysis. There were five participants in this multiple case study: Georgette, Izabella, Shari, Chanley, and Elise. For validity and triangulation, the analyses included ten data sources for each participant. Member checks, peer debriefing, and Tracy's (2010) Eight Quality Criteria were also used to ensure the credibility of this study.

This chapter provides a description of the findings and individual case analysis in response to each of the following research questions:

1. How do Wilcox SEF fellows understand their experience designing and implementing an autonomous professional learning plan?

a) How did the fellow's come to identify and articulate their GPS goals?

b) What barriers, if any, prevented the fellows from investigating their GPS goals prior?

c) Did the fellows' processes designing and implementing their GPS work contribute to an understanding of their work as practitioner inquiry, and, if so, how?

This chapter is organized with respect to the five individual cases that were studied. After detailing the findings and analysis of each individual case, the cross-case findings and analyses will be discussed in Chapter 5.

To answer Research Question 1 and Research Question 1a, I embarked on the individual case analysis through looking at the educational backgrounds, teaching journeys, professional learning histories, and effective learning beliefs that the participants bring with them as they enter the Wilcox SEF program. As an adult learner, the participants brought their background with them (Galbraith, 2004), so it is not possible to fully understand their Wilcox experience without considering these factors. Once that was addressed, I discussed their Growth Plan System experience longitudinally. I began prior to their GPS work, focusing on the path from their awareness of the Wilcox SEF program throughout their application process and acceptance, and then I moved to the time period immediately preceding the Year 2 and their GPS project. I then covered their GPS journey, from preconceived notions to goal selection, project implementation, and presenting the results of their work. At this point, I investigated any ways their GPS work may have launched them into new phases of their career or personhood. At the end of the longitudinal journey, I looked to answer research questions 1b, studying barriers, if any, that were described or inferred, as well as research question 1c. For research question 1c, I also used a temporal analysis process; I inquired about any prior knowledge and experience with practitioner inquiry, their possible identification of their GPS work as practitioner inquiry, attitude towards practitioner inquiry, and any future intentions to engage in practitioner inquiry.

Georgette

Georgette is a Caucasian, female educator with between four and ten years of teaching experience at Valtis High School in the Plains School District. At school, Georgette has taught Advanced Placement (AP) and International Baccalaureate (IB) level courses as well as Honors level courses. At home, Georgette lives with her spouse and elementary-aged child.

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Educational Background

Georgette's education journey began in the Midwest, where she attended half-day kindergarten and elementary school. Her family relocated to the Southeast for her middle and high school years, and then she moved to a different Southeastern state where she received an undergraduate degree in biology at a R1, or very high research activity, university. Like many science teachers, Georgette was not thinking of a career in education at the time she was in college. In fact, she wanted to be a pediatric oncologist. Of all the doctors she shadowed, she only met one female pediatric oncologist. One day when Georgette was working with her, the oncologists' son got a compound fracture, and the oncologist told Georgette she realized she had a lack of empathy towards him. Georgette watched this doctor remain depressed for another week, and while talking, the pediatric oncologist said: *"you can have it all, but it's harder than I ever imagined.*[2]*"* This was a turning point in Georgette's life. She realized that she wanted to make having a family a priority in her life; pediatric oncology was no longer a career she desired. She said, *"so I turned to research and found out that wasn't it. And so it was kind of, honestly, like a drift. I didn't really know what I want to do with my life. That was my goal forever."*

Through the uncertainty, Georgette continued her side-job of coaching competitive cheerleading when one of her cheerleaders asked her to apply for a coaching position that had just opened at her school. She said, "*So I did not go to school for education and really honestly fell into it entirely. I had not planned to be a teacher, but was coaching cheerleading, actually. And here we are.*" She continued to describe the situation:

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[2] Italicized quotes are from interviews of the participants.

One of the kids I coached said, "hey, there's a high school coaching position open if you want to. Like, we really need another coach that knows what they're doing. So would you apply for it?" And I went and then sat down, applied for it. They gave me the job, but it was another just small part time job, along with still applying everywhere and coaching full time outside of that. But then the coach actually got fired mid-year. The head coach. I was only the assistant coach, and so I ended up taking on both teams, and it became a little more than just a tiny part time job. It was like a full part time job. And the guy that was actually head of athletics said, "you have a science degree?" "Yes." "I have somebody going on maternity leave come August. Would you be willing to teach science?" I was like, "I've never been in a classroom. I have no idea what I'm doing." And he was like, "It's okay. Do you know chemistry?" And I was like, "yeah." So, he kind of threw me in.

In summary, Georgette, who initially aimed to become a pediatric oncologist, completed her undergraduate degree in biology at a university with very high research activity. However, an impactful encounter with a female pediatric oncologist, who struggled with her professional and personal life balance, caused Georgette to reconsider her career choice. She felt lost and uncertain about her future career, turning briefly to research but finding it unsatisfying. Concurrently, she was coaching competitive cheerleading, a part-time endeavor that led her unexpectedly into an education career. When the school required a new cheerleading coach, she took up the position, which eventually led to a full part-time job. The head of athletics noticed her science degree and offered her a temporary teaching position during another teacher's maternity leave. Despite her initial apprehension, due to her lack of classroom experience, she agreed to teach and began her career in education.

Teaching Journey

After being a long-term substitute, the school hired her as a teacher for their Emotionally and Behaviorally Diagnosed (EBD) students. She said, *"honestly, EBD was when I realized I really liked doing this. They were the most important kids I've ever had."* She went through an alternative certification program provided by the district and became certified to teach biology. A biology teacher was leaving, so the assistant principal suggested she apply for it. She continued:

> I applied. They gave it to me. I got a call at a cheerleading camp before school started. *"Can you do AP Biology too?"* And so I taught honors bio, regular bio, and AP bio, which was AP [and] IB combined…So I did that for them.

Over a decade later, Georgette still teaches at that school. She said:

> I stayed there forever, and then I gave up AP because I was not a fan of the way the school did it. I don't think that traditional IB [students] should be combined [in the same class with AP students] if we're not teaching the same curriculum. So, I gave that one up and just stuck with all bio for a few years and then started anatomy. I've had AP bio off and on throughout those years. Just once or twice. Like every few years when they run out of teachers to take the section. But then I started anatomy and had biology with that, and then I had all anatomy for two years. This year I had genetics and anatomy, and now next year I'll have all three bio, genetics, and anatomy.

As discussed above, Georgette's teaching journey commenced with a long-term substitute position for Emotionally and Behaviorally Diagnosed (EBD) students which found deeply rewarding. Following an alternative certification program, she became certified to teach biology and filled a vacant biology teaching role at her school. She taught different levels of

biology, including regular, honors, and a combined AP/IB class. However, she disagreed with the combined AP/IB approach due to divergent curricula and chose to focus mainly on biology, anatomy, and genetics. Despite the changes in her teaching roles, Georgette has remained at the same school for over a decade.

Leadership Role History

Georgette's school required everyone to participate in a professional learning community (PLC). I provided a general explanation and description of PLCs in Chapter 2, but Georgette's specific PLC met weekly during a dedicated time after school for about 40 minutes. As a PLC facilitator, Georgette has led weekly meetings, focusing on science practices and tracking students' progress. She described the PLC objectives:

> *It's where we sit and essentially make sure that our deliberate practices for observations*
> *are on par. We're working towards the goals of the school with the mission statements,*
> *and we track data throughout the year for things that we want to focus on.*

Georgette had four years of experience serving as a PLC facilitator. Her first two years, she led the PLC for the biology teachers. More recently, she served as the PLC facilitator for the non-core science teachers, which consists of teachers primarily teaching elective courses such as genetics and anatomy. In terms of how the participants are assigned to PLCs, she said:

> *We don't really have a vertical or horizontal [alignment], especially in science. We*
> *don't have grade levels, so I have, like, someone who teaches forensics and marine.*
> *Another one teaches marine and environmental. Two of my teachers teach chemistry and*
> *earth space science, so it's all over the place. Honestly, it's a jumble of everyone that*
> *doesn't have biology or IB.*

Georgette strived to have a PLC environment that helped teachers be better at their practice and lead by example. She said,

> I presented them the science practices, thanks to Wilcox actually, and said, "I'm going to focus on questioning for this...is there anything here that you guys want to work on that you think your kids [are] struggling [with] that, you know, is a skill you want them to walk out of your room saying, 'I have more confidence in?'"

Overall, Georgette has served as a PLC facilitator for four years, leading these gatherings, focusing initially on biology teachers before transitioning to facilitate non-core science teachers specializing in elective courses like genetics and anatomy. Georgette is committed to fostering a PLC environment that improves teaching practices and helps students develop confidence in their skills.

Professional Learning History

Georgette's alternative certification experience provided by her district was her first professional learning experience. In fact, she said, *"I think now it's called professional development certification program or something like that…but mine was alternative certification program and we did it in one to two years depending on how fast or slow you want to do it."* Her other professional learning experiences were from district mandated professional development sessions, *"such as ESOL (English for Speakers of Other Languages), classroom management courses, and half-day release sessions led by school administrators or district personnel. We have a district mandated half day release. I think there's six of them throughout the year."* As previously mentioned, Georgette also participated in a mandatory PLC where she later became a facilitator.

Georgette has also sought out professional learning opportunities for herself. She has attended two Advanced Placement Summer Institutes (APSI) for AP Biology, a Kagan (a commercial, cooperative learning program based on engagement) training focused on teaching strategies, and two inquiry learning sessions led by a Southeastern university research team. Those inquiry sessions were aimed at doing inquiry work with students and were not about teacher inquiry. When asked what professional learning opportunities she is attracted to, she said *"I usually choose science ones, but I've also done a lot of formative assessment ones."* Additionally, she participated in the Together We Learn symposium for the five years, focusing on science and formative assessment sessions. Her most recent professional learning experience was the Wilcox Science Education Fellowship (SEF) which is a two-year program.

In the year prior to our interview, Georgette engaged in professional learning through the Wilcox SEF program. She completed the first year of the Wilcox SEF program as a member of Cohort 3. In this year, Georgette attended monthly meetings as well as worked within two Collaborative Coaching and Learning in Science (CCLS) teams. I provided a general description of the CCLS professional learning protocol in Chapter 2. For Georgette, she was paired in teams with fellows that spanned all three of the Wilcox SEF partnering school districts. In the fall semester of her first year, Georgette was a part of a vertically-aligned CCLS team (V-CCLS), and in the spring semester, she was engaged with a horizontally-aligned CCLS team (H-CCLS). The fellows attended monthly meetings addressing many topics ranging from an overview of the CCLS methodology and protocols to issues of equity and student funds of knowledge. Table 6, on the next page, details the topic or agenda item covered in each month during the third cohort's first year of the Wilcox SEF program. Because all the participants in this study were in Cohort 3, they also attended these monthly meetings.

Table 6

Wilcox SEF Cohort 3 Year 1 Monthly Meeting Topics

Month	Meeting Topics
August	An overview of the CCLS methodology and protocols
September	Community building and V-CCLS lesson study activities such as course study and research article discussions
October	Introduction and overview of the Next Generation Science Standards (NGSS)
November	Principles of adult learning and tips for being a dynamic trainer
December	V-CCLS presentation workshops
January	V-CCLS presentations
February	H-CCLS practice and pedagogy, issues of equity in science teaching and learning, integrating student funds of knowledge
March	Equity in science classrooms
April	Science teacher leaders for social justice in the classroom and culturally responsible science
May	H-CCLS presentations

To briefly summarize, Georgette's history of professional learning began with an alternative certification program provided by her district and has continued to include multiple district-mandated workshops. Beyond these compulsory trainings, Georgette sought further opportunities such as the Advanced Placement Summer Institutes for AP Biology, Kagan teaching strategies training, and inquiry learning sessions. She preferred science-based professional learning but also valued formative assessment programs. In the year prior to the interview, Georgette was part of Cohort 3 in the Wilcox SEF program, involving her in monthly meetings and two Collaborative Coaching and Learning in Science (CCLS) groups.

Effective Professional Learning Beliefs

Regarding the format of her professional learning experiences, Georgette noted that some sessions were hands-on and engaging, while others were more lecture-based. She identified that most of the district-mandated professional learning sessions were *"sit and get, without much interaction,"* and she felt these were less effective than the professional learning she sought out for herself. She elaborated, *"I need to be able to apply it to what I do. I need to be able to see it with my kids."*

Georgette emphasized that effective professional development should provide opportunities for participants to reflect on and improve their teaching methods, while also offering practical strategies that can be tailored to their specific classroom needs. She stated, *"it has to have an application that I can take, and there has to be time for me to take it and say, this is what I would do for myself and for my kids in my classroom."* When speaking about her most recent professional learning experience, she realized the importance of pairing dedicated and intentional time to reflect with observations. She said, *"I didn't find [observations] valuable until we actually went and observed other teachers and then had to come back and say, 'what do you see of them and your own self?'"* Georgette also offered her perspective on the importance of autonomy in professional learning:

> *I like the fact that it was [autonomous], that I really got to focus on something that I wanted and that I had resources provided to help me excel in it or to get better at it, to improve in it and to really develop in that area. It's not something you find in most [PDs]...I feel like we don't find that in most of our PDs.*

Georgette expressed dissatisfaction with lecture-based professional learning formats that lack interaction. She found more value in hands-on, engaging sessions that allowed her to apply

learned concepts directly to her teaching context. She believed effective professional development should afford opportunities for reflection and improvement of teaching methods, provide practical strategies adaptable to specific classrooms, and incorporate observation and reflection of other teachers' practices. Importantly, she appreciated the autonomy to choose her learning focus in some professional learning experiences, which she acknowledged was rare, yet essential, for personal growth and improvement.

Research Question 1: The GPS Experience

I answered the first research question in this study, "How do Wilcox SEF fellows understand their experience designing and implementing an autonomous professional learning plan?" by evaluating the nine aspects that correspond with the phases of Georgette's GPS journey: (1) how Georgette became aware of the Wilcox program; (2) her Wilcox SEF preconceived notions; (3) her Wilcox SEF application process; (4) her GPS preconceived notions; (5) her GPS goal selection process, (6) her GPS description and implementation (7) her GPS academic poster creation process; (8) her GPS poster symposium process; and (9) her personal impact after the culmination of her GPS work. I also analyze an additional five aspects that manifested at multiple points during the GPS phases: (10) moments of ease; (11) moments of challenge; (12) reliance on support systems; (13) benefits of engaging in GPS work; and (14) barriers preventing prior GPS investigation.

The process that Georgette went through to select her GPS goals was addressed in research question 1a. The purpose of research question 1b was to identify if any barriers or past experiences prevented Georgette from investigating her GPS goals prior to the Wilcox SEF program, and, if so, what those barriers were. Through examining these fourteen aspects, how Georgette conceptualized her GPS experience in the Wilcox SEF program was discovered.

Awareness of the Wilcox Program. Georgette became aware of the Wilcox SEF program through an email from one of her district's science supervisors, Russell, who also serves as a District Science Coordinator (DSC) for the Wilcox SEF program. When Russell and Georgette later talked in-person, Russell told her, *"I think you'd be great for it."* This encouragement led Georgette to consider the program more seriously, but she was concerned about the time commitment due to having so many other responsibilities: (a) teaching a full course load with all Honors classes; (b) facilitating a PLC; (c) coaching competitive cheerleading; and (d) managing her family's home life as a wife, mom to an elementary aged child, and dog owner. Nevertheless, Georgette decided to apply, stating that she likes *"getting better on things that are applicable in my classroom."* While the stipend wasn't her primary motivation, she admitted that *"it didn't hurt"* and made her feel that the time spent working with the Wilcox SEF *"will be worth it."* Overall, Georgette had concerns about the heavy workload associated with the Wilcox SEF program, but she was motivated to improve her classroom practice and decided to apply to the program, with the stipend also serving as an incentive.

Preconceived Notions. Before starting the Wilcox SEF program, Georgette's district science supervisor who also served as a DSC in the Wilcox SEF program, Tom, talked with her about the program. Tom warned her that *"it is a lot of work."* She was uncertain about how the program would proceed due to the ongoing COVID-19 pandemic. Georgette mentioned that not knowing how the program would adapt was *"a little bit nerve-wracking."* Despite these concerns, Georgette was excited to improve her teaching practices and decided to participate in the program. Georgette knew that the focus of the second year of the Wilcox SEF program would be completing a GPS project. Being in Cohort 3, Georgette was able to see some members of Cohort 2 present their GPS projects in a research symposium. Watching these

presentations allowed to Georgette form some preconceived notions about what she may experience when engaging in her GPS work:

> *I felt like I was going to be doing a research symposium because I did a bunch of those in undergrad. Posters and all that reminded me of the presentations we watched. I don't want to do a greenhouse. I have high schoolers. I have 150 kids a day. The only GPS [projects] that I got to see were [done by] elementary school teachers, at least in my symposium, the ones I was assigned. So, I was like, "Oh, God, I don't want to do a greenhouse or a clicker program." So, I was like, "What am I going to do?"*

Georgette was not concerned about being a part of a research symposium, but because she had only seen GPS projects done by elementary school teachers, she had anxiety pertaining to how she would come up with GPS goals that were appropriate for honors-level secondary science students and struggled to visualize herself working on a GPS project that met her teaching needs.

To briefly summarize, before starting the Wilcox SEF program, Georgette had some reservations due to warnings about its demanding nature and uncertainties surrounding the COVID pandemic. She was also concerned about how would devise a GPS project that was suitable for her secondary science students at the honors level.

Experience Selecting GPS Goals (Research Question 1a). Georgette considered several GPS project ideas. In sharing how she arrived at her main GPS goal, she prefaced the specifics of her journey with, *"So it took me a long time to get here, and it was thanks to Miranda (her assigned Wilcox mentor), I finally got here"* and *"I think picking the topic was the most daunting thing for me. For sure."* Originally, Georgette wanted to design a project to help new teachers be comfortable with lab work; this also evolved into designing a new PLC focused

on science practices. Her brainstorming document revealed that, for a personal goal, Georgette

wanted to increase student engagement, teacher confidence, and new teacher confidence in

science skills as well as make teachers more comfortable doing lab work with their students.

Georgette quickly realized her focus was too broad. Serving in his DSC role, Tom offered

Georgette written feedback on her personal goal: "Finding a clear definition for engagement or

measuring confidence may help you frame the work you will focus on. New teachers are

sometimes a tough group [to get] to engage in new work in that first year of teaching."

Georgette later admitted in her interview that she was also concerned about adding more to the

already high workload of new teachers as well as giving administrators more criteria to use for

teacher assessment.

Based on Tom's feedback, Georgette adjusted her personal goal slightly in her proposal

document. Here, her goal was to "work with each teacher in my PLC and two other new

teachers in my department to administer labs that begin with a stated goal," which narrowed the

number of new teachers she would work with to two. However, it was through working with her

Wilcox mentor, Miranda, that she was able to articulate her project goal to have a student focus,

and her goal really evolved. Georgette said Miranda gave her the following advice, *"this isn't*

about you helping other teachers, because that's kind of where I was focusing." Georgette

continued, "*She [Miranda] was like, 'when it was designed, it was for you to do what you*

wanted. What do you, Georgette, want to work on with your kids?'"

Georgette reflected on this and noticed that her students, especially those in honors and

AP classes, were reluctant to ask questions and lacked curiosity. She felt her students were often

more focused on achieving good grades than on actual learning and discovery. She said, *"I don't*

get curiosity. I don't see it anymore" and *"my kids struggle, especially at [the] honors level and*

AP level, with failing. They don't allow themselves to ask a question they don't know the answer to." Georgette also mentioned that she had been frustrated with the state curriculum's linear approach of the scientific method; she believed that focusing on questioning would help her students understand that science is not a linear process. She and Miranda discussed her dissatisfaction with the linear approach of the scientific method in her state's curriculum. She said, *"our kids have no idea"* that science isn't linear, which made her focus on questioning even more important. She continued, *"I wanted to spend a full year with my kids remembering what it was like to be curious and being confident in their curiosities and knowing that questions aren't stupid."*

Georgette believes that students need to learn to ask questions they don't know the answers to and to embrace failure as a learning opportunity. While she has tried to promote inquiry in her classes, Georgette realized she had never focused on questioning as a specific skill. She felt developing this skill would help her students regain their curiosity and become more confident in asking questions, which she believed to be essential for their success in science. She titled her GPS project "Renewing Student Curiosity through the Practice of Questioning."

As described earlier in Chapter 2, a core component of the GPS project is that it addresses two goals, with one goal being district-aligned and a second goal focusing on personal relevance. When fellows first learn of the GPS structure, they are informed that the time spent investigating these two goals is not intended to be equal; rather, it is encouraged that 70% of their time is spent working towards one goal and 30% of their time is spent working towards the other. The goal selection process I described earlier pertained to Georgette's personal goal. Georgette allocated the majority of the time she spent doing GPS work on her personal goal and dedicated a much smaller amount of time to her district goal.

Georgette's district goal had a narrower evolution process when compared to her personal goal. The description of the district goal in Georgette's brainstorming document was fairly straight-forward; Georgette desired "to increase student and teacher engagement in our science fair." Her plan to achieve this, however, was more complex. Georgette wrote she desired:

> to come up with selling points and a way to show teachers how applicable and useful the science fair and the students' projects will be in their classrooms as well as out of them…to develop different processes and tools that will make the science fair more palatable to hesitant teachers and less time-consuming on their end to increase engagement.

Russell read Georgette's brainstorming document and offered Georgette written feedback on her district goal, saying, "This is definitely connected to a District Science Team goal of increasing participation in the Science and Engineering Showcase. We have a district planning team that considers ways to increase participation." When Georgette realized she would not be dedicating as much time to her district goal, she narrowed her action item to one thing. In her GPS proposal document, Georgette wrote that her district goal would be "working to create a myLearning (learning software) course to improve participation in our school district's STEM (Science Technology Engineering Math) fair…to lessen the burden for teachers and students and promote participation in the school (and hopefully district and state) fair." While the sentiment of her district goal remained the same to her original desire, Georgette planned to implement it solely by creating a myLearning course instead of directly working with teachers or creating multiple tools.

As described above, Georgette grappled with defining her GPS project goals, initially focusing on teacher support. However, mentorship from Miranda and feedback from her district

science coordinators, Russell and Tom, helped her refine her personal goal toward student engagement, specifically rejuvenating curiosity and question-asking among her honors and AP students. Her project, titled "Renewing Student Curiosity through the Practice of Questioning," thus emerged. Her district goal, which was less time-intensive, aimed to boost engagement in the school's science fair by creating a myLearning course to facilitate participation. These goals emerged through multiple iterations and guidance from her mentor and the district science team.

Experience Implementing a GPS. In her project, Georgette emphasized the importance of using the Science and Engineering Practices (SEPs) (National Research Council, 2012) she learned about during the first year of her Wilcox SEF program. She also explained that her state curriculum standards (NGSS Lead States, 2013) primarily focused on the scientific method, which she found limiting for her students. She said, *"I don't want the kids to think science is linear. I want them to know that it's circular, and the science practices give that better than most things that I've seen."* By introducing her students to the science practices, Georgette encouraged them to think beyond the linear perspective of scientific inquiry and embrace a more dynamic understanding of the process.

Georgette worked diligently to incorporate the science practices into her classroom. She detailed her approach, saying, *"I took the science practice, and I kind of looked at what the science practice itself said with the research that I used for the science practices."* By consulting various sources and analyzing her students' progress throughout the year, Georgette tailored her instruction to address their specific needs and struggles. She aimed to help her students develop a deeper understanding of the nature of scientific questioning and the iterative process it entails.

In Georgette's March monthly reflection, she acknowledged Miranda for helping her maintain a narrow focus and resist her natural inclination to try and address questioning with all her students in all her courses:

> With Miranda, I was able to narrow down my focus to the success in questioning with my genetics course...I was able to pull student samples for my GPS [and] narrowed prompts for myself in order to keep my personal GPS focused in the portfolio.

Through her work with the science practices, Georgette was successful in shifting her students' perspectives on scientific inquiry. Georgette's poster showed Georgette's commitment to using the science practices in her classroom ultimately fostered a more enriching and effective learning environment for her students when measured by student outcomes. Her poster shows that her students experienced a 25% "average growth in student ability to recognize and ask complex scientific questions from beginning of year to end." It also displayed that Georgette found her students were able to rephrase a peer's scientific question to include "a claim, research, evidence, and reasoning to support this claim."

Overall, Georgette prioritized breaking away from the linear approach of the scientific method and embraced her narrowed focus to improve questioning techniques among her genetics course students. Her persistent efforts resulted in an average growth of 25% in students' ability to recognize and ask complex scientific questions by the end of the year, as presented in her academic poster. Her students also enhanced their ability to rephrase scientific questions, demonstrating substantial progress in their understanding of scientific inquiry.

GPS Implementation: Moments of Ease. Georgette noted that the autonomous nature of the program combined with built-in support systems and resources was especially helpful to her. She said:

I like the fact that I really got to focus on something that I wanted and that I had

resources provided to help me excel in it or to get better at it, to improve in it and to

really develop in that area.

She later echoed this sentiment, saying, *"the actual working on the project in my classroom, I love that part."* Georgette appreciated the autonomy and the provision of resources that helped her focus and improve in her area of interest. She particularly enjoyed working on the project within her classroom, indicating that the practical application and development in her chosen area provided a sense of satisfaction and ease.

GPS Implementation: Moments of Challenge. Georgette's monthly reflections revealed some of the challenges she faced. Her November reflection shared:

I am still struggling with confidence in my students as well as time to devote to my GPS

project. I am hoping that with the winter break, I will be able to create surveys for my

students to show them how far they have come and increase their confidence.

In her March monthly reflection, the theme of not having enough time returned. She wrote: "The biggest challenge though is getting the time to complete my district project. While I made great progress over spring break, I still have a long way to go with the course creations and especially with finishing touches." In Georgette's GPS poster she wrote, "the hardest part of this process was trusting myself and my students to be honest about how we were progressing through questioning. We had to consistently address our concerns and errors throughout the process." Combining this with her monthly reflections, it becomes clear that Georgette's lack of time to dedicate to her project during the school-week caused her reliance on school breaks to prepare changes and plan the implementation of questioning strategies to address the concerns and errors she was facing with her students.

Aside from time, which was her largest challenge, Georgette found the process of putting her thoughts together coherently for others to understand in preparing to present her work to be one of the more challenging parts of her GPS experience. For both the process of creating a poster and verbally presenting, Georgette said, *"putting it all together and trying to make sense of my crazy, like ADD (Attention Deficit Disorder) brain for someone else to understand what I gained from it. That's the hardest part for me."* Although she found this aspect of the project challenging, Georgette appreciated the opportunity to reflect on her teaching practice, make improvements, and share those improvements with others so that they may feel inspired to improve their teaching practices as well.

As described above, Georgette faced a number of challenges throughout her GPS project. Time was a major issue, as she struggled to balance the demands of her project with her other responsibilities, often relying on school breaks to progress. She also found it challenging to trust herself and her students in assessing their progress and needed to address ongoing concerns and errors. Another difficulty was expressing her thoughts clearly for others to understand, both in creating her poster and verbally presenting her work. Despite these hurdles, she valued the chance to reflect on and improve her teaching practices and inspire others to do the same.

Reliance on Support Systems. The support systems in place were essential for Georgette's successful completion of her GPS project and Wilcox fellowship. She said,

> *I loved having Miranda as a mentor. I think that's a really big part of it. And I love that we did it after forming the bonds with our V-CCLS and H-CCLS groups that we even had peers to reach out to if we had snags or areas of like, I have no idea what I'm doing here…Floundering through it together makes you more comfortable diving into your GPS.*

While Georgette credited her Wilcox mentor, Miranda, with helping her through the goal selection process, she also continued to reach out for the duration of her GPS project. Georgette said, *"Miranda was an amazing resource because she would talk about her work with the science practices and what she had seen with kids, which was really nice."* Georgette also collaborated with Miranda when creating the poster for her symposium presentation on refining the poster's design and ensuring that it effectively communicated the project's essence. Georgette elaborated, *"Thank God for Miranda, because I had different fonts at one point... She was just very helpful with getting it finished and looking better."*

In addition to her assigned Wilcox mentor Miranda, Georgette worked with the Wilcox District Science Coordinator, Russell, and her district supervisor, Tom, to articulate her GPS goals. Georgette felt strongly that her Cohort 3 peers directly contributed to her growth in the program, and she credited their encouragement with re-energizing her when she was feeling overwhelmed, confused, or disappointed. She said:

> *I love that we did [the GPS project] after forming the bonds with our V-CCLS and H-CCLS groups, that we even had peers to reach out to if we had snags or areas of like, I have no idea what I'm doing here….I don't think I would have been as confident or gotten as much out of it without year one… I feel like in Plains, we don't do a really great job of peer observation. I've only had it happen a couple of times, maybe in my entire career. So, I think that…having other people observe and look at what you're doing and talk about [Warm (supportive) and Cool (constructive) feedback], having people give you that and asking questions and kind of probing for, you know, "what if we had done this?" Or "What if you had looked at this?" I think that's really valuable because it makes you automatically start asking yourself that as you do lessons from that point on. And that*

helps with the reflection in my GPS, at least to help me with what could I do differently?

It wasn't so scary to try to fix mistakes as the year moved on.

Georgette's extensive use of her support systems was also reflected in her poster which will be described in the next section.

In summary, Georgette heavily relied on her support systems to successfully complete her GPS project and the Wilcox SEF program. Her mentor, Miranda, was instrumental throughout the project, offering invaluable advice and guidance. Additionally, Georgette also found support in the Wilcox District Science Coordinator, Russell, and her district supervisor, Tom, in the process of defining her GPS goals. Her peers in Cohort 3 also played a critical role in her growth, providing encouragement and feedback when she encountered difficulties or uncertainties. This collaborative environment fostered her confidence and influenced her approach to teaching, facilitating reflection and willingness to improve.

Sharing Knowledge: Poster Creation Experience. Except for mentioning the title of her district goal, Georgette dedicated her entire poster to her personal goal. Georgette felt it was important to include the actual question stem tool and a blank student survey she used with her students on her poster so that if teachers happened to look at her poster, they could see the actual handouts she offered her students. Georgette felt the provided question stem tool laid the groundwork for her students' growth in scientific questioning. She explained, *"So this was like their foundation and understanding scientific questioning. And seeing again, those levels of complexity was really important for me and for them."* Through her focus on fostering her students' development in this area, Georgette effectively utilized the question stem tool to enhance their learning experience. Georgette stated, *"This is what they used to kind of start seeing that there are different levels of questions and realizing that there are millions of ways to*

ask questions and different action verbs and things like that.'' In the student survey, students rated their skills in recognizing, asking, and formulating scientific questions that require experimentation before and after the project.

Georgette also included pictures of students actively engaging in inquiry-based lab work and offered samples of student work on her poster. The student work included an original and rewritten question to showcase the growth that occurred in their ability to write scientific questions as well as responses to an open-ended prompt asking students for their "notes or thoughts on their year with scientific questioning," which showed students identifying increased confidence and comfort with writing scientific questions. Georgette's poster also included graphic representations quantifying her students' growth in skills related to question writing by class period and course.

One thing I found interesting on Georgette's poster, however, was found in the "Participants" section. Here, Georgette mentioned the students she worked with who developed their questioning skills; however, she also acknowledged a school administrator and her Wilcox mentor, Miranda, as participants. While Georgette previously acknowledged the support she received from two DSCs as well as her Cohort 3 fellows, identifying her Wilcox mentor, Miranda, as a participant showcased how integral Miranda was to Georgette's study and implied that her study would not have been possible or conducted in the same manner without their collaboration. Georgette's poster effectively shared her GPS personal goal, highlighting the tools and methods used to foster growth in her students' scientific questioning abilities.

To briefly summarize, Georgette's poster predominantly revolved around her personal goal and depicted the tools and student activities used throughout her project, intending to provide other teachers with concrete examples of her methods. She also showcased samples of

student work, pictures of students during inquiry-based lab activities, and data illustrating student progress. Georgette recognized her school administrator and her Wilcox mentor, Miranda, as participants in her project, demonstrating the significant role of collaborative support in her GPS project's success. Overall, her poster served as an effective means of sharing her personal goal and the processes that led to its successful implementation.

Sharing Knowledge: Presentation Experience. Georgette presented her work at a Wilcox poster symposium along with the other fellows in her Cohort. She described her experience:

> *I hate speaking to adults. I can speak to kids all day, every day. I was nervous. It did not help that my first presentation had, like, three district personnel from my district and my assistant principal standing in front of me…and I was just like, this is horrifying a little bit, but no pressure there. But overall, it was actually a lot easier than I expected it to be.*

Prior to the poster symposium, Georgette felt empowered to share her Wilcox CCLS and GPS experiences with her school administration. She stated:

> *I do have a good relationship with my immediate administrator. So when things have gone really well with Wilcox or things have gone that I really liked doing, that I've seen, I've just been able to go and sit in her office and say, like, "Hey, this is a really great thing we did, and I think we should try it"…When she's seen what I've brought back in terms of templates or what we've worked on and what it looks like, and the posters and what teachers are able to work on [within] the timelines. I've been able to [show] her, like, how much time this really takes. She's been great about listening to that and helping other teachers that want to do things like this.*

Georgette also shared her experiences with the instructional design coaches at her school; she noted they have been receptive to her ideas and have helped her implement new strategies in the classroom. Georgette believes her initiative regarding sharing her professional learning with her administration has resulted in positive changes within her school and acknowledges that sharing what she has learned in the Wilcox SEF program with others has granted her the ability to influence change and inspire others to try new approaches in their own teaching.

As described above, Georgette overcame her initial apprehension and found the experience of presenting her work at the Wilcox poster symposium easier than expected, even in front of district personnel and her assistant principal. Georgette's efforts to share her professional learning have led to positive changes in her school, underlining her capacity to inspire change and encourage innovative teaching approaches among her colleagues.

Launch: The GPS Propulsion. Georgette wrote on her GPS poster that she "will be continuing this work with questioning with my students in subsequent years, and I will (slowly) be adding in other science practices as well." In addition to continuing this work with her students, Georgette's poster shows she "would also like to use this model with my PLC as well as my entire department to model for all our students that science is not linear and that their curiosity matters." In our interview, Georgette reinforced this desire saying, *"So my goal is to eventually take the science practices as a whole and present them to the county."* She also has plans to share her work with her school's science department during their planning week in August 2022. Georgette's poster elaborated on her future goals saying, "I plan to use this as our submissions for data-driven decisions in the upcoming school year for PLC and hope to provide a district training geared to science practices in the years to come." While Georgette does not desire to pursue a change in her career or seek out more formal leadership roles, her GPS

experience is undoubtedly correlated with her future goals of having a leadership component through sharing her knowledge and creating professional learning opportunities to assist other teachers in bettering their practice.

In summary, Georgette plans to extend the work she began with her GPS project, focusing on the development of scientific questioning skills and the non-linear nature of science. Georgette intends to eventually present the science practices to her county and share her work with her school's science department during an upcoming planning week. Although she has no desire to transition her career or pursue formal leadership roles, Georgette's GPS experience has influenced her future goals, inspiring her to lead by sharing her knowledge and creating learning opportunities for other educators.

Benefits of Engaging in GPS Work. The use of student outcome benefits or career cycle benefits as a method for identifying effective professional learning was previously discussed in Chapter 2. While my study does not have an evaluative lens, it would be remiss to not consider what benefits, if any, the GPS work offered to the fellows and their project participants.

Georgette mentioned that through completing her GPS project, she has seen an increase in student outcomes. Specifically, her laboratory exercises have improved, and her students have gained confidence. As previously mentioned, her poster showed her students experienced a 25% "average growth in student ability to recognize and ask complex scientific questions from beginning of year to end." Georgette elaborated on how her GPS work has changed the way she interacts with her students:

How I approach my own class time with my students [has changed] from my GPS. I

learned about science practices last year, but the way that I've approached labs

completely changed for me because of [my] GPS. Even how I approach inquiry; the way

that I scaffold it out now because of this year is completely different. And then also, like,

the survey thing. I ended up surveying [my students] on, like, four different aspects of the

classroom, and [I] got more out of that data than I've ever gotten out of their test scores.

In terms of career cycle benefits, Georgette does not have a desire to apply for more

formal leadership roles, but when asked if she envisioned teaching as her long-term career, she

replied: *"There are many days where I wish it wasn't. But yeah. This last year made it really*

hard. I'm not going to lie." Georgette may be more likely to stay in the teaching field due in

part to Wilcox SEF's helping her grow professionally and her changing view of professional

learning. She shared a memory working with her mentor, saying, *"Miranda really said you have*

to think about what helps you. What you care about to think about with your kids because you

deserve to have PD for yourself, essentially."

As discussed above in Reliance on Support Systems, the warm and cool feedback

technique taught Georgette how to be encouraging with self-talk and has also bettered her daily

teaching environment which may influence Georgette continuing her career as a teacher. *"It*

made a big difference in my own confidence, because now when I write down reflections, I'm not

yelling at myself." Instead of being self-deprecating and focusing on negative statements, she

now asks herself questions to prompt constructive reflection and improvement. She said, *"Asking*

myself a question like "What if I had done this?" or "What if we change it this way? What if I

see this as a model instead?" or changed how I approach it." This shift has made her self-

evaluation process more effective and less stressful. She explains, *"It wasn't so scary to try to fix*

mistakes as the year moved on." She continued, *"I think that's really valuable because it makes*

you automatically start asking yourself that as you do lessons from that point on." Georgette

also admitted, *"It's something that we use in my school now"* and expressed pride that the feedback technique she brought to her immediate administrator has now been incorporated into her school's PLC and administrative observation protocols.

Georgette's GPS work boosted her confidence as a presenter as well as increased her public speaking skills and her willingness to present more in the future. She said, *"for me personally, I've had more confidence in speaking up."* It has also increased her willingness to consider different presentation formats and engage with her peers in the future. She envisions leading future PD for teachers with an interactive format where participants can discuss questioning techniques or science practices. She said, *"I think my session would be more of a Q and A kind of session, like a quick one-and-a-half-minute video clip of my class and what happened and then let them ask questions."*

Overall, engaging in GPS work has offered significant benefits to Georgette, both in terms of her teaching practice and her personal development. Notably, she observed enhanced student outcomes, such as increased confidence and a 25% average growth in students' ability to recognize and ask complex scientific questions. The GPS project changed Georgette's approach to lab exercises, inquiry, and student feedback, leading to a more productive classroom environment and valuable insights that surpassed test scores. Implementing the warm and cool feedback technique not only improved Georgette's self-evaluation process but also became a part of her school's PLC and administrative observation protocols. Additionally, her GPS work improved her confidence in public speaking and spurred her interest in leading interactive professional development sessions for teachers in the future.

Barriers Preventing Prior GPS Investigation (Research Question 1b). Georgette has wanted to help her students regain curiosity and become more comfortable doing inquiry for a

while; in fact, she made her very first lab of the year for her honors and AP students an inquiry lab. However, she has never formally investigated ways to make her students more comfortable with scientific questioning due to time constraints and feeling over-committed to other responsibilities. These same barriers also contributed to Georgette designing GPS goals that did not involve working with any other teachers at her school. She said:

> All I could think was like, I'm not adding to their plates this year. [The administration is] asking so much of them already. And I'm not trying to ask. I just want to be there to help. I was going to try to provide binders for them that gave them ideas for their curriculums ...but it just felt like I was giving them more. And honestly, it would also give my admin more to grade them on. And I just didn't want to do that.

In addressing Georgette's thought that teachers are overworked, with different preps and large numbers of students, differentiation, duties, and PLCs, Georgette was asked, "Is it even realistic to throw an inquiry, like a practitioner inquiry project, into your own teaching? Is it even realistic to get buy-in or to find the time? How do you find the time or how do you solve that?" Georgette's response echoed what the true intentions of PLCs, as discussed in Chapter 2, are:

> I think this should be the PLCs. To me, a professional learning community is about collaborating on your teaching and reflecting on your teaching together. This should be the goal...since ours is going to be [on] the science practices, I'm going to do the same thing I did this year, where everyone chooses their own practice and they focus in on how they are going to deliver it. How are they going to increase...oh, what's the word? It's not performance, but we'll say performance for now. But how are they going to increase their understanding of that practice and their ability within that practice? I think that

every discipline could do that within PLC. Just to choose whatever they want to focus on,

like give them an umbrella or let them choose an umbrella, what they think they need to

work on because every teacher is different.

From the previously discussed moments of challenge, it was clear that Georgette's main

challenge was insufficient time; she felt over-committed and struggled with finding available

time to execute her GPS project in the way she originally, and ideally, planned, and she relied on

school breaks to reflect and make changes to her GPS project. Georgette's September monthly

reflection also addressed her desire to receive training on questioning and the science practices,

but she lacked the funding to engage in training courses and conferences. She wrote:

I would really like to attend a conference in order to see and hear other professionals in

our field and how they apply the science practices with their students, but personal

funding does not allow it and Wilcox is not able to [offer it] either from what I gather.

While the Wilcox SEF program may have been able to distribute partial funding for Georgette to

attend a conference, it would not have been enough to completely cover conference fees,

lodging, transportation, etc. Unfortunately, without personal financial ability to pay for these

things, or available time to find and apply for grants to attend these conferences or trainings,

Georgette felt as if they were unavailable to her and did not move forward trying to improve her

teaching practice in this way.

In short, Georgette's prior attempts to engage in a formal investigation of her practice

were hindered by time constraints and an overwhelming sense of being overcommitted. This

also influenced her decision not to involve other teachers in her GPS goals to avoid

overburdening them further. Georgette also faced financial limitations that precluded her from

attending conferences or training courses, and the time required to seek and apply for grants presented another obstacle.

Conceptualizing GPS Work Through a Practitioner Inquiry Lens (Research Question 1c)

The purpose of the final research sub-question, "Did the fellows' processes designing and implementing their GPS work contribute to an understanding of their work as practitioner inquiry, and, if so, how?" was to explore the participants' understandings of practitioner inquiry, its tenets, and how they conceptualized their GPS work through a practitioner inquiry lens. This conceptualization arose from studying the fellow's prior knowledge of practitioner inquiry, potential identification of their GPS work as practitioner inquiry, attitudes displayed towards practitioner inquiry, and any future intention to engage in practitioner inquiry work.

Prior Knowledge of Practitioner Inquiry. At the time of our first interview, Georgette admitted she was not explicitly familiar with either the term practitioner inquiry or the term action research. She speculated that action research could mean *"actively researching for things that you want to change in your classroom or to change in your professional career whatever it is"* and that practitioner inquiry could involve *"me throwing myself to the wolves and failing and being okay with failing, like I did a lot through Wilcox, [essentially] applying what I'm talking about my kids trying to do to myself and my own teaching practices."* After discussing with Georgette definitions of Practitioner Inquiry previously described in Chapter 2, she felt that any prior teaching reflections she had done were more informal in nature:

> *I have done, not this in depth, but I have worked [on] a couple of different things with just inquiry-based learning...again, it wasn't as intense because there weren't reflections I had to write for someone. There weren't brainstorming documents, but there was just*

my own note taking on how things were going. And you know, the same kind of thing,

reflecting for myself.

As described above, Georgette was unfamiliar with the concepts of practitioner inquiry

and action research before this study. After learning more about these terms, she reflected that

her past teaching reflections were not as elaborate or structured as the process defined by

practitioner inquiry. Instead, Georgette's past experiences were more informal, involving

personal note-taking and reflection.

Identification of GPS as Practitioner Inquiry. When asked if Georgette believed her

GPS work fit the definition of practitioner inquiry, she replied, *"Absolutely."* She elaborated,

explaining that her GPS project involved a systematic and intentional study of her professional

practice. She said, *"I think that in being required to kind of write down, like, my own procedure*

and what I was doing with this focus, that does make it systematic." She also mentioned, *"I had*

my own research question, or, in terms of the goal, I made my own research question off of

that." Georgette referred to her process of taking notes throughout the project, reflecting on

what worked and what did not, and making changes based on her observations when comparing

her work to tenets of practitioner inquiry:

> *But, as well, just on my own, like, I took notes throughout the whole thing. I had a*
>
> *certain place in my lesson planner, actually, where I was constantly writing this is what*
>
> *worked. This is what didn't work. Here's what I think for the next lesson. We chose to*
>
> *go back to this, that I need to go look at. As I graded, I left notes for myself. I took notes*
>
> *on their labs and things like, there were a lot of like, this question doesn't work. Like*
>
> *these kids' questions are completely not at all where we need to be. And how am I going*
>
> *to change this? Because in discussion, too, kids tend to be a lot more eloquent or they*

get, I don't know, in discussion, kids do a lot better in terms of getting to the point and

understanding, like what makes sense and what sounds good versus written. Something

completely different comes out on paper.

In summary, Georgette identified her GPS work as an embodiment of practitioner

inquiry, recognizing the systematic and intentional investigation of her professional practice it

entailed. Her self-devised research question and procedural reflections fit the tenets of

practitioner inquiry. Throughout her project, she engaged in meticulous note taking, reflection,

and change-making based on observed outcomes. She scrutinized elements like the efficacy of

students' questions and their varied performances in discussions versus written tasks. She

adjusted her approach based on these observations, highlighting the continuous and adaptive

nature of practitioner inquiry.

Attitude Towards Practitioner Inquiry. Georgette believed practitioner inquiry is an

effective opportunity to engage in professional learning. When asked if she thought the GPS

process could also be useful in other disciplines, she said, *"I definitely think that."* She

elaborated, *"the way that we did the [school-wide, PD] curriculum days was very similar to*

this" and in those professional learning sessions, teachers were encouraged to look into their

curriculum and address areas that needed improvement and they "*never stood and delivered*

anything" referencing the absence of the ineffective sit-and-get models of professional learning

previously described in Chapter 2. Georgette also acknowledged that she wishes that more

professional learning would follow a practitioner inquiry approach.

Discussing the challenge of balancing various responsibilities, Georgette suggested that

the practitioner inquiry model should be the focus of PLCs, as it encourages collaboration and

reflection on teaching practices. This was previously discussed in Barriers to Prior Engagement, but Georgette elaborated about her attitude towards her old PLC design and how she changed it:

> *Usually, [the] district says that they want [the focus of PLC to be] common assessments and, like, formative and summative assessments, and they want us looking at data constantly. Miranda taught me a huge thing in this - the data doesn't have to be [only test scores]. A lot of the teachers seem to actually look at test scores, and that's all they were comparing. That was kind of like the numerical data they were putting up on a board or on their posters. And…for me, I didn't want to look at test scores. The kids' test scores are already analyzed to death.*

Georgette continued, explaining what data she hoped to analyze:

> *I wanted to look at what the kids felt, how the kids actually saw what they learned or did not learn throughout the year. And then I can use their test scores behind the scenes and look at that myself.*

She also described what she felt her district focused on:

> *So, I wish the districts would stop putting so much emphasis on those test scores...because again, we always just have to look at data like, take your EOC (End of Course) data, take your district final data, and then create common assessments for the lowest scoring standards or whatever it is. That's usually where our focus ends up being. I wish that teachers were able to do their own focus.*

Georgette continued to describe how she has changed facilitating her PLC:

> *Honestly, the way that they have you do it, there isn't really a reflection on how to teach [the skills required by the standard]. That sounds so terrible, but I run a different PLC now [after completing my GPS project]. But when we were doing biology with the*

common PLC, it was very much like...build all these common assessments throughout

each unit and then decide what your remediation is going to be, and you have to move on

because you have so many standards. Like, GPS was nothing like that for me. It was very

much [like] I want to focus on this one thing. Regardless of all the standards

surrounding this class, this is the skill that I want my kids to get better at. I wish that we

would focus more on skills, I guess in those PLCs instead of standard.

In short, Georgette voiced a strong positive attitude towards practitioner inquiry, identifying it as an effective model for professional learning that extends beyond her discipline. She compared the process to the school-wide curriculum days and emphasized its advantage over traditional lecture-style professional learning methods. Despite the challenge of juggling various responsibilities, Georgette recommended practitioner inquiry as the focal point of PLCs, encouraging collaboration and reflection on teaching practices. Georgette was also dissatisfied with her district's emphasis on test scores as the primary data for evaluation and urged for a shift in focus towards qualitative aspects of student learning and the development of skills. Following her GPS project, she revised her approach to PLCs to align more closely with practitioner inquiry frameworks.

Future Engagement with Practitioner Inquiry. Engaging in the GPS project has made Georgette more likely to engage in practitioner inquiry or action research work in the future. She said, *"I am already going to be doing it only because next year I'm going to work on data the same way that I worked with questioning this year."* She appreciated the warm and cool feedback approach, which helped her feel more confident and less defensive. She said, "*It made a big difference in my own confidence, because now when I write down reflections, I'm not yelling at myself like 'that sucked' or 'that failed;' those aren't useful statements for me.*"

Furthermore, Georgette mentioned that she had already used similar approaches in the past, but the GPS project provided a more formal and focused structure that she found helpful. She said, *"I have worked on a couple of different things with just inquiry-based learning. I spent two years really honing in on that. Again, it wasn't as intense because there weren't reflections I had to write for someone."* Overall, the experience with the GPS project has made Georgette create concrete plans to personally engage in future practitioner inquiry work as well as have the members of her PLC engage in their own practitioner inquiry projects.

In summary, Georgette's GPS experience has positively influenced her perspective on practitioner inquiry, making her more likely to continue employing this approach in the future. She plans to apply the inquiry-based model to her work with data in the next academic year, in the same manner she worked with questioning during her GPS project. While she had previously employed similar strategies, she found the formal and focused structure of the GPS project to be particularly beneficial. Georgette's experience has not only led her to commit to future personal engagement with practitioner inquiry, but also encouraged her to incorporate it into her PLC's practices.

Izabella

Izabella is a Black, female educator with between four and ten years of teaching experience. While she has taught at multiple schools, Izabella has taught at her current school, Mountain High School, which is part of Mountain school district, for between four and ten years as well. She lives with her wife and does not have children. Currently, the most advanced course level Izabella teaches is International Baccalaureate (IB). Izabella is loquacious and has a sometimes-loud, always-vibrant personality.

Educational Background

  Izabella began her educational journey in the British Virgin Islands, attending a private elementary school. She described her early education as equivalent to American Pre-K through 6th grade. Izabella attended a public middle school and high school. When high school began, Izabella experienced a British-style education system, which she likened to Hogwarts: "*So there's four houses, and every student gets sorted into a house.*" It was during her high school years that she became aware of the racial segregation in the Caribbean. She noticed the segregation between the local kids and White kids, as the White kids attended the one private high school on the island which was an international school named Palm.

  Growing up, Izabella was exposed to different cultures. She shared the diversity of her elementary school years and summers abroad compared with her surprise and confusion when she became aware of the informal segregation between public and private high schools. She described her experience in the private elementary school in this way:

> *I went to school with a lot of kids that weren't Black. There were a lot of Indian [South Asian] kids because [the] Caribbean has a lot of Indian kids…I had a lot of White kids at my school that I went to [for elementary] school with and White teachers as well. So, for me, [being around diverse cultures] wasn't weird to me.*

But then she had a very different experience in the public high school:

> *And then I remember my first day of high school, we got to school…I was standing there and I'm like, I was talking to one of my friends from elementary school, and I'm like, "Where's Sophie?" and "Where's this person and that person?" And they just looked at me, and all the people around me just looked at me crazy.*

The other students told her that her friends from elementary school were going to a private high school. In retrospect, she realized:

> I didn't have White kids around me all the time. Now that I look back and think about it, even where I lived, it was Black people, Hispanic people, Indian people, and that was it. I don't think any White people lived near me, but it just never occurred to me. Like, it just wasn't weird to me because our island is 95% black…I never noticed, like, the glaring omission of White kids and White people. It was crazy. And so, when I got there, all my friends are looking at me like, "What do you mean, where are they? They're going to Palm," which is the name of the private school. "Like, they're going to Palm." And I'm like, "But why?" They're like, "They don't come here. Like, those kids don't go here, they go there." And I'm just, like, I'm looking at them in my head . I'm like, I don't know that. How do you know that? And they're just looking at me with this look of pity on their faces because I literally had no idea. That was the day that I learned about the crazy ways that people segregate themselves in the Caribbean. It is absolutely wild.

She described her first experience with integration in high school:

> And so, we went to high school. I spent all four years in high school. And my last year at the high school, a White student came in. He was the only White child. His parents were also expats. And his dad was a big believer in if we live here and we're going to be here, and I'm going to work here, then you're going to go to school with the local kids. So, he went to all public school[s] his whole time he was there. And he was the first White kid ever at the high school, and he was the only one for all four years. I still think that no White kids go there even now to this day. He was the first and only one, which is crazy. And the year I graduated is the year he came in.

At that time, the Caribbean education system was different from the traditional, American K-12 grade program where students graduate at approximately 18 years, so Izabella graduated at the age of 16.

After moving to the U.S. at age 16, Izabella took a year off from school and taught elementary-aged students piano lessons while the private studio's piano teacher was on maternity leave. At age 17, she enrolled to earn her associate's degree at Ray Community College. Due to her international schooling, her diploma had to be evaluated for equivalence to an American diploma. Unfortunately, she did not have enough of the required Caribbean Examination Council exams, so her diploma was not accepted, and she had to pause her college career while she earned a General Educational Diploma (GED). Izabella shared how she turned this disappointing experience into an opportunity to connect with her students:

> *Looking back on it, I was super depressed. I hated it. I was really upset that I had to go back to school again after I already had a diploma. But now looking back on it, it's been like a really invaluable experience because I can talk to my students about it. So, it turned into something that I'm able to use all the time. Like, I talked to my kids about it all the time, and I wasn't the best student academically in high school. So, I get to talk to my kids about that all the time as well, just about how far you can come and what that looks like.*

Upon completing her associate degree, Izabella transferred to Vonceil University (VU) to pursue a bachelor's degree in biology with an intent to go into the medical field. Despite the fact that *"every teacher that I have ever had in my entire life has told me that I should be a teacher,"* Izabella remained adamant: *"I'm not going into education. I'm going into medicine."* However, all that changed when her personal life also went through changes:

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Somewhere in the middle of my senior year, my parents got divorced. Then I had, like a whole breakdown. It was a hot mess. And so, I ended up having an extended senior year. And, like, halfway through, I was like, gosh, I don't want to be a doctor anymore. I'm not feeling it. I don't think I want to go to med school. I don't know what I want to do. I was lost in the world. And so, I just started looking at stuff that was interesting.

She described how a recruitment event brought her into education:

Mountain County Public Schools came down [to VU] one day, and they were doing a talk on education and looking for teachers. And VU [had] a new program for people who don't have education degrees that are thinking about [pursuing] education. And I went to their little presentation, and I was like, oh, this could be cool. And I just liked it. It sounded like something interesting and fun to do while I tried to figure out what I was going to do with my life. And so, I applied for the master's program and got accepted before I graduated for my bachelor's and then literally graduated in May and turned right back around and got like maybe two- or three-weeks break and then went right back to school in June to start my MAT (Master of Arts in Teaching) at VU.

In summary, Izabella's educational journey started in the British Virgin Islands during which she became aware of informal racial segregation between public and private high schools. Her transition to the United States was marked by a pause in her education due to the non-acceptance of her Caribbean diploma, resulting in her earning a GED. This initially disappointing experience later proved invaluable as it allowed her to connect more personally with her students. Pursuing higher education in the US, Izabella first aimed for a career in the medical field, earning an associate degree and then transferring to Vonceil University for a bachelor's degree in biology. However, a recruitment presentation by Mountain County Public

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Schools caused her to shift her focus to education. She was accepted into a Master of Arts in Teaching program at Vonceil University, paving the way for her journey into the field of education.

Teaching Journey

After graduating with her M.A.T., Izabella began her teaching journey at Annistown Middle School, where she taught 8th grade advanced science. She recalled her time there, feeling like an outsider and substitute teacher because she came in halfway through the year for a teacher who relocated to a media center specialist position within the same school. She said:

> *I was one of two Black teachers in their regular program. There weren't very many Black kids. There weren't very many Hispanic kids either…The rest of the Black teachers were in the ESE [Exceptional Student Education] program, and it was just very I don't know. I never really felt 100% comfortable."*

At the end of the school year, Izabella's *"unit was cut,"* and she had to apply to a different school. She ended up taking a teaching position at Westminster Middle School where she taught for five years. Here, Izabella *"just kind of fell in love with [teaching]"* and had an *"excellent experience."* Izabella had to drive two hours each day to work at Westminster, and she was also considering transitioning into teaching high school. So, when Izabella was offered a high school position with Sunshine Virtual School, she left Westminster. Izabella described how a very negative experience with Sunshine Virtual School enabled her to get her current job. She did not have good interactions with her principal:

> *So, I ended up moving into high school with Sunshine Virtual School, and it was an absolutely horrible experience. Like, we just got a new principal, and she was not the nicest person in the whole world. She would say one thing and do something else. And*

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she actually ended up putting me on probation because I was struggling to keep up

because Sunshine Virtual School is essentially paperwork. Like, I'm not really teaching

anything. I'm just grading papers. And I absolutely hated it.

She struggled to keep up with the virtual school grading requirements:

Like, I never saw anybody because I felt tired and tethered to my house because I was

always grading, because I was always behind in grading. And then, at the worst of it,

when it got really bad, she basically told the mentors and helpers to stop helping me

grade, to stop helping me, because I was just so behind. I was so overwhelmed. They

ended up actually firing me, which was the best thing that they could do because I was

planning on leaving that year anyway. I wasn't going to stay for another year. I was

planning on going back to the classroom.

Ultimately, abruptly leaving Sunshine Virtual School led Izabella to her current school:

And they actually ended up firing me in March instead of the end of the fiscal year, which

was only maybe three months away. And so, I basically had to scramble. I had no

money saved up or anything for the summer because we got paid in the summer because

Sunshine Virtual School is year-round. So, I wasn't thinking about saving up money [in

case] I wasn't working here. And so, I had to scramble and find something. And I ended

up subbing for the end of the school year for my friend at Westminster Middle School

who was having surgery…And so [Westminster] actually ended up hiring me for his 6th

grade science position. I ended up taking over his 6th grade science classes and got a job

for the last couple of months of the school year. And they hired me. Hired me, like, not

temporary, but permanent. And so therefore, I was able to [apply for a district] transfer

at the end of the year and transfer here to Mountain High School, where I've been since

2016, when I transferred at the end of the school year. And this is where I've been ever since.

At Mountain High School, Izabella started teaching freshman biology and after a curriculum redesign, she taught sophomore biology and physical science. From there, she solely taught biology, until she had the opportunity to teach anatomy and later AP Biology as well. One year, she had three preparations: AP Biology, anatomy, and *"normal"* biology. However, when an IB Biology teacher retired, Izabella applied for that position:

[I] got the IB Bio position, and they moved me in literally two weeks before the school started because they couldn't hire me any sooner because there was a hiring freeze. Two weeks before school started, I found out that I would be getting the IB Biology position. I hadn't planned anything. I didn't know anything about the IB curriculum. Last year was an interesting year…this year is my first full year of IB where I kind of know a little bit about what I'm doing. And I only have juniors and seniors now, and I have all of the SL (Standard Level) juniors and all the SL seniors by myself. And then the other bio teacher who's here, she has the HL (High Level) juniors and HL seniors and freshmen.

As described above, When Izabella's teaching journey began at Annistown Middle School, she felt somewhat like an outsider due to a lack of diversity among both staff and students. After a year, she moved to Westminster Middle School, where she taught for five years and grew to love the profession. A shift to Sunshine Virtual School proved to be a negative experience, but her dismissal from the school, in retrospect, was a fortuitous turn of events as it eventually opened a door for her to transfer to Mountain High School, where she continues to teach. At Mountain High, she has taught different biology courses, including AP and IB classes. Her teaching journey has been shaped by numerous challenges and transitions, but she has

consistently grown and learned from these experiences, supported by her colleagues and mentors.

Leadership Role History

Izabella has held both formal and informal leadership positions throughout her teaching career. In terms of formal roles, Izabella served as a *"PLC Facilitator at Westminster for a few years"* which was a paid position. Izabella says since moving to Mountain High School, her leadership roles have been more informal:

> *I'm on the ILT (Internal Leadership Team), one of the members of the ILT, and we write a lot of PD and that kind of stuff. I'm on that. I'm also one of the PLC leads. So, I wrote the PLC training that we give to the PLC facilitators at the beginning of the year to kind of train them on what PLCs are and what's supposed to happen at PLCs and how to facilitate one and all that stuff. So, it's me and two other people and one of the APs (Assistant Principals), and we wrote the PLC form that the teachers fill out at the end of their PLC meetings and stuff. So, there's that.*

PLC meetings at Mountain High School are held once a month on Mondays after school. Izabella described their organization:

> *The way we do them here is we decided to group them by subject. So, all of the biology teachers meet together for PLC. The math teachers of specific math classes. A lot of the math teachers have multiple PLCs because they have more than one math class that they teach.*

Some well-functioning PLCs may meet more frequently to discuss lesson plans and engage in discourse. The school also tries to incorporate reading into content areas by having reading teachers attend different content PLCs. Izabella described another informal leadership role:

I've just always been a really informal teacher leader. I do a lot of coach [providing

support for other teachers] things, even though I'm not officially a coach. So, I even

have, like, coach access on the website. Just not officially a coach.

To briefly summarize, Izabella has taken on various formal and informal leadership roles

in education. Formally, she served as a PLC Facilitator at Westminster. Upon transferring to

Mountain High School, her leadership roles evolved into more informal settings, including

membership in the ILT and providing unofficial coaching support to her peers.

Professional Learning History

As a self-described *"PD junkie"* who *"loves PD a lot,"* Izabella has a rich history with

professional learning experiences. When Izabella was a middle school PLC facilitator, she was

sent to a Learning Collaborative Design (LCD) training. These sessions focused on teaching

inquiry-based activities for students, and she would then teach these activities to her fellow

teachers in their PLCs. Izabella gave examples of the activities:

[7th grade students] had to design a coffee cup that would hold heat...they got to design

their own coffee cup…So that was semester one's PD (Professional Development), and

then semester two's PD was invasive species in the Everglades, where we talked about

pythons.

Izabella described how she participated in the training:

We basically got to do the LCD as if we were students, and then we got the teacher piece

of it where we learned, like, this is how you would do it with your students, or these are

ways you can do it with your students. These are the materials, and then [after that one

day,] we have to go back and teach it to our PLC.

As a high school teacher, Izabella attended a district level workshop where they discussed unpacking standards for teaching and planning purposes. She recalled:

[My principal] sent me and another teacher who was a formal teacher leader...to a standard training that the district was having where they talk about how to unpack your standards and that kind of stuff and to teach it to your students and for planning purposes.

Izabella also attended mandatory professional study days at the beginning of the school year. These days included a keynote, mandatory sessions, and optional sessions to choose from, creating a mini-conference feel. In addition to mandatory professional study days, Izabella is passionate about seeking out her own professional learning opportunities. She said, *"I usually try to do things outside of like [district PD]; I'm always trying to find stuff to do, so I'll do things outside of the school where I [get to] go places and learn things."*

A few years ago, Izabella attended a paid, two-week summer program at a state university, called the Activation Program, focused on infectious diseases. She shared:

I spent two weeks there. It was an absolutely amazing experience. We got to go into the labs. I got to see machinery that I've never seen before in my life because where would you see them? We didn't have it at VU. I got to see an electron microscope for the first time in person and watch them use it. And because I was the only person that went, I got a one-on-one tutorial with the scientists that worked in the electron microscope lab. It was freakin' awesome…We got to relearn how to use micropipettes. We ran gels. We did the whole night in lectures and learned things. We got to go to [the] medical school and get lectures from the doctors and the heads of the medical program. We did a lot.

This past summer, Izabella took three *"self-paced PDs"* through the district as well as helped write curriculum for the district. Most recently, as a member of Cohort 3 of the Wilcox SEF program, she completed the Year 1 V-CCLS and H-CCLS work as well as attended the monthly meetings as described earlier in Table 6.

Overall, Izabella has a robust history of engaging in professional learning experiences. She received LCD training in her role as a middle school PLC facilitator. At the high school level, Izabella attended mandatory professional study days, but she also proactively sought out further learning opportunities, including extended programs at a state university as well as self-paced professional learning through the district, curriculum writing, and the Wilcox SEF program.

Effective Professional Learning Beliefs

After participating in professional learning experiences with varied formats and content, Izabella expressed a belief that effective professional learning should have several key characteristics. She emphasized the importance of interactive and hands-on experiences. She recalled one engaging experience about genetics: *"I did a session with transcription, translation, and I had beads and stuff, and I had to build a protein."* Izabella also found the inclusion of real-world applications and experiences to be crucial, sharing that effective professional learning should provide teachers with practical knowledge and skills that they can apply directly to their classrooms.

Izabella also believed that effective professional learning experiences must provide opportunities for collaboration and networking, allowing teachers to connect with peers and share best practices. In addition to offering an opportunity to meet, interact, and network with colleagues from all over the district, Izabella believes that effective professional learning

experiences will include flexibility and choice, allowing participants to engage in professional learning that aligns with their personal interests and teaching or student needs. Izabella described one professional learning experience she particularly enjoyed:

> *[After] mandatory sessions that you have to go to, and then you can choose any other one you have to go to after that. And it's like a whole day, 8 hours. You get to see all your friends from all over the county, and it's just lots and lots of fun. And the sessions are really good, so that's pretty cool.*

Izabella also described engaging in autonomous professional learning opportunities that aligned with her personal interests as participating in passion-driven learning. Izabella appreciated when outside companies and experts contribute to professional learning sessions, providing additional perspectives and resources that enhance the learning experience. She also clearly articulated what professional learning opportunities she feels are ineffective:

> *I don't believe in PDs, where you just go to PD, you sit there, you learn some stuff, and then they don't make you do anything with it because I feel like it's a waste of time. Like, you should have to do something with the stuff that you're learning or else why are you even here?*

In short, Izabella believed that autonomous, interactive, and hands-on professional learning experiences that provide real-world applications and experiences for teachers to bring back to their classrooms are more engaging, relevant, and effective for teachers, and these types of professional learning experiences ultimately lead to improved teaching practices and better outcomes for students.

Research Question 1: The GPS Experience

Research question 1, "How do Wilcox SEF fellows understand their experience designing and implementing an autonomous professional learning plan?" was answered through the same fourteen aspect protocol that I used in Georgette's case analysis. Additionally, the research sub-questions were examined according to the same protocol described the prior case.

Awareness of the Wilcox Program. Izabella first found out about the Wilcox SEF program when she saw her colleague, Jaime, who was part of Cohort 1, present about it during a professional study day. Izabella considered applying for the program, but she hesitated, saying, *"I don't know. I don't feel like I'm qualified for this quite yet."* Despite her reservations, Jamie encouraged her, saying, *"I think that you would be awesome. I think you should do it. I think you would love it."*

When the application for Cohort 3 was released, Jaime emailed it to Izabella, who still felt hesitant. Izabella said, *"I just drug my feet, and she was emailing me, and I just drugged my feet."* She continued, *"I missed the application deadline the first time…they extended the deadline two times, and wouldn't you know, I missed it the second time, too."* Unaware of Jaime's encouragement, Izabella's district science supervisor reached out to her, saying, *"Hey, have you seen this? Did you apply? You should totally apply. You would be amazing at this."* With the combined support, Izabella finally decided to complete the application. She said, *"I started my application. I was like, okay, you know what? Let's just do it."* Izabella said, *"I knew why I was procrastinating, because I didn't feel like I was good enough to do the program, like, I wouldn't get in."* Speculating her hesitation was due to a combination of the length of the application and Izabella's imposter syndrome, her wife encouraged her saying, *"Just do it. You*

literally meet all the qualifications on this paper. Just apply." Izabella finally wrote the essays and submitted her application, *"literally the day before the application was due."*

To briefly summarize, Izabella first became aware of the Wilcox SEF program through her colleague who was part of the program's first cohort. Initially, Izabella felt unqualified and hesitant to apply, even missing the application deadline twice. With encouragement and support, she managed to overcome her feelings of self-doubt and procrastination and submitted her application just a day before the final extended deadline.

Preconceived Notions. Before starting the Wilcox program, Izabella had conflicting preconceived notions regarding the intensity of the program. She admitted, *"I was super intimidated,"* and was doubtful about her ability to fulfill the program's requirements, but, at the same time, she felt she was going to learn a great deal which made her feel excited. She described grappling with these conflicting emotions by initially discussing her fears:

> *I can't do those things. I'm not experienced enough to do those things…I have imposter syndrome. I was super concerned that I wouldn't be able to do it, that I wouldn't be good enough to do it, that other people would just be better, and I would get kicked out of the program because I just wouldn't be good enough. I wouldn't be able to keep up. That's my constant fear - that people would kick me out of things because I'm not good enough. So, I was worried about that.*

Then, she described her excitement:

> *I was excited because just listening to Jaime talk about, like, how much she got out of the program and, like, how really good it was for her and all the things that she learned, I was like, okay, I'm really excited about what I'm going to learn…but I'm worried about, like, what I have to do at the end because I don't know if I can do that…I just knew that I*

figured I would learn a lot, which I did. But I was just really worried about whether or

not I would make it all two years or whether they would kick me out.

Izabella also knew that she would receive a significant stipend to participate in the

program, so that was likely reflective of how much work would be involved. Izabella clarified

that because she believed she was going to learn so much from the program, depending on her

financial capabilities, she *"totally would have paid for it."* Speaking about if the program was

free but did not offer a stipend, Izabella said *"I would have [participated] whether they paid me*

or not. I just really like that. I like learning things."

Izabella knew that the focus of Year 2 of the Wilcox SEF program would be completing a

GPS Project. She shared her preconceived notions regarding her GPS work:

> *I knew that it was going to be something that we were going to research, and we would*
>
> *have to do, like some kind of product. I didn't realize that there was a personal part and*
>
> *a district part. I thought it was just going to be like something you did for the district,*
>
> *and that was it. The personal part completely threw me. I actually spent more time*
>
> *focusing on my district one than my personal one, to be honest, because the district one is*
>
> *the one I was the most passionate about.*

As described above, Izabella had a mix of emotions before beginning the Wilcox SEF

program. Despite her excitement about learning new things, she was often gripped by feelings of

self-doubt, fueled by her imposter syndrome. Izabella also had misconceptions about the second

year of the program; she initially believed she would be focusing solely on a district goal, not

realizing there would also be a personal goal involved. .

Experience Selecting GPS Goals (Research Question 1a). As described in the prior

case, the GPS project involved spending a disproportionate amount of time achieving both a

personal and district-aligned goal. Izabella described her thoughts as she entered the second year

of the Wilcox SEF program, excited to design a GPS project that could help her jumpstart her

future career:

> *I was super excited at the end of last school year, going into my GPS, like, really excited*
>
> *about it because I knew kind of, like, what direction I wanted to go. I knew I wanted to*
>
> *do something around PD because I love training teachers and I love doing PDs myself*
>
> *personally. So, I knew that my long-term goals for myself are to eventually have my own*
>
> *company where I get to train teachers and do PDs and get hired by school districts to*
>
> *train their teachers and do PDs at their districts and that kind of stuff. So that's what I*
>
> *would like to do long term. And so, I knew that I wanted my GPS to have something to do*
>
> *with that. I just hadn't flushed it out yet, but I was super excited about it.*

Despite her self-described eagerness, as Year 2 began, Izabella struggled to complete her

brainstorming document and remained stagnant in articulating her GPS goals. In one monthly

reflection Izabella wrote, "I have been honestly struggling with getting started. I started the

school year in the hospital and have been struggling to catch up. My biggest struggle has been

narrowing down a focus."

Izabella found clarity and inspiration after attending her district science coordinator,

Leslie's, professional learning session on bias, equity, and social justice in the science classroom.

She said:

> *It resonated so much with me. I was so passionate about it. I absolutely loved it.*
>
> *Everything she said was amazing. And I was like, "Oh, my God, we need this. Why*
>
> *don't we have this in my county? We need it immediately. Why doesn't this exist? I*

would love to take this PD," and I think other people need it, too, because we're not

reaching all of our learners.

Izabella completed her brainstorming document and defined her district GPS goal. She

wrote, "Through my GPS project I would like to be able to develop more PD that could be

helpful to science teachers in the district." While she previously mentioned she always intended

to conduct a professional learning experience for teachers to accomplish her district-aligned GPS

goal, her brainstorming document showed a very different process:

> I would like to begin by creating a survey to send out to all the district's science teachers
>
> to gauge their areas of interest as it relates to PD. I will need to do research on different
>
> areas of science pedagogy to help me develop categories for the survey. I would also
>
> want to collect demographic data, as veteran teachers are bound to have different needs
>
> from new teachers. I would like to offer this to secondary science teachers grades 6-12 as
>
> this is the area I am most comfortable with.

Izabella also articulated her personal goal in her brainstorming document, writing "For my

personal goal, I would like to learn more about storylining and using that lesson strategy to plan

lessons making my content more connected." Surprisingly, Izabella never expressed a personal

interest in storylining, or showed a connection between storylining and her students' needs, or

planned professional learning experiences regarding storylining, prior to writing this goal in her

brainstorming document.

Her assigned Wilcox mentor, Miranda, gave her feedback on her brainstorming document

which Izabella credits as a turning point for being able to articulate her project. In written

feedback to Izabella, Miranda wrote:

It feels like your focus really is about learning how to best design and facilitate professional learning. Perhaps your GPS could be about: working with your district science supervisor and coach to identify an area that you…are already exceptional at doing… and then dig deeper into what it means to design and facilitate professional learning for others in that area….You could work with your district folks and engage them, as well as the teacher participants, in giving you feedback on your sessions.

Izabella wrote in her October monthly reflection that she was struggling with having too broad of a goal, saying:

[Miranda and I] discussed narrowing down the focus of my GPS project. It was very broad trying to look at PD for ALL district science teachers in secondary [schools]. We discussed choosing one thing to focus on that I am passionate about [and] do PD just around that. Possibly I can use [my] social justice [work] and expand it?

Working with Miranda allowed Izabella to define her district-aligned GPS goal: "Design and facilitate professional development sessions for science teachers that cover both science content, as well as culturally responsive teaching as it relates to the science classroom." Izabella's poster also provided rationale for why she chose this goal to be her "focus goal" and dedicate the most time to it:

There is a lack of PD in my county around bias and equity in the classroom and actionable steps we can take to make our spaces more equitable. After participating in a similar training led by Leslie, I began to think of all my learners and examine my own biases. It was very important to me that we offered a similar training for our [district] teachers so that we could make science accessible to all our learners by making our classrooms more equitable spaces.

Izabella's poster also identified that to achieve the personal goal component of her GPS work she intended to "learn about NGSS (Next Generation Science Standards), and research how to incorporate NGSS with the IB standards for SL biology." This was corroborated by Izabella's September monthly reflections which said, "I would like to focus on learning more about [the] NGSS," and her October monthly reflection which said, "The biggest challenge [in my GPS work] I have been facing has been attempting to find ways to incorporate the IB benchmarks with [the] NGSS." However, in January, Izabella's monthly reflection document reported, "I decided to change the logistics of my personal goal for my GPS project and am looking at just the research aspect." Changing her personal goal by eliminating working on incorporating NGSS standards to her IB curriculum acknowledges the way her district-aligned goal also meets her consistently-articulated strong personal desires to address *"bias and equity and create culturally relevant classrooms."* Izabella ultimately deviated from the disparate, two-goal protocol and spent 100% of her time on one goal, designing and implementing a bias and equity centered professional learning opportunity for science teachers, that addressed both district and personal needs.

In summary, Izabella initially had ambitious ideas for her GPS goals, but she struggled to narrow down her focus. After attending a professional learning session on bias, equity, and social justice in the science classroom, she found her inspiration. Taking her mentor's feedback into account, she focused her GPS work on designing and facilitating professional learning sessions that covered both science content and culturally responsive teaching.

Experience Implementing a GPS. After Izabella identified her desire to lead a professional learning experience on equity and social justice in the classroom, she immediately began seeing if there was a similar opportunity available in her district:

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I emailed [my district supervisor], and she said, "We don't, but I think that you should do it. I think you'd be really amazing at it." And I was like, you might be onto something. And so, I reached out to a colleague of mine, Kate, who used to be a science teacher, but at the time was the AVID (Advancement via Individual Determination program) teacher at my school. She moved from teaching biology to teaching AVID. And we got together, and I was like, "Listen, I'm not really strong in this whole bias and equity thing," but she was. I was like, "But I'm totally here for the training of teachers and the topic, and I could learn." And so, I was like, "Let's write this PD together and facilitate it." And that's what we ended up doing.

Izabella and Kate collaborated and designed a two-day workshop that tackled bias and equity issues in the science classroom. According to Izabella's poster, they "read several peer reviewed articles on social justice, bias and equity in the science classroom when writing the PD and chose some of those same articles for participants to read and analyze." Izabella stressed the importance of including both the social justice and bias aspects in her workshop:

I really wanted to include that social justice piece and the bias piece as well, because you can't really talk about equity without talking about your biases that you have…when I was searching for articles, I was trying to find articles that really spoke to what we were trying to get at in the training when we wrote it.

Then, after discussing the articles, Izabella wrote in a monthly reflection that they had participants "take an existing lesson, analyze it for bias, and modify it to be more equitable."

Izabella struggled to recruit participants for her professional learning experience, so they changed the dates multiple times as her March monthly reflection stated:

We were planning to have our first in-person session of the training [in late February].

Unfortunately, we had to reschedule due to scheduling conflicts with my co-trainer for

this month (March). We were able to reschedule our training to [early March], but we did

not have any participants registered, and [we] decided that we needed to [reschedule

again to] do more advertising to get participants. It has been very difficult getting people

to attend PD in our district at this time. People are tired and don't really want to do

anything after work hours, and we don't pay for training. In the end we rescheduled our

training again to [late March] after spring break and created a flyer to send out to

[possible] participants. We ended up getting originally 2 participants, then added a hybrid

option and got one more [participant].

In Izabella's interview conducted in the summer, she also shared the sentiment that teachers are

trying to limit voluntary commitments. She said, "*It's been, like, a really big thing this year*

where people have not really been signing up for PDs across the board because teachers are

tired." Izabella also mentioned in her March monthly reflection document that people may be

hesitant to engage in in-person trainings due to COVID-19 concerns. She wrote, "When we do

this in the future, we will market it as [a] hybrid [event] as some people are still not comfortable

attending in-person trainings."

When the workshop began, Izabella switched the format to virtual. "So, we actually did

the first day hybrid, and then the second day, we just decided, let's just do the whole thing

virtual, and let's just have everybody be virtual." Izabella described how she facilitated the

professional learning experience on her poster:

[After reading and analyzing] several peer reviewed articles on social justice, bias and

equity in the science classroom…we incorporated AVID resources for building culturally

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relevant classrooms which included a self-audit survey for participants to help them explore their biases…[Then,] these educators were able to have deep discussions about the impact of these biases and put into action plans to modify their own lessons to eliminate these biases and make their classrooms more equitable for all learners. They also committed to have these discussions with their PLCs [after they completed the training] so that this change could be seen across their respective school sites.

As Izabella designed her professional learning opportunity to accommodate her personal and district needs, she did not delve into her other personal goal as originally required. However, she elaborated on what she was trying to accomplish with that goal:

So, we were doing a lot of NGSS training with Wilcox, where they were teaching us about NGSS and the SEPs and the cross cutting-concepts. And I was like, you know what? I think that I can use the SEPs. Like, a lot of the stuff doesn't align with my standards, but the SEPs go with everything.

She continued to describe how she could use the NGSS and SEPs:

And so, if I bring in the [NGSS or] SEPs into my curriculum, I'll be able to get my kids to do more of the things that I want them to do that they're really struggling with…And [despite not spending time on this goal as originally intended] I'm still technically using NGSS and arranging my curriculum in a way that makes sense.

She also explained how this would help address the needs of her students:

So that's really what the second goal is about - trying to figure out how I could fit my IB standards with the NGSS, at least the SEPs, so that my kids could really practice science because right now…They have no application skills, no matter how hard I try to teach it to them. They just are terrible at applying. And so, I really want them to be able to

analyze and kind of think critically…So that's really what my [original] personal goal was.

Izabella's second interview suggested that she has informally worked on incorporating the NGSS, and specifically SEPs, into her IB curriculum. Ultimately, Izabella also decided to list this as her personal goal on her GPS poster as well. However, with conflicting data, such as a monthly reflection declaring it is no longer her personal goal, it is unclear how much of the work done on this goal was done prior to the end of the GPS phase of the Wilcox SEF program.

To briefly summarize, Izabella collaborated with a colleague, Kate, to design a two-day workshop to help science teachers address biases and promote equity in their lesson plans and classrooms. She struggled to recruit participants for her workshop due to scheduling conflicts, participant fatigue, and concerns about in-person meetings during the COVID-19 pandemic. They adjusted the format of the workshop to make it hybrid and then completely virtual. The workshop was a success where participants engaged in deep discussions and committed to sharing their newfound learning with their respective PLCs.

GPS Implementation: Moments of Ease. Izabella found that the autonomous nature and absence of strict deadlines in the GPS project worked well for her, as it allowed her to focus on her work without feeling overwhelmed. She appreciated that the GPS was self-paced, allowing her to work independently. She said, *"If I had strict deadlines, nothing would have gotten finished because I would have been freaking out the whole time…it was really helpful to not have set in stone."*

Relating to the autonomous nature of the experience, Izabella said she appreciated having her work meet her specific needs and being *"on my own, doing my own research and kind of doing my own thing."* Izabella also appreciated being afforded the flexibility to design a GPS

project that could build on her prior work. She said, *"I ended up getting stuck the first time [I tried to pick a goal]. But then I was talking to my mentor, and I was like, 'Can I use something that I've technically already done and then build on it?' And she was like, 'Sure.'* So, Izabella designed her GPS project based on her prior social justice and equity work.

Izabella also acknowledged that the support systems in place worked well for her*: "I had a mentor that I could call. I mean, I didn't call her that often, but if I needed her, I knew she was there."* Izabella also found it *"really helpful"* to work with her GPS affinity group, a group she was assigned to with other fellows who had similar GPS project goals, and bounce ideas off of them. This helped her work through some of the challenges she faced in her project. She said, *"hearing their ideas and how I could kind of rework myself to work for me"* was very valuable.

Overall, Izabella appreciated the autonomy and flexibility of the GPS project, as it allowed her to work independently and at her own pace without strict deadlines. She was also able to tailor her project to her specific needs, building upon her passion of social justice and equity. In addition, Izabella recognized the value of her support systems during the project such as the availability of her mentor and the assistance of her GPS affinity group. The ability to exchange ideas within her GPS affinity group was instrumental to overcoming challenges in her project.

GPS Implementation: Moments of Challenge. Izabella experienced difficulties with the GPS project, primarily due to time constraints. She said, *"Just [finding] the time to finish everything was hard,"* and admitted to falling behind on her monthly reflections as well as delaying the start of her GPS project due to her workload. She said, *"I didn't start working on my GPS stuff, like in earnest, until probably January or February is when I really started working for real, for real…because I spent the majority of the school year just doing work stuff, I*

didn't really get to my GPS up until the very end." Her monthly reflections echoed this sentiment as well as acknowledged the added burden of having to match her availability with that of Kate: "The biggest challenge has been finding time to work on everything in between my workload with my classes. I have also been having a hard time finding time to meet again with my co-facilitator due to her schedule."

A main challenge Izabella faced when executing her GPS project was recruiting participants for her professional learning opportunity. Izabella overcame this by switching to a hybrid format and being dedicated to facilitating the training despite having a very small group of participants. She reflected that she is not unique in having recruiting challenges: *"Participants...we are having a hard time in Mountain County right now just getting people to sign up for trainings. It's across the board."* She commented that teachers are *"tired, burnt out, not getting paid,"* so she understands the reluctance of those to sign up. Offering a hybrid option proved to be a good solution, as some participants preferred virtual trainings over in-person sessions. Ultimately, Izabella said, *"the hybrid worked out well."* Izabella overcame several challenges executing her GPS project including time management, coordinating with her co-facilitator, and difficulty recruiting participants for her professional learning initiative.

Reliance on Support Systems. Izabella greatly depended on the support systems in place to successfully complete her GPS project. The mentor-mentee relationship served as a much-needed layer of support, assisting Izabella with everything from articulating her project to finalizing her poster. Izabella felt reassured knowing that her mentor was there to check in on her and provide assistance when necessary; she said, *"I didn't call [my mentor] that often, but if I needed her, I knew she was there."*

Izabella also utilized her affinity group as a valuable support system during her GPS project. Her affinity group was composed of Cohort 3 fellows with similar GPS project themes. They met every other month to discuss their projects, share progress, and talk about any struggles they were experiencing. Izabella said:

Those are the people you meet with every other month to kind of say, "How's it going? Where are you struggling? What struggles are you having right now?" And then they would offer suggestions. They would offer suggestions of things you could look at, things you could read, like things you might think about. Actually, [it was in] one of those sessions that somebody suggested, [transitioning my training to a] hybrid [model] because we were having trouble getting people signing up.

The support, guidance, and a collaborative environment provided by the support systems fostered Izabella's growth and helped her overcome challenges to ultimately complete her GPS projects successfully.

As described above, Izabella heavily relied on support systems to successfully complete her GPS project including her mentor-mentee relationship, which offered reassurance and assistance throughout the project's stages, and her affinity group, which provided a platform to discuss progress, struggles, and suggestions. Overall, these support systems provided crucial guidance, collaboration, and encouragement that contributed to Izabella's successful project completion.

Sharing Knowledge: Poster Creation Experience. Izabella's experience making an academic poster to summarize her GPS work was a labor-intensive process. After somewhat procrastinating, she worked late at night and into the early morning hours constructing her poster. Izabella sought inspiration from other posters, looking at *"six other posters before I*

started making my posters." She reviewed examples from various cohorts and observed that

"people tended to focus on whichever goal they spent more time on," so she made her poster

primarily reflect her work facilitating a training on bias and equity in the science classroom.

Izabella made sure to showcase some of the articles she used in her workshop,

emphasizing that *"it was really important to me to make sure that we were using articles that*

were peer-reviewed or came from a journal like NSTA (National Science Teacher Association)."

She was proud to have used articles from different platforms, including NSF (National Science

Foundation), NSTA, and STEM Teaching Tools. In the evidence section of her poster Izabella

included *"screenshots of some of the participants and the modifications that they made to their*

lesson plans or to their lessons themselves to eliminate bias." Izabella's poster shared the results

of her work:

> I helped those educators who participated in my PD explore their own ideas around bias
>
> in the science classroom…have deep discussion about the impact of these biases and put
>
> into action plans to modify their own lessons to eliminate these biases and make their
>
> classrooms more equitable for all learners. They also committed to have these
>
> discussions with their PLCs so that this change could be seen across their respective
>
> school sites.

Izabella hopes to continue offering professional learning opportunities throughout her career, and

her poster acknowledged her future plans to redesign her GPS training, which was aimed at

secondary science teachers, to make it applicable to K-12 teachers of all subjects.

In summary, Izabella drew inspiration from other posters and decided to have her poster

focus primarily on her workshop related to bias and equity in the science classroom. Her poster

highlighted the peer-reviewed articles used in her workshop and included screenshots of lesson

modifications made by participants to eliminate bias. It conveyed the project's success, emphasizing how participating educators implemented plans to reduce bias in their classrooms. Looking forward, Izabella expressed plans to redesign her GPS training to make it relevant for teachers across all subjects and grade levels.

      Sharing Knowledge: Presentation Experience. Izabella's GPS project culminated in a presentation prior to the GPS poster symposium. Izabella said, "*I was super excited about presenting my work at the poster session.*" However, she was nervous about presenting at the STEM Academy, which occurred immediately before the poster symposium, because it was her first time doing her workshop without Kate, her co-presenter. Izabella found confidence by reflecting on a *"master trainer"* course she previously took through her district, and she said, "*I used pretty much every strategy that they taught me in that course for how to present to adults.*" Izabella's nervousness was compounded by the size of her audience at the STEM Academy. Previously, Izabella had led hybrid trainings that were around a total of 6 hours in length for as little as three participants, but the STEM Academy was in-person, had over 20 participants, and was condensed to 75 minutes. Izabella realized in the middle of her training that she was running out of time: *"the conversations that they were having were so rich that I couldn't justify stopping their conversations just so that we can analyze scenarios.*" To address her limited time, she amended the workshop to focus on article discussion and cut out the lesson plan modification section.

      Izabella expressed that conducting her GPS work increased her confidence and eagerness to present her work in the future. When asked if she intended to offer more workshops, she said, *"Definitely. 100%."* Her confidence strengthened her commitment to addressing equity and bias in the classroom, saying, *"I hope that I get to offer it every semester - at least once a semester -*

for people to take it." Izabella found all the three presentations she conducted regarding her

GPS work prior to our interview to be a great success, and she felt offering the workshop

regularly would help make a lasting impact on education.

To briefly summarize, Izabella effectively engaged her workshop audience and overcame

her initial nervousness. With limited time for her workshop, she adjusted her presentation

content in real time and emphasized article discussion over lesson plan modification. Facilitating

this workshop boosted her confidence and reinforced her commitment to addressing bias and

equity in the classroom.

Launch: The GPS Propulsion. Izabella's GPS project allowed her to the benefits of

working with educators from various counties and facilitating professional learning on bias and

equity in the science classroom. While the Wilcox SEF program only required Izabella to

facilitate one professional learning workshop, at the time of our final interview, Izabella had

offered this workshop two additional times.

With each workshop Izabella's confidence as a presenter as well as strategies for

marketing have increased. Izabella said, the main thing that has surprised her is how much

people desired a training on equity in the science classroom. She said, *"everybody was burnt*

out, everyone was tired and stressed, and we still had seven people sign up, which was

absolutely shocking to me. They were just so excited to take a training about equity in the science

classroom." Reflecting on her third presentation at the STEM Academy, Izabella said:

> *I had a full house. I had almost 20 people in there, and everybody was just, like, really*
>
> *excited to be able to take equity in the science classroom training. They were surprised*
>
> *that it existed…They didn't even know that the training had happened before that…I*

guess I didn't advertise well enough, but, I mean, people were just really happy to have it."

Izabella's students inspired her to pursue this work: *"I have so many kids that are like, I hate science, or I'm bad at science just because of teachers that they may have had, that may have biases that they either do or don't know about, and they can't see themselves doing science."* She has dreams to expand her training to benefit all students in all subjects. She explained, *"I want it to be K-12, because I want to be able to catch those elementary teachers as well as the high school teachers."*

Izabella's future career aspirations involve teaching adults and ultimately starting her own consulting company. She is currently working on establishing an LLC in preparation for when she decides to leave the classroom. Izabella's goal is to work with school districts, providing professional learning for teachers and writing training materials. She envisions herself as a consultant who collaborates with districts or companies, creating curriculum and conducting professional learning experiences. While Izabella's GPS work has inspired her to continually redesign and share her bias and equity training, her experience in the Wilcox SEF program has also ignited a passion for her to spearhead future professional learning opportunities that revolve around a cross-county platform and facilitate collaboration, lesson planning, and access to professional learning opportunities among educators from different counties.

Through her time in the Wilcox program, Izabella recognized that Pier County offered *"amazing PDs,"* and wondered, *"Why can't I go to PDs in another county? Why can't people from other countries come to my PD? Like, why can't someone from Pier train me?"* This led her to question existing rules that prevent such exchanges especially when *"we all teach science"* and have the same benchmarks. Izabella's GPS affinity group also discussed their

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desire to attend certain professional learning events in other counties because they perceive them to be of higher quality than the professional learning opportunities offered in their counties. When challenged with the colloquial grass is always greener perspective, Izabella reiterated her wish for educators to collaborate across counties, saying, *"Why can't we all just do it together?"* Izabella acknowledged that she never explicitly asked if she could attend professional learning offered by other counties, rather she assumed she could not due to the protected nature of district resources.

Izabella further dreams of the idea expanding beyond her local area, stating, *"What if it expanded, and it became something that happened in different states and their surrounding counties?"* She envisions virtual workshops spreading throughout the country, providing access to quality professional learning and collaboration opportunities for educators everywhere with, for example, the possibility of a Facebook group where educators from surrounding counties could collaborate on lesson planning and essentially form *"giant PLCs"* to benefit everyone. Izabella also felt that creating this collaborative space has the potential to address equity issues in education, as it would provide valuable resources to smaller, rural schools that, in its absence, may lack access to effective professional learning opportunities. Izabella continued, *"It becomes about access even more [than] content; it's an equity issue for schools."* Whether it is continuing to facilitate training on bias and equity in the classroom or designing collaborative professional learning opportunities, Izabella's GPS project has a significantly propelled Izabella towards her dream of having a career in professional learning.

In summary, Izabella successfully facilitated several workshops on bias and equity in science classrooms, which not only boosted her confidence but also highlighted a strong demand for such training among science teachers. Her experiences prompted her to aim for expanding

this training to all grades and subjects, reflecting her desire to dismantle perceived biases among educators. Izabella is working towards establishing her own consulting company to deliver professional learning for teachers and write training materials. Furthermore, she expressed her desire to eliminate professional learning barriers between different counties, advocating for more collaborative and cross-county professional learning opportunities. Izabella also envisions the expansion of this concept nationally, hoping to enhance access to high-quality professional learning resources, particularly for smaller, rural school helping to address an essential equity issue in education.

Benefits of Engaging in GPS Work. As mentioned previously in Georgette's case study, the use of student outcome benefits or career cycle benefits as a method for identifying effective professional learning was discussed in Chapter 2. While this research does not seek to have an evaluative lens, it would be remiss to not consider what benefits, if any, GPS work offered to the fellows and their project participants.

It can be inferred that addressing issues of bias and equity in the classroom will positively impact student outcomes. In two of the three workshops Izabella offered, she had teachers modify an actual lesson to eliminate bias. While Izabella did not have data on student outcomes before and after the teachers modified the lessons, there seems to be a reasonable chance student outcomes would improve. It would be worthwhile to study this at a later date.

The benefit the GPS experience has had on Izabella was described in the Launch section prior. Izabella directly acknowledged that she chose to participate in the Wilcox SEF program with future career aspirations in mind. She explained, *"When I [chose to participate in] Wilcox, I [chose to do it] with the thought in mind that I know that this is something that I want to do one day."* She continued to say that as a result of engaging in her GPS work, she is *"slowly building*

credentials for my resume and my CV (Curriculum Vitae) so that, eventually, when I branch out, I have all these credentials under my belt."

Although this research did not formally evaluate benefits, it suggests that Izabella's focus on addressing bias and equity issues in classrooms could potentially improve student outcomes. Izabella's participation in the Wilcox SEF program and her GPS work greatly benefited her career progression as her GPS project has allowed her to build valuable credentials for her CV.

Barriers Preventing Prior GPS Investigation (Research Question 1b). Izabella has always felt passionate about areas of race, bias, and equity. In fact, racial components were discussed almost immediately in our interview as Izabella shared about her educational background (*"That was the day that I learned about the crazy ways that people segregate themselves in the Caribbean"*) and teaching journey (*"I was one of two Black teachers in their regular program. There weren't very many Black kids…I never really felt 100% comfortable"*). Despite Izabella freely sharing about racial issues, Izabella stated she had never addressed race, bias, and equity in her classroom because she was unaware of it. She said:

> *I hadn't really thought about it before…yeah, I hadn't really thought about it before. But then when Leslie did her PD [for our Wilcox monthly meeting], it was just so good. Like, all the peer reviewed journals, all the peer reviewed articles that she had us read were so amazing. I was like, "Why aren't we doing this [addressing bias and equity] in PD?" And then that's when I was like, "Maybe we should be doing this. We should make this."*

However, after Izabella became inspired and recognized the need for such a workshop in her district, she still faced barriers to actually implementing the training she desired. She admitted:

I got behind on all of my GPS stuff…The project itself was a difficulty. Not because the

project was necessarily hard per se, but just time. I don't know. This year was like, I

keep saying this year was rough, but it was rough. Just the time to finish everything was

hard. And those reflections that we had to do every month; I was so behind…I just fell

behind on doing them because [of] work."

In my researcher journal I wrote, "it makes sense that since Izabella couldn't really find the time

to do her GPS program even with Wilcox 'buying her time,' she likely also lacked time to do this

work prior." .

Despite her personal experiences and passions around these topics, Izabella had not

considered addressing bias and equity issues in her classroom until after participating in the

iterative GPS goal selection process. Time constraints, due to her workload and the difficulty of

balancing her other personal and professional responsibilities, were other identified barriers.

Conceptualizing GPS Work Through a Practitioner Inquiry Lens (Research Question 1c)

As previously described in Georgette's case study, research question 1c, "Did the

fellows' processes designing and implementing their GPS work contribute to an understanding of

their work as practitioner inquiry, and, if so, how?" was answered by analyzing the fellows' prior

knowledge of practitioner inquiry, potential identification of their GPS work as practitioner

inquiry, attitudes displayed towards practitioner inquiry, and any future intention to engage in

practitioner inquiry work.

Prior Knowledge of Practitioner Inquiry. Prior to her engagement in the Wilcox

program, Izabella was not familiar with the term practitioner inquiry, but she was familiar with

the term action research from a prior professional learning experience. She said:

I'd actually never heard about [action research] before [the state university program].

And I was super intimidated and concerned because I was like, I don't know how to do

this. And they kind of taught us step by step. So, as I understand it, it's basically you

learning about some kind of topic and then essentially building a lesson that you would

take back to your students or that someone could take back to their students based on

whatever it is that you were learning in the moment is how I took away from it.

Izabella's personal definition is slightly different than the definition discussed in Chapter 2 with respect to the ongoing refinement of teaching practices based on data analysis. Overall, Izabella was not initially familiar with the term 'practitioner inquiry' but she was aware of 'action research,' and her description of the term 'action research' did not fully align with the definitions provided in Chapter 2.

Identification of GPS as Practitioner Inquiry. After discussing the definitions for action research and practitioner inquiry that are present in Chapter 2 of this dissertation, Izabella confirmed that she considers her GPS work to be both action research and practitioner inquiry. She felt that the facilitation of her professional learning falls under action research, as she had to conduct research on how to teach the material, plan, and set objectives. She said:

I think that for me anyway, [my] teaching the PD portion was more action research

because I had to go do all that research on how to do this. Like what is that going to look

like, what is the plan, what are the objectives, what are we going to be talking about?

Izabella felt her second goal of incorporating the SEPs in her curriculum aligned more with practitioner inquiry, *"because this is me going out learning from me and learning how to change my practice, although I wasn't trying to learn how to change my practice as my first goal, but it happened anyway."*

Izabella didn't necessarily originally consider engaging in a GPS project as *"a traditional PD"* when compared to the monthly workshops, stating that *"it didn't really feel very PDish. It was more research."* It is interesting that Izabella expressed a distinction between "traditional PD" and her GPS work as it may imply that the long-established, and often ineffective, sit-and-get method of professional development does not resemble practitioner inquiry work.

Ultimately, Izabella considered her GPS work as both action research and practitioner inquiry after having the definitions clarified. She specifically felt the research and planning associated with her facilitation of professional learning aligned with action research. Izabella also noted she felt her GPS project was not a traditional form of professional learning because it was more research-oriented.

Attitude Towards Practitioner Inquiry. While Izabella may not have been aware of the specific terminology at the start of her GPS work, she has consistently shown a preference for the tenets of practitioner inquiry to be incorporated in professional learning. Izabella admitted, *"I do informal action research [and practitioner inquiry] all the time. I don't call it that, but I do it all the time."* She continued, *"I'm always looking at how I teach something and kind of like trying to revamp it. Like, I'll give my kids random surveys in the middle of the year, like, okay, this is obviously not working. What do you want to do? What are we going to do?"*

Izabella acknowledged that she has consistently favored the principles of practitioner inquiry in her professional learning, even if she was not initially aware of the formal terminology. She views herself as someone who routinely practices informal practitioner inquiry in her teaching methods through soliciting feedback from her students and continually evaluating and refining her teaching approach.

Future Engagement with Practitioner Inquiry. For as long as Izabella is in the classroom, she plans to consistently reflect on her teaching and make adjustments to improve her practice. In terms of designing and facilitating professional learning, Izabella also plans to continue practitioner inquiry work. She said, *"I have a couple of things that I [will] definitely look into: equitable grading and using standard space grading. And that's on my list of things that I would like to do."* Izabella also specifically acknowledged Wilcox for brainstorming ways to launch future professional learning opportunities. She said, *"And then at [one of the] Wilcox [monthly meetings], we had someone come in and talk to us about equitable training and what they do. And I was like, oh, I like this. I think I could do this."*

In summary, Izabella has asserted her intention to continue using practitioner inquiry in her work, both in the classroom and in the development and facilitation of professional learning. She identifies equitable grading and standard-based grading as areas she would like to explore in future practitioner inquiry projects. Moreover, Izabella attributes her inspiration to implement future professional learning initiatives to the experiences and insights gained during the Wilcox program, and she continues to reiterate a commitment to addressing equity in education.

Shari

Shari is a Caucasian, female educator with between four and ten years of teaching experience. At the time of our interviews, Shari had worked at her current school Scholastica High School, for less than two years, where taught AP level courses. Shari lives with her husband and two elementary-aged children; she is succinct in her commentary and has a pleasant personality.

Educational Background

Shari began her academic journey in Virginia, attending Brantley High School before moving to the Southeast and graduating from Kraus High School with a high GPA. She continued her education at Ciega University, where she earned her bachelor's degree in biology. Despite her original aspiration to become a research biologist, Shari found herself drawn to teaching due to her mother's battle with stage four breast cancer. She said:

> [It was] my senior year of college, my mom's really sick…So we had a network of family, like, me, my sister, my dad, and my friend came [to help care for my mom]. But I was taking [on] the most amount of the work.

She discussed her original career aspirations:

> I originally wanted to go into cancer research…but I [didn't] really see how I could manage getting [a] master's [degree] at that high level [of] rigor and taking care of my mom…so then I was like I'll just put it on the backburner, and I'll just start teaching.

Shari was surprised to find that she enjoyed teaching, and it allowed her to pursue a fulfilling career while also attending to her mother's needs. As she put it, *"I started teaching, and I just loved it. I fell into it."*

Teaching Journey

Shari embarked on her teaching career by attending a teaching fair and securing a position at Gulf Winds High School. Shari pursued alternative certification through temporary certificates which allowed her to start teaching while she continued to work on the requirements for a full certificate. She described her experience at Gulf Winds High School as *"very much a similar school to where I am at now… low socio-economic background, high minority*

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concentration." As a young, inexperienced educator, Shari benefited from mentorship and guidance from a mentor teacher. She reflected on her early teaching days:

> *I was very young. Yeah, I started teaching when I was 22, so I was young, and I didn't really know what I was doing…I had a lot of help. I had a mentor teacher, and then just kind of followed their lead and their instruction with lesson planning.*

After teaching at Gulf Winds for two years, Shari left to spend a year teaching in Chile.

In Chile, Shari taught chemistry and physics, which offered her a unique opportunity to work with a diverse group of students. She recalled, *"I taught at an English-speaking school, so I didn't have to speak in Spanish. So, I had a very eclectic group of children of all different varieties. Their parents were expats, so they all spoke English."*

When Shari returned from South America, Shari found that her temporary teaching certification had lapsed. She said:

> *I was on a temporary certificate for the first three years, but when I came back from South America, my teaching certificate had elapsed. And I had been taking the courses…but when I moved from South America, I had stopped, and I didn't have access to the same courses as I did [before], so when I came back, it was on a second temporary certificate.*

Shari stopped teaching upon moving back to America. After a year, she began coursework through the district ACP (Alternative Certification Program). After completing the necessary coursework, Shari earned her full teaching certificate. She taught at Kirk High School for one year and then moved to teach at Wilson High School. After teaching at Wilson High School for two years, Shari had a baby and decided to stop teaching in order to provide full-time care for her child. During Shari's five-year teaching hiatus, she earned a Master of Arts in Teaching

(M.A.T.) degree in teaching science through a program at the Peninsula University. When Shari decided to return to teaching, she took a job teaching science at Scholastica High School where she was also hired as the department head. Overall, Shari's rich teaching experience has spanned two countries and five schools.

Leadership Role History

Currently, Shari serves as the science department head at Scholastica High School. Although she had no prior formal leadership positions before being hired as the department head, her education and various teaching roles has equipped her with necessary the informal leadership skills. As of the time of our second interview, Shari had accepted a promotion with her district to leave teaching and work as a District Science Supervisor which will be discussed later the Launch section of this case.

Professional Learning History

Shari has participated in a variety of professional learning experiences, some of which were mandated by her job while others she sought out for herself. Shari participated in two professional learning programs, one called Response Instruction to the Emerging Bilingual Learner (RIEL) and another called Learning Through Collaborative Design (LCD) Shari was compensated for her participation in both of the programs which were offered by her district.

Shari found the RIEL program, which was focused on strategies for teaching emerging bilingual students, to be effective and applicable to her classroom. She said, *"the strategy used for the ELL kids are the same strategies used for all your kids."* The RIEL program was structured so that it mirrored a lesson study format, though Shari did not use that terminology to describe it. She said:

You watch a video on what the [strategic] element is, and then you watch a video on

someone using the element, and then you plan a lesson for it, and then you go into the

group meeting. And in this group meeting, we kind of work together. We have a couple

of the teachers and then like a teacher leader or other graduate assistants on the project,

and then we work through, and we vet it kind of. And we make sure that the element is

being supported in the science and engineering practices and standards, and everything

is great. It's kind of like, refine and polish that lesson up. And then implement it and

then video it, and then eventually we'll make one exemplar lesson at the end of the year.

That's been a very beneficial professional development.

Shari also described her experience doing LCD work:

We had to teach four lessons throughout the year. For one lesson we were treated like

students and did the lesson as students, and then we looked at the lesson, and then we

built the lesson collaboratively with a group of our peers where we're trying to foster

student talk.

Shari described how this process was supposed to occur for four lessons, and each of the teachers

in the LCD group were supposed to work collaboratively and implement the lessons. At the

beginning of the program, Shari said: *"We met [for a week] over the summer, and it was very*

effective." However, after they dispersed back to their local schools, she said, the *"time isn't*

used as effectively." She shared that for each lesson, they did less and less of the expected work:

"the third lesson, I think we did, but we didn't start writing it. And the fourth lesson, we didn't

touch at all until the middle of the year."

Shari has also attended professional learning opportunities that are mandated by her

school's administration: *"We do professional development like four times a year."* She

continued, *"It's Mondays, after school. Mondays are early release."* However, she did not find them to be effective due to their lack of subject-specific focus, saying, *"I personally don't feel like it's that effective because it's not pointed towards my needs as a science teacher."* She also feels that the limited time allocated for each of these sessions is insufficient, saying, *"I don't think you can make an effective professional development in one hour."* However, Shari did recall one of her school's mandatory professional learning offerings that was held at a different time than the usual one-hour on Monday afternoon:

> *One year they did a professional development [for the whole school] where they had us have [substitute teachers], and so they pulled us for that. And that was a very effective professional development. It was like classroom management called Peak. And then for a while we were doing the Peak strategy, and then somehow that lost its luster. And I don't know, those are new things.*

Most recently, as a member of Cohort 3 of the Wilcox SEF program, Shari completed the Year 1 V-CCLS and H-CCLS work as well as attended the monthly meetings as described earlier in Table 6.

Effective Professional Learning Beliefs

Shari felt the structure of the professional learning opportunity is critical to its effectiveness. As previously discussed, she found her LCD professional learning experience to be effective when they met in person, but when they stopped meeting in person regularly, she felt the program became ineffective. Shari also felt that having professional learning opportunities but sustained and on-going made them more effective. In reflecting on her most recent professional learning experience, the Wilcox SEF program, she explained that the long-term nature of the program allows for more significant and lasting impacts on teaching practices:

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"Well, other things aren't over a two-year period of time. I think that key growth doesn't happen overnight." Shari contrasts this with shorter professional development sessions, saying, *"You could sit into a wonderful professional development for 3 hours, but it's not going to have as much effect as this [two-year program] is going to have on you."*

Shari also emphasized the importance of tailoring professional learning opportunities to be applicable to the educator's subject matter: *"For me, it's going to be something about science... I think a lot of it's like a science strategy."* Shari valued when professional learning opportunities focused on pedagogy and instructional practices, rather than just classroom management. Even though she previously praised the format of her district's Peak classroom management program, Shari shared, *"I don't need classroom management. I like the idea of discourse, and that was like a lot of what my focus was this year."*

Collaboration and peer interaction play a significant role in effective professional development for Shari. She felt that one of the most valuable components of the RIEL project was working collaboratively with *"a couple of the teachers and then like a teacher leader or other graduate assistants."* Shari also felt that effective professional learning employed multiple modalities and diverse learning approaches, and she articulated the effectiveness of doing that in her RIEL training: *"you pull in their background knowledge, or you offer them multiple modalities, like multiple modes of learning."* When carried out effectively, Shari emphasized, *"I am all about professional development. I will do professional development all day long because I know what's best for me and my students and the needs of my students."*

Research Question 1: The GPS Experience

Research question 1, "How do Wilcox SEF fellows understand their experience designing and implementing an autonomous professional learning plan?" was answered through the same

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fourteen aspect protocol that I used in the prior case analyses. Additionally, the research sub-questions were examined according to the same protocol described the prior cases.

Awareness of the Wilcox Program. Shari found out about the Wilcox SEF program indirectly. Her colleague, Katherine, told Shari about a different program that the Wilcox Principal Investigator (PI) was working on, and in researching that, she learned about the Wilcox SEF program. She was initially drawn to the program because "*It sounded like a useful professional development.*" Shari's interest in the program was also sparked by its focus on science leadership, as she recently began serving as a science department chair. She said, *"It was this idea of the science leadership. I was a science leader, so I want to perfect that."* Shari also admitted that the stipend offered by the Wilcox program influenced her decision to apply. She said, *"Yeah, it did. I mean, my husband said no more professional development unless I'm compensated."* However, later after completing the program Shari said, *"I am so proud of the project that I've created…I think that I would [participate in the GPS program] if it was free [and I was not compensated]."*

Preconceived Notions. Before participating in the Wilcox SEF program, Shari did not have any preconceived notions. Shari said, *"No, I really didn't know what I was getting into."* She was primarily interested in the program's leadership aspect, but as she progressed through the program, she realized: *"I think [the focus is even] more in instructional practices."* Shari knew the focus of Year 2 of the Wilcox SEF program would involve completing a GPS project and culminate in presenting her work. Regarding any preconceived notions of this part of the Wilcox SEF program, she shared:

> I think I was excited to get started. I like the idea of working on something specifically. I also consider[ed] it bittersweet because I really enjoyed working with fellows as well, on

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the H-CCLS and V-CCLS groups [and some of those colleagues would no longer be in

my GPS affinity group], but I didn't really know what to expect.

Shari also shared that, as a personal trait, she is comfortable when expectations are not clear, and

she tends to avoid forming preconceived notions when she embarks on new career experiences.

"*Work wise, that's pretty much how I do it. When I came in as a science department head at*

Scholastica, there was no one to tell us [what to do]. I figured it all out."

Experience Selecting GPS Goals (Research Question 1a). Shari had a few other ideas

for her GPS project before she settled on her current goals. She said, "*I was going to do*

something with the greenhouse." In her September monthly reflection she mentioned she needed

"some more purchases for my greenhouse" in order to successfully complete her GPS project,

but she ultimately deviated from that, saying: "*it's not something I [was] really that interested*

[in]." She also considered learning Spanish but said, "*I think that'd be like a handicap for my*

students if I learned Spanish." Shari's brainstorming document articulated her desire to work on

"using real world examples in science lessons, while spiraling standards throughout the biology

curriculum," and in doing this her students would "achieve higher scores on the biology EOC

(End of Course assessment)" and identify biology "as a science that is valued and has importance

in the [their] everyday lives by making connections to real world applications." The decision to

focus on spiraling the standards was influenced by the advice she received from Chris, an

administrator in the Wilcox SEF program, who suggested "*she should choose something she was*

genuinely interested in."

Shari was able to articulate why she was passionate about spiraling the standards in her

GPS portfolio:

When you focus on remediation, the students stay behind academically and never get a chance to catch up academically…the acceleration method works like this: It connects unfinished learning into the context of new learning…as new information is taught, students' brains try to make sense of new concepts by linking and integrating the incoming barrage of information with prior knowledge.

According to written feedback on her brainstorming document, Brian, Shari's assigned Wilcox mentor, encouraged her to focus on three or four units of study instead of all ten. Shari's final GPS poster showed that her district-aligned goal was to achieve "acceleration through teacher-led small group instruction" and her personal goal was to use "real world applications to enhance learning biology in the classroom." The original version of her personal goal included a focus on improving her student's EOC scores, but in her September monthly reflection, Shari shared that she "refined my personal goal to focus more on my goals around myself as a person as opposed to as an educator."

Experience Implementing a GPS. Shari's GPS project was titled "Spiraling the Standards for the Biology Curriculum." Her brainstorming document articulated that she preplanned "each unit with spiraled standards and real-world connections, [had] students participate in more student-led learning with small group discussions and whole group discussions, and [used] argument driven inquiry (ADI) and claim evidence and reasoning (CER) in the units." As Shari implemented this, she noticed *"that when we spiral back in previous standards into our newer units, it really reinforces their knowledge of the content*."

Shari felt passionately about the importance of spiraling these standards into the curriculum with an acceleration mindset as opposed to doing it for remediation. She introduced the instruction through small-group instruction, which reflects a district initiative, and also

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brought in *"real-world examples so I could stay current on science topics,"* which was a personal goal. Shari continued, *"the acceleration versus remediation works with spiraling the standards. And also, I can interject that into small groups as well."* Because Shari's goals were intertwined in her project, she dedicated equal amounts of time working on both her district and personal goals as opposed to having one goal serve as a greater focus of her time.

Shari provided a detailed explanation of one of the sequences she used to spiral the standards for a biochemistry unit:

> *So, in biochemistry, the first thing you're talking about is water, macromolecules, and enzymes. Those are the three major ideas. And so, with water, I introduced plants in biochemistry. I introduced DNA, and I think cellular energetics, and then enzymes, I again introduced some molecular genetics.*

By incorporating these additional goals throughout the biochemistry unit, Shari was able to present the subject as a whole rather than as isolated standards, saying, *"It's not a matter of fact that you need to know this before you learn this, or I'm only going to learn translation in the molecular biology unit. It just doesn't work like that."* Spiraling the standards in this way enabled her to provide students with a more in-depth and interconnected learning experience in biology.

Shari further explained how she worked through all biology units, as opposed to only few as her mentor suggested:

> *So, in one of my documents that I have on my portfolio, I worked through all the units, all ten biology units, and took each subject standard that is directly assessed, and then found a standard that would be spiraled back with it for every topic I did that with.*

This approach allowed her to create a more comprehensive and interconnected understanding of biology for her students.

While Shari could have chosen many structures to offer her students acceleration, she chose to do it through small group instruction to address a district initiative. She said,

The small group was like a big push in the district, and teachers were struggling from the first day because we didn't know what we're doing. So, I chose the hardest standard or the hardest district aligned goal. So, it was a big challenge. However, I think that it needed to be done. I needed to do it, right, regardless, and Wilcox forced me to do it with equity and efficiency.

Shari struggled because, while the school was strongly advocating for small group instruction, she said, "*I don't think [the administration] knew what that looked like. So, their [workshop on small group instruction] was just really bad.*" She clarified how she originally thought small group instruction was supposed to look and compared it to what the district was intending:

Our principals presented to us, and it was like, oh, it's like your kids are working in groups and you're doing this small group instruction. Like lots of individuals, you're like circulating a room, you're having little mini lectures to these small groups. And they were like, "No, that is not it." And I was like, "what?" But that is it. It's teacher-led small group instruction. But that is not what it's supposed to look like. It's supposed to look like the teacher sits with one group, one group for 15 to 20 minutes in a class period, while the rest of the class does something independent. They do this in elementary school time, and it's successful, and so with high school, like, what are you

supposed to do? What if they don't get it? They need you; they need me. That was just

hard for me to understand.

Small group instruction can be particularly difficult to execute due to the complexities of differentiation and ongoing formative data. As department chair, Shari felt that all her teachers were struggling with implementing small group instruction as well, so she brought in her district supervisor for a workshop which helped, not only her department, but also helped her understand how to do the small group instruction for her GPS project:

I had [a DRT (District Resource Teacher)] come in [and] do professional development

for me and my department because everybody in my school is equally having a hard time.

So, when she came in, she presented it. I had a better image of what was expected, and

then I continued to work with the science coach, and I just got a better image of what was

expected. And I think changing my vocabulary in regard to my students…you have to

group them. You're not grouping high, medium, and low groups. You're going to group

a group that has a high level of support and a low-level support. So what support are

you giving them? And so, essentially, at the end of the year, I felt like I successfully

implemented teacher-led small group instruction that was differentiated based on

ongoing formative data because I could give the students the tools they need to be

successful.

In summary, Shari's district has challenged instructors to teach one-on-one in a small group setting once a week; however, in completing her GPS project, Shari reduced the frequency and *"created one teacher-led small group instruction per unit."* While Shari's GPS project led to successful implementation of small group instruction in her classroom, her experience underscores the importance of subject-specific and pedagogical workshop for teachers, as well as

the need for school administrators to have a clear understanding of the instructional strategies they promote.

GPS Implementation: Moments of Ease. Shari believed that the two-year design of the Wilcox SEP program is part of what makes it effective. She found that having the GPS project in the second year made it inherently easier for her to complete the project "*because you learned about the science and engineering practices, and you learned how to use them in the classroom and the cross-cutting concepts*" before designing your GPS. Shari also emphasized that using *"various different research articles to support and pick those methods to teach the practice"* was particularly helpful. She elaborated that *"using all the strategies all at once [in the GPS project made] really becoming a better teacher"* possible.

When completing her GPS project, Shari found that her personal goal was relatively easy compared to her district-aligned goal. She mentioned, *"I don't think I have any issues with my personal goal. I think inherently that's usually the easier one."* However, Shari felt she selected *"the hardest standard or the hardest district aligned goal"* when she decided to engage in small group instruction, so it is possible Shari felt at ease addressing her personal goal since small group instruction *"was a big challenge."*

GPS Implementation: Moments of Challenge. The main challenge Shari faced in executing her GPS project was finding enough time to dedicate to the district-aligned work she wanted to do. Her February monthly reflection summed it up: "Time is always the challenge. Planning meaningful instruction takes time and with all the expectations placed on teachers, it can be a struggle." In addition to February, Shari wrote about her time challenges in September monthly reflection, stating:

In my district aligned goal, a big challenge has been to plan data driven small group

instruction. The planning around a lesson takes several hours, and I am not sure the

students are benefiting as much as they should. It could be that I haven't been properly

trained on [the] implementation of this strategy.

Thinking that receiving proper education would make her faster at planning lessons, she

brought in her district supervisor as described above. However, this did not resolve her time

concerns; in her November monthly reflection she echoed the same sentiment: "Once again the

time that it takes to build teacher-led small group instruction is overwhelming." In discussing

how Shari handled the challenge of time, she said: *"I mean, it definitely took a long time. I have*

to work on it and step back and work on a little bit more and just kind of approach it in that kind

of way."

Another challenge Shari encountered is that she desired to do a virtual professional

learning experience to understand how to incorporate storylines into her curriculum, but she did

not have the financial support accessible to her to do that. In her March monthly reflection, she

wrote that the Wilcox SEF program administration could help her "attend a virtual PD on

storylines. [There is] a cost associated with the professional development, and I have not spent

all my funds." In Shari's April monthly reflection, she echoed that need and wrote that she

would like support from the Wilcox SEF administration to support a "purchase of PD for Illinois

story lines." There is a high likelihood that with additional financial resources, Shari would have

engaged in more education to better her GPS project and furthered her professional learning.

Reliance on Support Systems. Shari utilized support systems, such as her Wilcox

mentor and DSC to articulate her final GPS goals as described prior. Shari also *"really enjoyed*

working with fellows as well" and felt a lot of camaraderie with her CCLS group members as

well as her GPS affinity group. Shari also considered the pedagogical information she learned in Year 1 to be a support for her GPS work in Year 2. When asked if it would have been possible for her to successfully complete her GPS without going through Year 1 and the CCLS work, she said: *"It has to be both. It's a beautiful recipe."*

In the participant's section of Shari's final GPS poster, rather than mentioning her students who were a part of her small group instruction, she mentioned her support systems: her GPS affinity group members, other Wilcox Cohort 3 fellows she relied on for collegial advice, a Wilcox SEF administrator, and other district administrators including her science supervisor, science coach, and resource teacher. Honoring her support systems in this way implies that their collaboration played a major part in the success of Shari's GPS work.

Sharing Knowledge: Poster Creation Experience. Shari found the process of creating her GPS poster straightforward, using the provided poster template but amending it to add a strategies box. Shari explained, *"I added a strategies box because I worked really hard at spiraling the standards, and I really wanted, like, pictorial evidence of that spiraling."* She then combined the results and evidence sections, as she felt the two were closely related with assessment data showcasing the growth that occurred from the students' baseline to mid-year and Form 3 assessments for Units 1-10. Shari felt it was important for her to provided examples of how she introduced various concepts such as plants, DNA, and cellular energetics in the biochemistry unit, and how she continued to incorporate these topics throughout the course. She said, *"on each step, you have all the contents that you're spiraling through."* Shari acknowledged that it took her some time to complete her poster, working on it in stages and revisiting it periodically.

Sharing Knowledge: Presentation Experience. Engaging in GPS work made Shari more confident as a presenter. Going into her presentation at the poster symposium, she expected to be a bit nervous because she had *"never really presented like this."* However, she was surprised by her comfort level: *"I was very comfortable presenting. More comfortable than I thought I was going to be…I was actually really surprised."* In Shari's presentation, she had a hard copy of her portfolio available, as well as her poster, and she also allowed her audience members to access the virtual portfolio she created on the website Sway through a QR code. Shari felt very positive regarding her presentation, and she said: *"I think that I would [do more presentations in the future]. In terms of experience, I definitely would like to."*

Launch: The GPS Propulsion. Shari's GPS program significantly and directly impacted not just her teaching practice, but, also, her leadership in science education. Since the Wilcox program ended, Shari has accepted a promotion, serving as a district science coach, and she credits her GPS work for earning her the job offer. She said, *"I owe my role as a new science coach to Wilcox, in my opinion."* She added, *"I can work better with other teachers now."* Shari also felt that *"being a pillar in your practice of instruction makes you a leader."* Shari elaborated on how her GPS work strengthened her instructional practice in her portfolio:

> I have become a better educator. I have learned that I need to go out of my comfort zone and challenge myself along with my students. Through the GPS project, I have learned to work with small groups in one-on-one instruction while the rest of the class does independent work. I have built tasks that are differentiated by varying levels so that every student has an opportunity to be successful.

Perhaps the main evidence supporting the fact that Shari's GPS work impacted her promotion is that she literally brought her GPS final portfolio to her interview. She explained, *"I*

brought part of my GPS project there because I was working on a district aligned goal, the

spiraling of the standards." This was corroborated in one of Shari's reflections; she wrote,

"Wilcox has opened doors in my teaching career. I have immersed myself as a student to gain

more knowledge in the pedagogy behind teaching science successfully." She continued to

elaborate on this:

> Wilcox has enriched my leadership skills. I can successfully run an influential
>
> professional learning community from Wilcox's skills. The school as a whole will
>
> benefit, including teachers and students. I can empower other educators to enhance their
>
> teaching practices by working with them.

In describing her new leadership role, Shari said she intended to take her experience and

help other biology teachers. She planned on working with eight to nine schools and helping

teachers adapt to new shifts in science education, such as changing standards and units. She will

showcase her leadership by collaborating with other science coaches, empowering department

heads and PLC leads, and guiding them to create better lessons. Shari stated a belief that her

new role as a science coach will enable her to have a more significant impact on students by

working with multiple schools and their respective PLCs. She said, *"I feel like my umbrella is*

widened to help students," implying that her influence will extend beyond her own classroom.

She will be focusing on biology and fully intends to share her wisdom gained from the GPS

project, saying, *"I definitely would like to even carry [the knowledge she gained in her GPS*

work] through to other teachers in the district…spiraling the standards throughout all of the

science units is something that we should all be doing."

Shari also plans to use some of her CCLS work in her new role. Acknowledging that

formal research literature is not commonly used in PLCs, Shari felt that incorporating it

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effectively is essential. She plans to introduce research-based resources in a way that is accessible and manageable for teachers who do not have time to receive a *"research article at 15 pages and say, hey, read this before PLC in between your grading and lesson planning and covering classes."* Shari highlights her strategy by saying, "*I think it has to be incorporated in a manner that will be effective*" and it may look more like *"OK, you guys wanted to work with this type of pedagogy. I found this research article. Here it is if you want to access it. But I've taken it and chunked it. And here's some takeaways from this article."* Shari also brainstormed other ways to blend research literature with existing practices:

> *Maybe we would do something similar to [the CCLS work] where they would, instead of them picking the article, maybe I pick the article; they picked the strategy, and then I figure out a research article that goes along with it."*

Shari also mentioned that she would like to train future PLCs to use the warm and cool feedback protocol, previously discussed in Georgette's case, saying *"I think it is pretty successful."*

What is perhaps most interesting about the fact that Shari credits a large part of her promotion to Wilcox and her GPS work is that, in Shari's first interview, she shared that she did not believe that GPS project significantly impacted her job, saying, *"I don't think it does impact my job. Like, I'm still going to be teaching."* This is a testament to the fact that when Shari was in the middle of her GPS work, she did not necessarily see the significance of her intended end result. As mentioned in Shari's introduction, she has a pleasant personality, but, at times, her interview answers were so succinct they seemed superficial. When she was asked questions in the second interview that probed deeper, the dialogue she offered was increasingly rich and at times contradictory to what she said in her first interview such as the way her GPS project

impacted her. A second example of this is when Shari was asked if the Wilcox program had significantly changed her curricular knowledge in the first interview, she said: *"Um, No. I don't know any more. No."* In our second interview, Shari spoke of her increased confidence and ability to serve in her new role and said, *"Now [after Wilcox], I also know all of the things in the science education world."* Ultimately, despite any prior contradictions, it is clear that Shari feels her GPS work has changed the path of her career and she will continue to grow: *"It prepared me for this leadership role, and I would like to continue this upward trend in the future."*

Benefits of Engaging in GPS Work. As mentioned previously in the prior cases and Chapter 2, student outcome benefits and career cycle benefits have been used as a method for identifying effective professional learning. In terms of impacting her career cycle, Shari clearly benefited from her GPS experience. As discussed in the prior section, Shari brought her GPS portfolio with her when she interviewed for a district science coach position, discussed it extensively during her interview, and was later offered the position.

It is also possible to see that Shari's GPS work was directly related to positive student outcomes. Shari tracked the progress students made on standards and assessments. The mid-year assessment showed that students were more proficient in their standards from the beginning of the year. Notably, the mid-year assessment covered 10 biology units, and at the time of the assessment, Shari had not yet taught units 7-10. Despite this, the students still showed significant improvement in Units 7, 9, and 10 and mild improvement in Unit 8. It can be inferred that the growth present in Units 7-10 is attributed to the acceleration structure Shari used to spiral the standards. This growth also implies that the students will have a greater baseline entering the second-half of the year, and students will have even more positive outcomes on the EOC (End of Course) assessments.

Barriers Preventing Prior GPS Investigation (1b). Shari has worked on spiraling the standards for her students' acceleration for a while, but she never engaged in this work in a formal way until her GPS project. She explained, *"Well, I think I've done it before, but I've never directly assessed them. And so doing that progress monitoring throughout and seeing their growth, I think was good."* When asked why she had never formally assessed her work, she said: *"I just didn't think about it."* This implies that participating in the Wilcox SEF program increased Shari's awareness regarding the value of assessing her work spiraling the standards through acceleration.

Shari commented on the significant amount of time required to implement her GPS work and create an environment where small group instruction could happen reliably and effectively. She repeatedly mentioned not having enough time in her interviews as well as in three separate monthly reflections. She also commented on all of her other daily responsibilities: teaching AP students, grading, lesson planning, covering classes, designing and facilitating PLCs, and more. While Shari did not directly identify having insufficient time or a lacking mental capacity as something that prohibited her spiraling the standards through acceleration and small group instruction prior to her GPS project, it can be inferred that those two things were considerable barriers.

Conceptualizing GPS Work Through a Practitioner Inquiry Lens (Research Question 1c)

As described in the prior cases, research question 1c, "Did the fellows' processes designing and implementing their GPS work contribute to an understanding of their work as practitioner inquiry, and, if so, how?" was answered by analyzing the fellows' prior knowledge of practitioner inquiry, potential identification of their GPS work as practitioner inquiry, attitudes

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displayed towards practitioner inquiry, and any future intention to engage in practitioner inquiry work.

Prior Knowledge of Practitioner Inquiry. Shari had limited prior knowledge of practitioner inquiry and action research. When asked about the term action research, Shari said, *"action research…I know I've heard that before. I feel like research while you're doing things? But I don't really know."* Regarding practitioner inquiry, she said: *"What was the other one? Practitioner inquiry? No, never heard of that."* After being told the definitions of action research and practitioner inquiry as previously discussed in Chapter 2, Shari stated that she had never previously engaged in practitioner inquiry as she has never intentionally studied her own practice, but she *"would say [she had] informally [made changes to her practice], probably over the past four years."*

Identification GPS as Practitioner Inquiry. Shari stated that she felt GPS work could be considered action research and practitioner inquiry as she investigated her teaching and classroom practices to improve student outcomes. She elaborated, *"I asked lots of questions about the levels of my students, the needs of the students, what supports they need, and then I made changes accordingly."* With respect to studying her professional practice, she said through participating in the Wilcox SEF program she *"attended various professional developments"* and intentionally studied her practice.

Attitude Towards Practitioner Inquiry. Shari felt that both her GPS work, specifically, and practitioner inquiry, on a more general level, is an effective professional development option. She thought everyone should engage in practitioner inquiry if they had the opportunity, stating, *"Yes. I mean, I think everybody should do it if they had [the opportunity]."* Shari mentioned that in doing practitioner inquiry through her GPS project she was exposed to

unique problem-solving methods and collaborative engagement with her peers.

As previously discussed, Shari felt the sustained, on-going nature of practitioner inquiry is critical, and this highlights her belief in the effectiveness of GPS work and practitioner inquiry as a means of professional growth. To reiterate, she said: "*I think that key growth doesn't happen overnight…You could sit in a wonderful professional development for 3 hours, but it's not going to have as much effect as this [two-year program] is going to have on you.*"

Future Engagement with Practitioner Inquiry. When asked if she expected to engage in practitioner inquiry in the future, Shari responded affirmatively, exclaiming, *"Oh, yes, definitely!"* She clarified that the reason behind her willingness was *"because I saw the rewards of Wilcox."* She went on to describe those rewards:

> *fellowship itself and practicing teaching using various pedagogical practices that are rich in research; having teachers watch you teach and give you warm and cold feedback and just intentionally invest[ing] in yourself… just really focus[ing] on yourself.*

It is interesting that Shari views having dedicated self-focus as a reward and not as part of the process. It is possible that the many time constraints and responsibilities teachers face combined with the altruistic nature of teaching cause such self-reflection to be viewed as a luxury and reward as opposed to a necessary part of everyday teaching. Shari also stated that in addition to committing to do her own practitioner inquiry in the future, she hoped to use her new job as a science coach to encourage other teachers to engage in practitioner inquiry. Shari elaborated, *"Being mindful…perform[ing] our lessons and edit[ing] them and just be[ing] mindful of what's best for students"* is essential for student growth, and that is where the heart of practitioner inquiry lies.

In summary, Shari expressed a strong intent to continue practitioner inquiry due to the rewarding self-growth and pedagogical improvement experienced during the Wilcox fellowship. Additionally, she plans to advocate for practitioner inquiry in her new role as a science coach, believing in its profound impact on student growth.

Chanley

Chanley is a Caucasian, female educator with over 20 years of teaching experience. For the past 15 years, she has taught at Shackford High School in the Pier School District where she currently teaches AP level courses. Chanley lives with her spouse and has three grown children. She has an encouraging and positive personality.

Educational Background

Chanley attended school in West Virginia and later moved to Pier County. She initially pursued a degree in pharmacy but decided to become a teacher due to her love for science and her family's background in teaching. *"I've always loved talking with people and interacting, and I've always loved science,"* she said. Chanley's family had a significant impact on her journey to teaching: *"My mom is a teacher. My dad was a pharmaceutical rep, and he died when I was about six. And so, she remarried my stepfather, who also was a teacher."* Her mother taught business, shorthand, and typing, while her stepfather was a vocational-education teacher.

Growing up, Chanley would play school with her brother, using papers from her teachers. She said, *"I used to get, we called them 'dittos,' papers from my grade-school teachers. And I used to bring them home and play school with my brother."* Chanley briefly considered a career in pharmacy, but *"I did an internship, and I'm like, 'Oh, is this what they do? This does not look like it's going to be for me.' It's just, really, they have to handle a lot of things that I did not want any part of. So, I said, all right, I'm going to pursue teaching."* Her love for teaching and

interacting with people, along with her passion for science, shaped her decision to pursue a career in science education.

Chanley obtained her Bachelor of Arts (B.A.) in Science Education with a concentration in Chemistry and became certified to teach chemistry through a traditional teacher certification program. She elaborated:

So, I set out actually to be a chemistry teacher…I went to student teaching, and then that was all part of it, the certification for chemistry…I'm probably one of the few teachers that are left that actually has a B.A. in Science Education with the concentration in Chemistry.

Chanley's mother also played a crucial role in her graduate studies:

My mom taught me that you need your master's. So, I went right away after I met my husband here and got my master's, took me a while working in the evening while I was teaching and got my master's, my M.Ed. (Master of Education), in curriculum and instruction, testing and research.

In short, Chanley's family directly impacted her career, combining the chemistry aspect of her late father's career and the teaching career held by her mother and stepfather. She engaged in a traditional teaching education and certification journey for her career, which is increasingly becoming a minority path for current secondary science teachers.

Teaching Journey

Over the years, Chanley has taught various science courses at several high schools in Pier County. She started at Calico High School, teaching earth science and the fundamentals of biology and physical science. After six years at Calico High School, she took a year off to be a

full-time caregiver for her daughters. After that, she returned to Calico High School, but they wanted her to teach out-of-field. She described the situation:

> *I went back to Calico High School to check my mailbox, and the principal [saw me with] one of [my daughters] in a sling and the other [daughter] was grabbing my pant leg. And my principal is like, "Oh, Chanley, can you come in here for a second?" I said, "Okay." And he said, "Oh, we want you to teach freshman next year because you're such a good teacher." I'm like, "No, [I want to teach] chemistry. That's what's there [on my certificate]." And he said, "Well, we're going to develop this 9th grade team." And so, then I didn't say anything else, and I left, and I called my friend at Shackford High.*

The next school year, Chanley moved to Shackford High School, teaching Chemistry 1, Honors Chemistry 1, and AP Chemistry for the next 15 years. She later became involved in teaching AP Capstone[3], which is an AP diploma program that requires students to take AP Seminar and AP Research as well as four AP courses of their choosing.

Chanley has also tutored students and worked with various educational programs such as the Transition to Teaching (TTT) program. Chanley described who the TTT program typically helped:

> *People that have lost their jobs or they're sick of their careers, and they're like, okay, I'm going to be a teacher now, and they come in and they're not certified. Then we help them become certified through our courses. So, I taught assessment and planning. I am a site-based mentor for the county as well as TTT.*

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[3]Typically, when the phrase "AP Capstone" is mentioned, it is used as an umbrella term for referring to both the AP Seminar course and the AP Research course. This study uses the term AP Capstone in this way.

Chanley acknowledged that teaching has not always been easy for her, especially in her early teaching days:

> *[My students] taught me more than I taught them, for sure. They were pretty challenging for me. Yeah. Maybe I had an inkling of quitting, but somehow there's always these three, four kids that really kind of have my back…There was a 19-year-old in my fundamental physical class, and I'll never forget…I was 22…he had just gotten out of prison because he shot his cousin in the head. And that kid, I was pretty afraid of. But after a while, somehow you get to have these relationships with the kids, and they kind of warm up to you.*

Chanley attributed her resilience in teaching to the support and encouragement she received from her family as well as the fact that there are always some kids in the class that she connected with that made the challenging situations tolerable while better situations were on the horizon.

At Shackford High School, Chanley taught *"AP Chem [for] probably 15 years. This is my first year without it, which I'm very happy about. I love that."* It was surprising to hear that Chanley was excited to stop teaching a course that she was an expert instructor in. She explained,

> *Don't get me wrong. I love teaching those kids. They were so high level and challenging and phenomenal kids. But we have a different clientele here now, and they don't seem to be as...I don't know how to put that...They don't seem to be like goal reaching. It's like we need to give them a path because if we give them too many choices, they're very confused.*

As described above, Chanley has taught at two schools, spending well over a decade at her current school. She has primarily taught chemistry courses, but recently she also became the

instructor for the AP Capstone program, and she also teaches adults through the TTT program. While Chanley's teaching experiences have not always been easy, she credits the relationships with her students as a motivation for making it through challenging situations.

Leadership Role History

Chanley has held various leadership roles throughout her teaching career, both formally and informally: *"I've been the chemistry lead for many years and the PLCs, and we have monthly meetings."* Chanley's leadership roles continued outside her academic department. Chanley actively participated in other school activities, such as helping facilitate graduation and joining the STEAM (Science, Technology, Engineering, Art, and Math) team. Chanley felt like serving in informal leadership roles was so much a part of her daily life that, over time, she struggled to identify it as leadership. When I asked her about informal leadership roles, she asked, *"should I say that I've been on teacher interviews? Is that something?"* Additionally, Chanley has, *"[facilitated] PD for the county...CER (Claim, Evidence, Reasoning) PD"* and shared how she also acts as an informal leader by welcoming people into her class for observations:

> *I've been one of those teachers that always [says,] "Yes, you can come through my classroom anytime you want!" Which is kind of cool, because I always love when people visit my classroom, and then they have, like, a little critiquing rubric that they go through. Do I have my standards? And are the kids on task and all that kind of stuff? So, I'm always the one to volunteer. So, I also like to give training to new teachers, too. So, it's not just new chemistry teachers, but new teachers here. So, I do [workshops] sometimes in pre-school (before the school year starts). Actually, a few years back, I did*

this for three or four years in a row, where I come in early [before the school year

starts], kind of show [new teachers] around, tell them where the bathroom is and all that.

Outside of her school, Chanley held leadership roles with the TTT program, as described above, and has also served as an education technology ambassador for an educational app called Seesaw. While this will be discussed later in the paper as it is a recent promotion, Chanley has been offered the role of science department head three times in her career. The first two times, she declined to accept the position due to a desire to maintain her work-life balance, but she just recently accepted and will serve as department head for the first time this upcoming school year. To briefly summarize, Chanley has had many leadership roles, including chemistry lead teacher, PLC facilitator, professional learning facilitator, and technology ambassador, and, most recently, science department head.

Professional Learning History

Chanley's professional learning history has encompassed a range of experiences, both mandated and self-directed. Professional learning provided by her district has included education on various science content and been coordinated in partnerships with external companies:

Science has been actually really good where they've had Pearson (a textbook and

curriculum company) out, they might have somebody from the community that does

environmental testing. Like they've had a water reclamation facility come out. A long

time ago."

At times her Professional Learning directly resulted in a field-trip opportunity for her students:

When the water reclamation facility came out, they had a man offer, 'Why don't you

come out and your kids can do some lab testing?' And it was awesome. It was free.

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They had the purple roller skate bus come and pick us up. It was awesome. And [the

kids learned], how does poop actually get processed? It was wonderful.

Other school-provided professional learning included a PLC, which Chanley facilitated, where she and her colleagues discussed topics like safety and equipment usage, and they also addressed the emotional topics that are tied to the students rather than the content:

Like, how do I handle this kid or that kid? Because we have now a lot of ELL (English

Language Learner) kids and EBD kids, special education kids that they are now mixed in.

It's not just Chemistry Honors. We don't have Honors anymore. It's all mixed in a

general population. So, we just have everybody together. So, we've got to handle a lot of

moving parts, if you would. So, we have a lot of case managers coming in to check on

their kids. So, it kind of disturbs the flow of things sometimes.

In addition to district-offered professional learning experiences, Chanley has actively sought out opportunities for her own professional growth. She described one professional learning opportunity she found from reading a magazine:

I was going through The Science Teacher (magazine) [in 2019] and, as I always do

because that's what I started teaching with, and it said free 'research science teachers

conference' is what it was called. And it was sponsored by Regeneron. And I'm like,

okay, they're going to pay my way. Okay. I'll go into a lottery, and I got picked, and it

was the most phenomenal professional development I've ever been to. It was a weekend.

And yes, they did pay for everything. And we were treated like we were just royalty. I

mean, all kinds of beautiful meals and snacks. That's the food part. But then everybody

else that was there, there weren't any sour puss looking faces. There were people that

really love the profession, that want to always learn something new and add to their

craft. It wasn't like, oh, I have to be here and all that stuff. These are the people that

really wanted to be there.

After COVID-19, this program stopped providing travel for applicants greater than a 3-hour drive, but Chanley participated virtually and actually used it in her teaching: *"It was cool because I actually did the online thing, and I had the kids actually look at some of the projects that were in ISAEF (International Science and Engineering Fair)."* Chanley has also participated in other virtual professional learning experiences provided by different chemical corporations, Flinn Scientific and Carolina, as well as the American Association of Chemistry Teachers (AACT). Chanley also wanted to have a dedicated website for her students, and other teachers, so she took the initiative to learn HTML and CSS to create her own website. Now that her district uses Canvas (a teaching and learning software), she does not use her website as often. Still, Chanley has *"tweaked [her website] every year"* and has *"a lot of pride in that because it's my own."* Most recently, as a member of Cohort 3 of the Wilcox SEF program, Chanley completed the Year 1 V-CCLS and H-CCLS work as well as attended the monthly meetings as described in Table 6.

In summary, Chanley has a rich professional learning history. She has transitioned from participant to facilitator for district workshops, instructing on topics ranging from laboratory safety and equipment usage to emotional learning strategies. Chanley has also sought out and attended multiple professional learning sponsored by corporations which are often experiential in nature.

Effective Professional Learning Beliefs

Chanley believed that the format in which professional learning is conducted determines its effectiveness. Chanley felt professional learning should be *"always collaborative and*

engaging." She stated that being engaged is perhaps the most important component of effective professional learning because, *"teachers are really hypocritical when they're in PDs, because if they're not involved, they're going to go on their phone just like the kids."* She elaborated on her views of effective professional learning:

> *It makes teachers want to come back. Because if you're just sitting there listening to people talk, and you're not doing the task at hand, or you're not practicing right there, then you don't have the confidence to go into the classroom and try new things.*

Chanley shared a personal example of trying to foster engagement when she was facilitating a workshop on using CERs prior to the start of school:

> *I had them do an activity where we had steel wool, and then the nine-volt battery, and that's all I had. And they were forming a chemical reaction right there, just touching the battery to the steel wool when it was burning. And about half the room was like, "Oh, my God, what?! We're going to have to get the vents on!" But they were laughing, and they had a great time, and they formed a claim. They provided evidence. And then we talked about how we don't have iron and oxygen anymore. We have a new compound.*

She continued her example and described how she proactively tried to create a collaborative experience with the math department:

> *But I invited the math teachers, at least my math teachers at my school, I grabbed them. I'm like, "Hey, if you guys don't see anything interesting, why don't you come to my CER?" My room was packed. I was so excited. There [were] like 55 people in my room. And the county is like, "That was awesome! You should see the feedback that you have. We're going to send it to you!" I'm like, "Okay, cool." So, they want me to do another one this summer.*

Chanley's desire to collaborate with the math department was a result of the contradictions she witnessed in a prior professional development:

> We always have a PD before school [starts in the fall]…and there was a STEM person who was the guest speaker. She was the keynote speaker. She was fantastic. [She spoke on] how math and science go together. We should do things together. And then, we leave for our separate rooms. All the science people went one way. All the math people went one way. And I just stood there and I'm like, "What's happening here?" I just thought it was just the weirdest thing. I'm like, this is not even making sense.

With webinars and virtual-based professional learning, Chanley felt achieving the same high level of engagement could be challenging, but it is ultimately possible through asking questions and participating in chat discussions. However, she acknowledged from her personal experience that it was more difficult to facilitate engagement on virtual formats:

> I had to do online TTT, and I was like, oh, this sucks. I hate this. That was rough…and then we had to monitor the chat and try to understand if everybody's there actually and put them in rooms and things like that. I hated that.

Chanley also commented that for her effective professional learning needed to be science-specific, which implied that she felt effective professional learning needs to be directly relevant to the participant. She also mentioned vertically-aligned professional learning was effective and necessary to ensure middle and high school curricula are interconnected and designed to facilitate a seamless transition for students. She elaborated on its importance:

> We need to figure out how we can get more STEM or STEAM learning throughout not just middle school, but high school. So…kids really get the skills needed to get to high

school STEM. And they have those skills so that they can continue on programs that we

offer eventually.

Chanley also felt that effective professional learning was not limited by financial constraints and an effective way to secure funding to develop engaging, collaborative, and relevant learning experiences for participants was to establish strategic partnerships with relevant companies. She felt this symbiotic relationship not only elevated the quality of the workshops, but also fostered meaningful connections between industry stakeholders and professionals seeking to expand their knowledge and skills. It is possible that Chanley's attention was drawn to corporate partnerships because, as her professional learning history discussed, she has attended four different professional learning experiences that had corporate partnerships. In her description of those sessions, she proudly referred to them by the name of the corporate sponsor and she also described her experience as *"wonderful," "awesome,"* and *"great."* In short, Chanley felt effective professional learning was collaborative, engaging, science specific, addressed content as emotional and pedagogical strategies, and was not limited by financial constraints.

Research Question 1. The GPS Experience

Research question 1, "How do Wilcox SEF fellows understand their experience designing and implementing an autonomous professional learning plan?" was answered through the same fourteen aspect protocol that I used in the prior case analyses. Additionally, the research sub-questions were examined according to the same protocol described the prior cases.

Awareness of the Wilcox Program. Chanley first learned about the Wilcox SEF program after receiving an email that contained a flyer from the district about the program. She described her thoughts when she saw the flyer:

They had been doing it for about three years because this is the last year, right. This is

the third year. So, I'm like, this sounds so interesting. This is so interesting! But I have

three daughters. And I'm like, well, they're now 19 and up, so they're all graduated.

They don't need me. And I'm like, you know, I can do this!

She began to do the application, and felt her excitement turn to a bit of concern. She described

the intensity of the application saying, it *"was a beast."* She thought, *"Holy crap! I [have] to*

write all this?!" Chanley reassured herself, saying, *"But I had time…[Since my children no*

longer need me at home,] I have time to do this application."

When asked if the stipend she received for participating in the program influenced her

decision to apply, Chanley admits that she would have joined Wilcox even if it was free, stating,

"It was a motivating factor for me…but it's like that wasn't my number one factor [in deciding

to do the program], that's for sure…It was an added bonus." Chanley's thoughts then shifted,

reflecting on if she would have still participated in Wilcox if there was not a stipend or if she had

to pay to attend the program. She said, *"I definitely would have done it if it was free, for sure. If*

I had to pay, I probably wouldn't [have applied], mainly because there are other things that I

could do myself because I am self-motivated."

In summary, Chanley's experience finding out about the Wilcox program involved

feelings of curiosity, interest, concern, and encouragement. When Chanley saw the flyer, she

was curious, and she asked more and more people about the program until she was excited about

applying. The intensity of the application made her feel a bit of concern, and in prior years this

may have dissuaded her from applying to the program, but she felt encouraged by the fact that

she had the necessary time available to complete the application.

Preconceived Notions. Chanley had three main preconceived notions regarding the Wilcox SEF program: (a) it was going to be time-intensive; (b) it was going to be a positive experience; and (c) it may or may not be able to meet in person due to COVID-19. When Chanley first began the program, she reached out to a couple colleagues who she had learned were in a prior Wilcox SEF cohort. She talked to them trying to assess if the program was *"worth the time."* While *"they were very positive"* about the program, they told her that *"they couldn't finish it."* Chanley said her colleagues told her, *"They liked the experience. They just did not have time to finish what they started."* It is important to note that both Cohort 1 and Cohort 2 were directly impacted by the COVID-19 pandemic, so it is possible that this a contributing factor to the fact they dropped out of the program. Regardless, Chanley's first preconceived notion regarding the program was that it was going to be time-intensive.

Chanley's second preconceived notion was a concern for the way the COVID-19 pandemic had forced some of the Cohort 1 and 2 meetings to a virtual format instead of in-person. As a member of Cohort 3, she said that, prior to beginning the program, *"my hope was that one day we would be able to meet [in person] as a team."*

Throughout her time in Year 1, Chanley knew that the focus of Year 2 of the Wilcox SEF program would be her completion of a GPS project. When asked about any preconceived notions she had regarding Year 2, she enthusiastically referenced seeing the projects some of her colleagues in Cohort 1 and Cohort 2 had completed. When she first saw her colleague Chuck's work, she said: *"I was just like, oh, my God! That guy is awesome. And he was a great speaker, too. I remember he couldn't present to us, so we watched his recording...we could go talk with him about his GPS."* She continued to describe a second GPS project, *"I have a colleague across the street at the middle school who did her [GPS] on equity, and she gave us a lesson on*

equity in the classroom." Seeing these two projects made Chanley wonder about what she may do for her own personal goal. She said, *"For me, when they said a personal goal, it was hard for me to separate personal and what our school wanted to do because I'm always a team player…So I'm like, well, what is my passion?"*

As described above, Chanley experienced a mixture of excitement and apprehension before entering into the Wilcox SEF program as well as in between Year 1 and Year 2. Before beginning the program, she was excited about being a part of it because she had colleagues tell her what a great experience it was, but she was apprehensive about the time commitment and the format of the program. Her feelings of excitement as she approached Year 2 were a result of seeing what she described as *"awesome"* and *"great"* GPS projects some of her colleagues had done, and her feelings of apprehension were related to being able to truly articulate a personal goal and identify her passions.

Experience Selecting GPS Goals (Research Question 1a). The first thing Chanley did in trying to come up with her GPS goal was identify what she was passionate about. After self-reflection, she explained what her passion was:

> *It's food…I really wanted to get into trying to get food science here on campus…this is what the kids are all excited about. They go to the gym, they work out. They know about high fructose corn syrup, and they're watching out for their diets. And I was like, okay, maybe I can do that.*

In Chanley's brainstorming document, she wrote, "I've always wanted to teach the science behind food." She continued, "I am communicating with our district to see if I can get the training for Food Science courses as specified through CPALMS." CPALMS stands for Collaborate, Plan, Align, Learn, Motivate and Share, and it is a software used by her district for

education and referencing official standards and course descriptions. As Chanley looked into the requirements to create a food science program on-campus, she learned the logistics were too significant and time consuming. She explained:

> *I haven't had any official restaurant business or restaurant experience…So I would need to take, like, all this training. And for CTAE (Career, Technical, and Adult Education) certification, I would not only be tested with the food part of it, but I would need to get into woodworking, and I think there's, like, metallurgy stuff…[My colleague] Fred gave me the book on this test that I would have to take, and I'm like, I don't want to spend time doing that.*

Once Chanley decided against food science, she considered developing a science research class for students to engage in experiments and research or similar to science fair projects as well as possibly bringing the science fair into her new AP Capstone courses. Thinking on a bigger scale, on her brainstorming document, Chanley wondered if she could make a long-term goal of "How can we establish a STEM magnet school at Shackford High School?" with a short-term goal of "How can AP Capstone be incorporated into STEM courses?"

In written feedback to Chanley's brainstorming document, Miranda wrote: "There is so much here!! All of it sounds deeply meaningful and important—and way too much to do as a GPS!" Miranda then made 11 bullet points, each one being a separate thing Chanley was trying to accomplish with her single GPS project. She later challenged Chanley's personal goal, writing in feedback, "this is supposed to be learning FOR YOU (emphasis in original), not just a contribution to your students, school, and district. Even your PD for AP Capstone is not really just for you." Chanley continued to work with Miranda to refine her GPS goals. She described that process to me in our interview, saying:

But then Miranda, Oh, my God, that precious lady. [She said] "This is way too much for

a GPS. This is too much; over the top." So, I'm like, "Okay, I better focus on my new

courses," which is argumentation in the Capstone, because [argumentation] is at the

heart and soul of [the AP Capstone courses]...And then, of course, I'm going to connect

that to STEM or STEAM. So that's kind of how that all evolved.

After Chanley and Miranda had been working together, she was assigned a Wilcox

mentor, Rosie, who took over helping Chanley refine her GPS vision in a manageable way.

Chanley wrote in her portfolio:

> [Both Rosie and Miranda] expressed their concern over the lofty goals and wondered if I
>
> would consider developing smaller, more specific goals. I did revise my goals several
>
> times, and with Rosie's help and patience I was able to focus on two solid goals.

Eventually Chanley articulated her personal goal: "I want to be able to teach students

and educators how argumentation helps to strengthen our ability to communicate." She felt by

identifying this personal goal, she would be able to better herself and take an ADI (Argument-

Driven Inquiry) training that she has wanted to do for a while and develop strategies to increase

student performance in her AP Capstone courses. Chanley determined this would be her focus

goal, as described prior, and consume approximately 70% of the time allocated to her GPS work.

Chanley also worked with Rosie to articulate her district goal, writing, "I will increase awareness

of AP Capstone & STEAM at my school through argumentation lessons." Chanley explained

her rationale for selecting this as a district goal in her GPS portfolio: "If we could increase

awareness of AP Capstone, I could not only support our school's initiative of increasing

enrollment in AP classes, but also support the CTAE enrollment."

In summary, Chanley experienced moments of ambition, chaos, encouragement, and focus in selecting her GPS goals. Her brainstorming documents showed her ambitious nature, with a brainstorming document that initially had her trying to achieve 11 separate things in one GPS project, and chaos as she tried to keep as many of those 11 things as possible in her GPS work as she narrowed her GPS goal focus again and again. It was through the guidance and encouragement of her Wilcox support system, Miranda and Rosie, that Chanley was ultimately able to refocus on her personal desire to strengthen her ADI skills and AP Capstone teaching practice and narrow her district goal to increasing awareness of AP Capstone work to potentially increase future course enrollment.

Experience Implementing a GPS. As Chanley wrote in her portfolio, "One of the first things I did was to enroll in a self-study of ADI, Argumentative Driven Inquiry, online." This training made Chanley feel increasingly confident in structuring opportunities for ADI for both her AP Capstone students and her chemistry students. Her September monthly reflection showed her excitement over implementing what she had learned in her workshop with her students: "Socratic Seminar ([in my] AP Seminar class]) implemented on 9/11 [the historical event, not the date of implementation] - My first one!" Her October monthly reflection acknowledged how her students felt regarding the Socratic seminars and her plans to continue to include them in her curriculum: "Students are really enjoying the Socratic Seminars. We did one on global warming recently. My goal is to do one a month."

As Chanley continued to work with her AP students, doing another Socratic seminar on "video gaming" and a pro/con debate on colonizing Mars, she then began to also implement her training into her chemistry course. She continued to have positive experiences conducting her project as seen when she wrote her October monthly reflection saying her students engaged in a

"successful argumentative nuclear power debate in chemistry; Pros and Cons using a Debate rubric that I received in my training workshop."

Chanley's positive experience was likely a result of the fact that, as her poster reflected, her students benefited from the inclusion of debates and Socratic seminars in her curricula. She wrote that only "20% of students did not change their view on nuclear power," but even for those students, "they learned the evidence [and] backed up their views from reliable sources." When her AP students presented team arguments, "80% of teams scored in the high range." Chanley elaborated on how her GPS work had helped her students get more comfortable working and communicating together:

> You know, it absolutely helped the kids, too, because at the beginning, [the kids were asking,] "Why am I sitting next to all these people?" And, "Why are the desks together?" So that was like, what is going on here with this? But I made them talk to each other. So not just in debate or Socratic seminar, but [also in] our little groups, our little lab groups that we do usually.

Chanley also felt as if implementing her GPS helped prepare her students for their future careers:

> I taught them how to do elevator speeches, which are great for business. And that's where I learned this. And I was like, what is this elevator speech? And then actually, I heard about it in the Capstone training, and then I went and googled it. Man, everybody does an elevator speech! It really is literally, what are you going to say to your potential boss in a minute on the elevator?

Chanley reflected on implementing her personal GPS goal, saying, "*I'm keeping this discourse in my teaching next year…it was just great to just have a new strategy that I felt confident in doing.*

At the same time that Chanley was implementing discourse methods with her students, she was talking with some of her colleagues about how valuable it would be for their students to be able to properly argue issues such as climate change and space travel. As her portfolio says, "However [after talking about how valuable argumentation is], our conversation ended with, 'Students think arguments are fights.' Teachers are frustrated and [do] not want to try having students argue anymore." This reflective conversation empowered Chanley to reach out to her colleagues, through an email survey, and ask if anyone would be interested in learning how to implement argumentative discourse lessons. Chanley's excitement was palpable in her September monthly reflection: "I had 39 faculty members respond. Win! Win!" She was even more excited when 70% of those responses indicated a desire for training. Chanley used her training to develop her own professional learning experience, complete with a PowerPoint, for the interested teachers. However, some frustrations occurred as her portfolio described:

> I advertised this lesson for two weeks and had to delay it two times because originally it would be after school. Many teachers voiced their concern over the time and asked for a lunch PD. Consequently, I did accommodate this request at lunch, however, only six faculty members attended.

Ever the optimist, Chanley said, "I did send the PowerPoint to the entire faculty in case others were interested." In this way, Chanley achieved her goal of teaching educators how argumentation helps to strengthen our ability to communicate. In addition to formally including her colleagues in discourse methods through workshops, Chanley's collaborative and welcoming personality allowed for her colleagues to informally stop by and join her classes as their planning periods allowed. In her January monthly reflection, Chanley described that her students had a graphing lesson focused on "aligning data to appropriate [graphing] methods in research [and]

how to defend [a] claim with evidence" that was taught by the marine science teacher, Addison. Her interview, however, described how organic that experience arose:

> *Addison was a marine science teacher. She's only a second-year teacher, and she had planning during the time that I [taught the AP Capstone course. So, we were doing...What is your shoe size?...And your age? How are they related? And so, I just wanted them to generate data...I left it all open ended...But she came in and she's like, "What are you guys doing in here" And, she said, "How did they relate? Is there a correlation?" So, we were talking about that word correlation. And then she's like, "Hey, we do graphs." And then she actually just organically kind of fell in the conversation. And she's like, "What kind of graph do you guys think we're going to have from this?"...And so she kind of just came in, and then she started talking about sharks or whales or something because the kids I think it was like 75% of them in the class have had her for marine [science] or currently had her as a teacher. So, they were going back and forth...and that was pretty cool; that was a pretty cool lesson.*

Chanley reinforced how appreciative she felt that teachers would spend their time working with her students and seeing discourse in action. "*Again, I did have some teachers that really were very supportive...the media specialist did some things with digital citizenship and how to use Gale [a research database], how to get to peer reviewed articles. She actually gave the introduction.*"

Chanley's portfolio described how she achieved her district GPS goal to "increase awareness of AP Capstone & STEAM at my school through argumentation lessons:"

Regarding my AP Capstone courses, in order to increase awareness of these courses, I sent a recruitment flyer and made a PowerPoint to our faculty and guidance department.

I went to my colleagues' classes and talked with students about the AP Capstone program. I also recruited students from my chemistry classes to enroll in AP Seminar. While Chanley did not mention these things directly, it is likely that Chanley's experience welcoming her colleagues into her classroom, both through formal mechanisms, such as inviting the media specialist in or through informal ways, such as when the marine science teacher stopped by, directly contributed to the increased awareness of AP Capstone and STEAM While Chanley intended to give formal ADI training to her colleagues in an effort to achieve her personal goal, there is also high likelihood that it assisted her in achieving her district goal. She proudly described the success of her district goal in her portfolio: "There has been an increase [in] enrollment from 12 to 47 students!"

As described above, Chanley mostly experienced moments of encouragement and excitement while conducting her GPS work. She was encouraged by the growth her students showed after completing debates and Socratic seminars, and she was inspired by moments of reflection, whether she realized teachers intentionally avoided argumentation in their courses or that she was teaching her students a lifelong career skill. However, Chanley was not immune to moments of frustration or disappointment, especially when she was only able to recruit six teachers to attend her training despite delaying it twice and rescheduling it for a time requested by her colleagues. Despite this, she remained optimistic and celebrated her excitement for a newfound confidence in teaching discourse and the increased awareness and enrollment for her AP Capstone courses.

GPS Implementation Moments of Ease. Chanley's GPS project had several aspects that worked well or were easier for her. It was clear from Chanley's interview that one of the main reasons her GPS implementation was enjoyable instead of a cause of stress was the

flexibility and autonomy she had over executing her GPS project. Chanley said, "*What worked well? Like I said, my timeline that I made up…And all of how I was achieving my goal one and goal two.*" Elaborating on this, she mentioned getting to create her own monthly calendar and do as much work as she could that was reasonable for her at any given time. Declaring that this worked well for her suggested that creating her own timeline for her GPS progress reduced some of the stress associated with completing her project and also made her hopeful for the future. Chanley kept track of things she wanted to do as a part of her GPS project but was unable to accomplish due to time constraints. She said, "*I actually outlined and read what I didn't accomplish with the GPS and what I want to do in the future…because I want to continue with this.*

Chanley also credited the pandemic for making her comfortable with technology that she used during her GPS work. She said, "*the technology that we were actually forced to use during the pandemic [worked well]. But man, [now] I can do graphs, I can do charts. The technology worked really well for [preparing virtual presentations for AP submissions]."* While the pandemic was a negative experience for Chanley in many ways, and she previously mentioned her initial concern that remote learning was going to be in effect for the entirety of the Wilcox experience, it is a tribute to her optimistic nature that when asked what was a moment of ease during her GPS experience, one of the three things she identified and acknowledged was what may have been the only positive aspect of being forced into remote learning.

The final thing Chanley identified as a moment of ease in her GPS work was her vast support systems and built-in collaboration. Chanley acknowledged so many people and credited them for helping make her GPS project easier to execute. She specifically mentioned her students, science colleagues, colleagues in other disciplines, administration, colleagues

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throughout her district, Wilcox SEF colleagues, and formal Wilcox SEF support structures all for making her GPS project easier to execute. The first people she acknowledged for assisting her were her science colleagues and students:

> *The other thing that worked well is, I got to say, my science team and the kids, they were just amazing. They're like, "How are you doing all this outside class?" Especially the Capstone kids, because they're like, "You're doing the same thing [independent research] too." And I said, "I know, it's making me a better teacher, that's for sure."*

Chanley acknowledged the media center specialist as well as her administration:

> *I didn't feel I had to hunt down my administration to say, hey, we really need to do this. They were open ears, and they really did embrace the fact that, hey, she really is wanting to do right by the kids, but also for the school, too.*

Chanley said her AP Capstone district colleagues were *"phenomenal at any time that I needed them."* She also acknowledged her assigned Wilcox mentor, Rosie, and GPS affinity group for their assistance which will be discussed in the Reliance of Support Systems section later.

To briefly summarize, Chanley's GPS experience was more positive due to the autonomy she had over her project timeline, the technology confidence she gained by teaching remotely during the pandemic, as well as the personal support offered to her by students, colleagues, and the Wilcox SEF program.

GPS Implementation Moments of Challenge. At first, when Chanley was asked if faced any challenges or difficulties that made her experience more complicated, she replied:

> *No. I put my whole heart and soul into this. I really was full of pride with the whole thing because I knew that I was going to make a product. I was going to have something*

tangible for kids, for teachers, for administration to understand that teachers shouldn't

be in that little box that you put [us] in.

The fact that Chanley did not immediately offer any challenges is, once again, an aspect of her positive disposition, but as her monthly reflections revealed, Chanley's biggest challenge in completing her GPS work was finding time to do it the way she desired. In her monthly reflections, Chanley was asked what challenges she was facing. In every single one, Chanley directly or indirectly mentioned time. In September, she wrote: "TIME is the challenge every day. I would like to have more time to coordinate the STEAM lessons I plan to incorporate." In October, she wrote: "Time – I need to find the time to interview the teachers who incorporate debates" and "Time with faculty to introduce them to ADI" as challenges. In November, she wrote: "Time – I need to find the time to interview the teachers who incorporate debates. What were the results and what did they mean?" In December and January, she referenced time challenges indirectly. In December, she wrote, "Scheduling meetings for all faculty to attend 'Arguments in the Classroom' debate.   Holidays!" were challenges indicating the lack of time due to the holidays as well as being able to find a time for faculty to attend her debate were challenges. In January, she echoed these sentiments writing, "Again, difficult to meet with faculty about arguments in the classroom." In February, she wrote, "I wanted to send another survey to teachers who have used debate but didn't have time to develop this." In March, "Time." April was her final monthly reflection; Chanley wrote her challenges were "finding time to talk with other teachers about their experience using debate or Socratic seminar in their classes. I've talked with some, but not all."

As our interview continued, Chanley admitted another challenge she faced was addressing interpersonal skills with respect to the STEAM program at her school:

We talk about STEAM on the Internet, but for high school, it's not something that we can touch. It's definitely a challenge…to get some of the teachers [who do not teach science] on board with us and try to understand that, yes, we have a program - that was a challenge [to get non-science teachers to join our program]…I don't know why, but I just feel like other teachers think science teachers are just, what can I say? I just feel like they think that we're like above others. I just feel like that's an attitude, and I don't know what I mean by that. But we do know a lot, a lot about a lot of things. And I'm not saying that we are above anybody else. What I'm saying is that we need to be together so that we can make each other better. And I hope that that comes across.

Chanley's monthly reflection echoed this, where she wrote that a challenge, she faced in February was: "Personality conflicts with the newly formed STEAM academy [a collaborative faculty initiative at her school]. Meetings have stalled until a restorative circle is done." A final moment of challenge Chanley mentioned was completing the reflection logs sent out by the Wilcox SEF program:

I didn't really like doing the logs [monthly reflections] that Rosie sent out because I was actually already doing my own kind of log…and it was lengthy…I know that others really like the logs because [it prompted] them to write stuff down, but I knew that was what you were supposed to be doing.

In summary, Chanley experienced frustration with not having enough time to implement her GPS program as she desired as well as navigating complicated interpersonal dynamics between science and non-science teachers. She also experienced some annoyance at having to complete lengthy monthly reflection forms sent out by the Wilcox SEF program since she was

already doing her own reflective log; however, after stating her dislike for these logs, she acknowledged they were useful for some of her peers.

Reliance on Support Systems. During her GPS project, Chanley utilized various support systems to ensure its success. She said, *"having a support system was essential to follow through with it."* Without this assistance, Chanley believes the project would have taken much longer to complete, if at all, admitting *"I definitely wouldn't have pulled this off in a year."* The connections and dialogue she developed through the Wilcox program were integral to her project's progress, and Chanley drew on a network of individuals who were, in her words, *"really, really helpful."*

As described above, a key source of support for Chanley was her Wilcox mentor, Rosie, who provided guidance and assistance throughout her GPS work. Chanley credits Rosie for everything from selecting a goal to argumentative discourse strategies to designing her poster. She said, "*As far as help, Rosie helped a lot. I texted her. I called her. We met at least once, twice a month, maybe more, depending on what I was working on."* She elaborated on their email exchanges, saying when she would finish different stages of her project, she *"emailed Rosie and said, 'Take a look at it; see if everything's okay'"* and *"Rosie came back and said, 'You got to shorten that up.'"* In her portfolio, Chanley wrote, "Rosie helped me decide if I was going to use data tables, charts, graphs for the GPS Portfolio and poster. I was able to call, text, and email Rosie anytime I had questions and she responded right away!" She also wrote, "Rosie shared her knowledge of argumentative research and expressed her own interest in it. We have been discussing our continued partnership, moving forward, as Rosie works on her Ph.D. using argumentative discourse." In addition to working with her assigned mentor, Rosie, Chanley

worked with another Wilcox SEF mentor, Miranda, and received guidance when she was identifying and articulating her GPS goal as previously discussed.

Another important support system for Chanley was her GPS affinity team. As previously described in the prior cases, the GPS affinity team was composed of Cohort 3 fellows with similar GPS project themes. While they didn't work closely together from the start, Chanley said: *"And my GPS affinity team, we didn't actually go through everything together, but it was like April when we started really talking all the time. And I thought, why didn't we do this earlier?"*

Chanley also benefited from the support of the Pier County teachers involved in AP Capstone and shared that they had monthly meetings during their scheduled PLC time. This support network allowed Chanley to exchange ideas and seek advice from her colleagues. She said, *"The [meeting] that could be counted on to be more reliable was the [AP] Research [teacher meeting.] She (the facilitator,) was faithful, and the agenda was awesome."* In addition to these formal support networks, Chanley also found help from her fellow teachers, including the marine science teacher and media center specialist as previously described.

Overall, Chanley's experience was highly collaborative. By utilizing these various support systems, she was able to address the challenges she faced during her GPS project and continue making progress. This demonstrated the importance of having dedicated spaces and people for open communication and valuable feedback to occur so that fellows do not have to navigate any GPS obstacles alone and are, ultimately, more likely to achieve a successful outcome for their GPS projects.

Sharing Knowledge: Poster Creation Experience. Chanley created her poster and portfolio simultaneously, and while she anticipated that her experience creating the poster would be easier than that of the portfolio, that is not exactly what she found:

> *I really felt like when I started the poster, I felt like, okay, this is going to be easier than the portfolio. But that's not exactly how it ended up with me because I was actually doing my portfolio as I was doing my poster because, of course, I'm like, man, I got to get everything done in my paper so that I know what to put in the poster.*

She described the vast amount of evidence she included: *"I have 38 pieces of evidence that I put into my portfolio. I'm kind of proud of it."* Chanley felt it was a challenge to *"dig deep"* and *"center on three [main pieces of evidence] because, again...with all of these pieces of artifacts, it was hard for me to pick and choose which ones were the most powerful."*

Chanley created her poster by selecting various artifacts, results, imagery, flow charts, and diagrams that represented her teaching methods and experiences in the classroom. One key aspect of her poster was the flow chart in the bottom right corner, which came from her AP Research class:

> *This [flow chart] is here because this actually is really good in a sense of, "Where is the argument piece in the grand scheme of absolutely doing hardcore research," which is great. I love how everything is set here. And I actually use this to teach research, but I'm going to use it in [AP] Seminar also. Maybe not the beginning because it's a little overwhelming.*

For her evidence and data, Chanley ultimately included images of her students working on adjusting their research questions, including images of the students, images of their

whiteboard work and chart-paper work, as well as screen shots of Chanley's notes. Chanley

explained that she included images of the students sitting to discuss discourse arrangements:

> *These are the seminar kids again in the upper left corner where I learned this format of*
>
> *just having them face each other…Now, when I did [the other] class, that was a little*
>
> *harder because we had 30 kids, so I had them, like, in an "L" shape. And so, I did the*
>
> *same kind of thing where they were debating using this style. Like, they climbed, went*
>
> *over one seat, [and then] they can talk to somebody else. And they did [the seat*
>
> *changing] three times. And then we had a whole class debrief at that point, [to] see who*
>
> *was in favor [of the pro con debate] and why were you in favor of this and all that.*

With the whiteboard imagery, Chanley wanted to showcase that "*kids were adding to [one*

student's question] to try to get a good research question."

The successful results of Chanley's work were previously discussed, but she also

included these positive results on her poster. On her poster, she showcased that her GPS

project's first goal of teaching students and educators how argumentation strengthens their

ability to communicate was effective, specifically noting that "50% of [her school's] teachers

increased their argumentative strategies after a lunch PD" and "72% of the [teachers who

responded to her survey] would be interested or possibly interested in implementing

argumentative lessons." For students, her success was reflected in 80% of her AP Seminar teams

scoring in the "high range" and confidently citing evidence that "backed up their views from

reliable sources."

In short, Chanley's experience creating her poster was complicated by the vast amounts

of evidence she had. While difficult, she was eventually able to articulate her main artifacts and

include a variety of visuals on her poster that were not only informative in their own right, but also served as a way to initiate further dialogue during a poster symposium presentation.

Sharing Knowledge: Presentation Experience. Before the Wilcox program, Chanley did not freely talk in front of other adults, especially in front of faculty members. She acknowledged, *"I think I have a pretty good reputation at school for being a teacher who is organized, who cares, but also delivers good content. Because I know when you're presenting in front of the faculty…it's almost like you're being thrown to the wolves."* She credited Wilcox for gaining confidence to speak to faculty members: *"Because of Wilcox in general, I'm more confident talking in front of others; [I used to struggle with my confidence] because teachers are very hypocritical and judgmental."*

In addition to presenting her GPS work at a Wilcox SEF poster symposium, Chanley presented a training to her colleagues as part of her GPS work and also presented in her science department meetings. She found that presenting in front of her science faculty was easier because "*they know me; they know that I have a lot to offer."* This made her feel comfortable which allowed her personality to show during her presentation. She said, *"When I came in with those ADI posters, I'm like, I got up and [said,] 'You guys really need to use these.' I was really energetic about the whole thing."* Chanley hoped to spread her belief that topics like colonizing Mars can be integrated across various subjects, such as politics, economics, and mathematics. She explained:

> *A lot of [non-science faculty] knew what STEAM was. They just [didn't] know how to incorporate that into their English class or their Economics [class]. And through my [work,] I'm like, "Oh, my God. We can talk about colonizing Mars, [You] got to talk about politics. You got to talk about economics. You got to talk about cost and money.*

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And of course, [the movie] The Martian, we can talk about that [with English]." And of course, the Math that goes on. People think math is just like, "Oh, let's just do a calculation." Well, it's all based on a question. What's the question? What are we trying to figure out? I mean, it's exciting, and I'm hoping to bring that enthusiasm to them.

Despite having to reschedule her training twice, Chanley successfully delivered it during lunchtime to six attendees from different departments. She was happy with the turnout and noted, *"they were six good people. That was awesome."* When asked about her future plans to do more trainings, Chanley enthusiastically replied, *"Oh, yeah. I'm absolutely doing that."*

As described above, Chanley presented to colleagues at her school in a training session that included both science and non-science faculty. At the culmination of her GPS work, she presented to her fellow Wilcox SEF colleagues as well as program and district administrators, university researchers, and other guests. Chanley's presentation experience allowed her to overcome a prior insecurity based on the belief that teachers as an audience are more hypocritical and judgmental than most other audiences and accept opportunities to present her discourse knowledge at future conferences.

Launch: The GPS Propulsion. Chanley's GPS project significantly affected her instructional practices, and she now incorporates Argument-Driven Inquiry (ADI), Claims-Evidence-Reasoning (CER), debates, and Socratic seminars into her chemistry, AP Seminar, and AP Research classrooms. Chanley further shared her plan to continue using discourse in her teaching next year, stating, *"It was just great to just have a new strategy that I felt confident in doing."* The workshop Chanley engaged in as part of the Wilcox SEF program increased her confidence in argumentative discourse to where she was comfortable offering training to her

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science faculty, school faculty, and district faculty. As previously mentioned, Chanley's district workshops were incredibly well received:

> *So, they want me to do another one this summer. So, I'm going to do [it when the district faculty meet the week] before school. I'm going to do the arguments based on my Wilcox research. So, Wilcox has absolutely given me even more confidence to teach other teachers because teachers are really hypocritical when they're in PDs, because if they're not involved and they're going to go on their phone just like the kids.*

The end of this statement was also written earlier in this chapter, but I wanted to include it again as I found it personally significant. In my Researcher Journal, I wrote:

> I was so surprised to hear Chanley say that statement about teachers being on their phones just like the kids. As someone who taught over a decade and sat in a lot of professional learning experiences myself, I know the hypocrisy of this firsthand, and I have always thought this same thing, but this is the first time I have ever heard someone actually admit this out loud. This is what makes giving PD or presenting in front of teachers SO much more challenging than presenting to other audiences. To compare it to another career, I feel like this sentiment would be as if a surgeon was operating on a fellow surgeon, you would assume that the surgeon would be just a little bit more nervous going in. I think the fact that Wilcox is what made her get the confidence to overcome the hypocrisy in the room is a testament to the program.

> Since finishing her GPS work, Chanley has also become department head at her school.

She had never been department head before, which I found interesting with her tenure and qualifications. Now that she had accepted the role, I asked her: "I know you said you are

department chair [next year], but is that something you desire? Is that something that you kind of got roped into and have to do?" She replied:

> *Well, that's funny you're saying that. So, department head was not something that I*
>
> *desired years ago, and I passed it off a couple of times. And then by doing this [GPS*
>
> *work], and then I see who's in our department, I'm like, Man, I kind of thought like, well,*
>
> *I am probably the 'go to'…But then I'm like, wait a minute. And there was actually two*
>
> *other people that wanted the job, and I had to have an interview. So that was interesting.*
>
> *But I was like, "Oh, no! These guys are not going to get this." Because I'm going to be*
>
> *the one that's going to make everybody get along, number one. But number two, to try to*
>
> *get everybody's voices heard and to help us continue to move in this forward direction*
>
> *where we need to go.*

In the past, it was more challenging for Chanley to maintain work-life balance, but now that she has fewer daily responsibilities to her children, her GPS work has allowed her to be dedicated to making a difference for her department and school. She could have easily let one of the other applicants fill the department head position, but she decided to serve her department and school instead, hoping to act as a change agent on educational issues.

Chanley felt that since completing her GPS work, she has become more likely to be outspoken on educational issues whether they are only affecting her classes or department or if they are impacting her school, district, or educational policy in general. She elaborated:

> *I was an outspoken person prior to this, but even more so [after completing my GPS].*
>
> *Like, they took our budget away, so now [that] I am department head, we're going to see*
>
> *how that's going to go. You got to give us some money to start the year out. That was*
>
> *weird. And so, I'm going to butt heads, I'm sure, with the administration, and I definitely*

will continue to be outspoken for goals that should be reached by our science

department, but also as our school, and then trying to figure out again how the county

can support schools more than just here's a little PD. How do we really try to talk with

each other [when] there's a lot of teachers that don't show up for district wide training?

And we only do [district-wide] like, well, we do it twice a year, but everybody takes a

trade day on the second, so we only really see each other once.

Chanley also credits the Wilcox SEF program as a whole for equipping her with a solid

foundation of articles and research, which she can cite when advocating for specific goals and

improvements. As an example, after learning about Next Generation Science Standards in the

Wilcox program, she felt they should be prioritized by districts, as they can help other standards

fall into place more easily, stating *"those standards really should be placed more in the front of*

other standards." She also emphasized the importance of vertically-aligned communication

between different education levels, asserting *"I think there has to be more communication*

between elementary, middle, and high school." Chanley sees the potential for collective action

to bring about change, noting that *"if we have enough people that are speaking up, then maybe it*

will work," and with her new role as department head there is a higher chance than ever that this

collaboration will occur. Chanley does not desire to have a formal leadership role in education

besides being a department head. She said *"No, I don't want to be in administration, nor the*

county office. God bless them. No."

In summary, Chanley's GPS experience has positively shaped the way she teaches and

engages with her immediate educational community. While she plans to finish her career as a

science teacher, Chanley acknowledged that her GPS work has caused her to accept a department

head role that she may otherwise have not engaged in. The positive difference her outspoken

nature will make through her new leadership role and continued roles as school and district trainer and teacher will span students, colleagues, districts, and the educational community at large.

Benefits of Engaging in GPS Work. As mentioned previously in the prior cases and Chapter 2, student outcome benefits and career cycle benefits have been used as a method for identifying effective professional learning. In terms of impacting her career cycle, Chanley has accepted a new leadership role at her school which will favorably impact her career. It is worth noting that since Chanley had been offered a department head position a couple other times in her career, her GPS work may or may not have been a determining factor in the interviewing committee's selection of Chanley as the next department head. However, Chanley's willingness to accept the position and her decision to formally apply for it this year was due the way her GPS work inspired her to be a change agent in her immediate community and the fact that she does not have as many outside-of-work responsibilities as she did when her children were younger.

It is also clear that Chanley's students benefited from her GPS work. As previously mentioned, 80% of her AP Seminar teams scored in the "high range" and confidently cited evidence that "backed up their views from reliable sources." While not directly assessed, it is also likely that career skills they learned, such as how to create an elevator pitch and how to properly engage in argumentation, will also increase student outcomes. Overall, Chanley's GPS experience provided a benefit to both her personal career as well as student outcomes.

Barriers Preventing Prior GPS Investigation (Research Question 1b). Chanley has had a long-standing interest in incorporating argumentative discourse into her classes as well as incorporating STEAM education into her school's curricula. When asked why she never looked into these goals before, she said:

I guess you get caught up in your life, and Wilcox allowed us to stop, and we reflected all

the time. And now I'm just like, yeah, I have reflected, but I have never really debriefed

and talked to others and really took that time. And that's just so important to kind of fine

tune and to finish up the work you are trying to do.

This statement echoed the main challenge she encountered when executing her GPS project - a

lack of time. Joining the Wilcox SEF program provided Chanley with a dedicated space and

compensated time for her to reflect and debrief, though it did not completely remove the barrier

of insufficient time.

Chanley also implied that a lack of funding was a barrier that prevented her from

engaging in this work prior. She suggested that the districts should work together and offer

trainings that are open to all; if this was the case, perhaps she could have received some of the

training she did to complete her GPS at a prior date. She said,

I think that the three counties really need to continue to try to work together [for

professional learning opportunities]...I'm like, "Where is Pier County here? Where is

Plains? This is all Mountain," which is phenomenal what they do. If there's interest,

why can't we find a way to include them…. I don't know. Hopefully we can find some

money.

Chanley indicated that the access to funding may solve the problem she experienced

when her district, Pier, was not invited to participate in the professional learning experience that

her neighboring district, Mountain, was offering to their teachers. She also had a negative

experience in terms of being reimbursed for training she received for her GPS project. In terms

of the amount of money available to her for her GPS work according to Wilcox, she said: *"First*

one paper said $600, another one said $500." She also had an unfortunate situation where she

had to go ahead and pay to reserve her seat for ADI training, or she would have missed the deadline to participate in the training. When she went to get reimbursed, she was told *"No, if you already paid for it, we can't reimburse you."* Ultimately, the main barriers that impacted Chanley from engaging in her GPS work prior was having insufficient time to engage in the work as well as a lack of funding, both personally, to engage in elective workshops as well as on a district level to increase the quality of the professional learning opportunities available.

Conceptualizing GPS Work Through a Practitioner Inquiry Lens (Research Question 1c)

As described in the prior cases, research question 1c, "Did the fellows' processes designing and implementing their GPS work contribute to an understanding of their work as practitioner inquiry, and, if so, how?" was answered by analyzing the fellows' prior knowledge of practitioner inquiry, potential identification of their GPS work as practitioner inquiry, attitudes displayed towards practitioner inquiry, and any future intention to engage in practitioner inquiry work.

Prior Knowledge of Practitioner Inquiry. Prior to her GPS work, Chanley was not aware of the terminology "practitioner inquiry" or "action research." She speculated:

> *I don't know if I've heard both of those…I feel like action research is going to be to actually solve a problem by researching it, but I'm not sure if that's the right definition or not…Practitioner inquiry. Don't know. I'm thinking that it's…is it talking about teachers that are teaching inquiry?*

After sharing the definitions of these terms as presented in Chapter 2, Chanley shared that she may have previously engaged in informal practitioner inquiry:

> *I have a little pad of paper on my desk. Well, now I put it in my phone, but I try not to use my phone in the classroom. So, I have this pad of paper, and one is, okay, I need to*

order this, and the other one is, okay, that didn't work well…If I write it down, at the end

of the day, I do reflect on how…[if] first period is not working out, let's change it up for

second period.

She further reflected, *"We do that all the time in teaching. Just give it so many different names."*

While Chanley's examples may reflect the tenets of informal action research, they do not

reflect the systematic and intentional study that is associated with practitioner inquiry.

Ultimately, at the time of our first interview, Chanley was not aware of the term practitioner

inquiry, and she did not have any prior experience conducting formal practitioner inquiry.

Identification GPS as Practitioner Inquiry. After being presented with the definition

of practitioner inquiry as described in Chapter 2, Chanley said she believed her GPS work was a

form of practitioner inquiry. She thought the structure and systematic nature was critical to the

success of her GPS work. She said, my GPS project reflected *"practitioner research because*

everything I did had a purpose, and if it wasn't systematic, which it wasn't at the beginning, then

it would have been a big flop." She continued to discuss that her motivation in successfully

completing her GPS project caused her to adhere to the systematic protocols, and she implied

that if you were not dedicated to a successful GPS project, it was possible to omit certain steps in

the design of the GPS work. She continued, *"But because I was intent on reaching these goals,*

then it absolutely, I think, would fall more under practitioner's research for sure." In short,

Chanley identified her GPS work as practitioner inquiry due to its intentional and structured

nature.

Attitude Towards Practitioner Inquiry. Chanley's GPS experience caused her to feel

that practitioner inquiry was a *"phenomenal"* way to engage in professional learning in part due

to its reflective and collaborative nature. She explained:

As far as this GPS, this was phenomenal. Because again, it made me reflect on what I

was doing on a normal day. And then, how do I change so that I can be a 21st century

teacher or 20th century teacher that has evolved into a more confident one and an

excited one, too? Because there's a lot of teachers that have been around like I have,

and they're stalemate. And so, this [GPS work] has given me confidence. And that's by

working with others, too, and being able to have that time to talk, say, "Hey, I do this,

and you do that," and share ideas.

Chanley also acknowledged she felt practitioner inquiry was most effective when the participants were invested in the learning process. She said:

I think some teachers would probably balk at it because of the fact that it is very...you

have to invest in it, but you also have to understand the big picture and if you're not up

for that… you're not going to get anything out of it if you have an attitude about it.

Chanley elaborated on this when describing that she felt the collegial collaboration was one of the best parts of doing her GPS work in the Wilcox SEF program:

The teachers that were here were present. They were focused. Even though we were on

Zoom, we were all invested in it. And you could tell. And that's why the rich

conversations were so phenomenal. Unfortunately, when you go back to the faculty [at

your school] and you talk about this and you're so excited, they take the wind out of your

sails pretty quickly.

As described above, Chanley's experience conducting practitioner inquiry through the Wilcox SEF program created a potentially biased view of how *"phenomenal"* engaging in practitioner inquiry can be. She especially enjoyed bettering herself and her practice through collaborating with a group of like-minded, invested, and present colleagues.

Future Engagement with Practitioner Inquiry. Chanley said that even without engaging in the Wilcox SEF program, she would *"continue doing informal [practitioner inquiry] because that's just my style, right? I love research. I really do."* However, Chanley clarified that as a result of her GPS work, she will be more likely to engage in formal practitioner inquiry projects in the future, and she is already seeking them out. In the next school year, Chanley hopes to engage in practitioner inquiry to ensure *"that [the] STEAM [program at my school] continues on its path to try to [recruit] the faculty. So, I'm kind of continuing my GPS, so to speak, next year without getting paid and without the funding of the money."* She said, *"I actually wanted to do more [work] with the biodigester [project at a local university], but I wasn't chosen."* Still, Chanley hopes to be able to find more practitioner inquiry opportunities and is currently looking into working with a water sustainability program next year. She elaborated:

> I don't know what else is out there for me to formally go that route… [I could] psychologically say, "Okay, Chanley, this is what you need to change." I can do that too. If I see something's not working or if [the] administration says, "This is what you're supposed to be doing for these low-level readers," or whatever. Yeah, [I would do practitioner inquiry for that.]

In summary, Chanley also hopes to encourage her other teachers to engage in practitioner inquiry through her department head role next year. However, Chanley acknowledged that engaging in practitioner inquiry may be overwhelming for new teachers, so they may need *"some years under [their] belt to accomplish this."* Chanley also concluded that the value her teachers would get out of doing practitioner inquiry would also depend on each teacher's personal attitude, saying *"you're not going to get anything out of it if you have an attitude about*

it." Chanley intended to personally engage in both informal and formal practitioner inquiry, and, through her role as department head, she hopes to encourage veteran teachers with a willing disposition to engage in practitioner inquiry alongside her.

Elise

Elise is a Caucasian, female educator with between four and ten years of teaching experience. She currently teaches at Shiloh High School in the Mountain School District where she teaches regular and honors elective courses. At home, Elise lives with and helps care for her father. Elise's commentary is typically very succinct, and it can occasionally come across as matter-of-fact or cynical depending on the audience, and she does not shy away from discussing finances.

Educational Background

Elise's educational background began in Mountain County. She graduated from Shiloh High School, the same school she teaches at now. She described teaching at her alma mater as *"very cool,"* and mentioned that *"many alumni come to work there."* After high school, she attended a local community college briefly before taking a break and then attending a state college a few hours north. Elise described herself as *"very serious about [her] schooling,"* and she *"graduated top of the class with honor"* with an associate's degree. She then transferred to a nearby large state university and majored in political science where she was also a *"a very competitive student,"* graduating with high honors. After graduating, Elise earned her law degree, specializing in transnational litigation and international law. Elise also began working on a master's degree in international affairs, but ultimately did not finish it due to disagreements with her thesis advisor.

Elise admitted that while she was good at law, she *"did not like all the other aspects"* and *"did not like the person [she] was becoming as a lawyer."* She eventually moved overseas and worked in various fields before returning to back to the Southeastern US. When she returned to America, she accepted a very stressful job as an analyst which she ultimately resigned from when her doctor advised her to *"plan a new career or plan [her] funeral."* Encouraged by her friends, Elise decided to try substitute teaching as a flexible way to earn money while figuring out her next career move. She discovered that she loved teaching, especially when she had the opportunity to do a long-term substitute assignment in earth-space science, a subject she had always been passionate about. Elise shared that she *"really took to [teaching] like a duck to water."* Elise considered teaching social studies due to her background in Political Science, however, Elise's love for science led her to get her teaching certification in Biology and Earth-Space Science instead.

Elise earned her certification to teach through the Alternative Certification Program (ACP) offered by Mountain County Schools. She found the program to be *"very intense"* but completed it within a year, ahead of schedule. She appreciated the classes, saying that they were *"good"* and provided her with *"more practical information"* and a *"broader understanding"* than other programs she had seen. Elise is also working towards obtaining her physics certification, although she has struggled with certain aspects of the subject. Elise mentioned that she enjoys theoretical physics and astrophysics but has difficulty with kinematics. She explained her struggle by saying, *"If I'm motivated to learn it, I can retain it, I can understand it, but I hate that stuff. And so, I don't want to learn it."*

To briefly summarize, Elise grew up attending the same school she teaches at now. Elise earned a law degree, but after a stressful law and analytics career, a temporary substitute

teaching job unveiled her love for teaching. To prepare for this career change, Elise earned her biology and earth-space teaching certification through her district's ACP program, and she is currently also pursuing a physics certification.

Teaching Journey

Elise's teaching career began as a substitute teacher eight years ago. As a substitute, she covered various subjects, including AP world history, English, social studies, earth-space science, marine science, and physical science. She sought out long-term substitute assignments, and specifically enjoyed one that lasted for over five months. In that assignment, the course's teacher was supposed to be responsible for planning, but Elise asked: *"Would you be willing to let me try to make the plan and you approve them?"* When the teacher agreed, Elise treated her substitute position as an internship, learning various aspects of teaching and preparing her for a full-time role. She explained:

> *I did it almost like an internship. That's how I kind of looked at it, because at that time I was paid a whopping $11 an hour with no benefits whatsoever…I did not get paid for writing lesson plans, for doing parent contact, for grading, for putting in grades. So, I was doing the full job of a teacher, which usually long-term subs are not required to do, but I was doing [it] because I wanted to learn.*

She elaborated on how this helped her when she took her first formal teaching job:

> *And it did make a difference because when I walked in as a first-year teacher…I already had a bunch of lesson plans. I knew how to do lesson plans. I knew all the software that we were using, like how all the computer programs worked. I knew how to buy copies. I knew a bunch of the kids. I knew everybody on campus. I knew the rules [and]*

procedures. I already had learned classroom management. So, I had a lot of that ahead

of the curve.

She continued to explain how valuable her substitute position was:

And I truly believe that an internship is not enough. I truly believe working as a long-

term sub with just kind of small supervision over you the way I did is a much better

training for teachers than [an] internship where you have somebody basically holding

your hand. Because it's kind of do or die; when you're a sub, they automatically don't

really respect you, so you really got to have that classroom management.

After completing her long-term substitute positions, Elise was offered a full-time

teaching position, and she has been teaching earth-space science ever since. She identified a need

for an honors level earth-space science course and worked to implement it at the school. Elise

also added an honors-level astronomy course, and when her students asked her to start an

astronomy club, she did. Elise's passion for her subject area and dedication to her students was

evident through her work to develop new courses and clubs at her school. She has said, *"I*

wanted to build kind of like a space program" and has worked tirelessly to do so.

In short, Elise's teaching journey has focused on developing the earth-space science and

astronomy programs at her alma mater. She credits the initiative she took in treating her long-

term substitute teacher position as an internship for preparing her for her teaching career.

Leadership Role History

Elise has engaged in a myriad of formal and informal leadership roles. She began serving

her district when she reflected that, *"I'm a bit of a control person, and our curriculum was*

decent, but not great." She continued:

When the opportunity came along for working on the earth-space curriculum rewrite

team, I applied for it. And I did get on that team, and I actually had only been teaching

for two years. My teammate believes in collecting a paycheck and not doing any work, so

I did the whole thing myself because that just kind of happens.

Elise went on to become the content expert for both earth-space science and astronomy. She also

"*wrote and set up all the modules*" on the learning management software Canvas and did

"lesson writing" for her regular-level and honors level earth-space science and honors-level

astronomy courses.

In addition to her teaching and curriculum development roles, Elise has facilitated

professional learning sessions for the district and has been approved as a STEM coach for Title I

secondary schools. Regarding her professional learning facilitation, Elise said, "*I've done the*

last four professional study days" and explained her motivation for becoming a facilitator:

I pretty much avoid any and all district PD as much as humanly possible. For

professional study day, I learned that if I'm presenting, I don't have to go to the other

ones. So that's why I present. So, I don't have to go to the other ones.

For two years, Elise also organized and led the freshman orientation program at her

school, creating a college-style program that included orientation sessions for both parents and

students. Elise proudly shared that the program has been *"copied at other schools"* because of

its effectiveness. She has also served as the SAC (School Advisory Committee) Chair for the

past two years and will continue in that role next year. She elaborated:

So, SAC chair has a $1,000 stipend that the county taxes as a bonus. So, you get about

$500. It's an entire year. Meetings every single month. And I write the Zip plan that is

federally required that the district has taken from a 15-page document to a 45-page

document. They used to put the data in for us. They no longer do that, but they also

don't give access to the data. So that's about six weeks of utter chaos that I deal with

every year.

Another stipend leadership position that Elise has held is Assistant Business Manager. In that

role, she "*helped run all the games and everything, handled all the money for that.*" Elise also

served as the PLC head for earth-space science; she clarified the lack of compensation for roll,

saying, *"but that's no stipend. Our district doesn't pay stipends that other districts pay."*

In my researcher journal, I wrote, "I wonder if the reason Elise was mentioning the

stipends associated with all of her leadership roles was because perhaps, she identified the formal

roles as those where she got a stipend and the informal roles as those where she did not."

However, immediately after she told me about her leadership roles, she mentioned her salaried

compensation was insulting to her qualifications and responsibilities. She said:

So those are some of the things I've done. I'm still paid as a first-year teacher…Yeah, no,

I'm paid as a first-year teacher. So, the guy that taught next to me [and] had no control

of his room whatsoever and wasn't certified. We got paid the same…Okay, so Mountain

County does not pay for advanced degrees. [My state government] decided advanced

degrees can only get paid for if they're in your area. So, if I were to switch to social

studies in any district but Mountain County Public Schools, I would get paid for my

doctorate degree. Mountain County Public Schools has been resetting every single year.

So, when I went to work here after three years, you got a big step. Every three years you

got a step [increase] in pay. They have changed that. Now you need at least nine to ten

years, meaning you've completed nine to ten years [of teaching] because we didn't get

our steps last year. So, we're a year behind before you make more than first year teacher

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> *pay. Because when they raise that first-year teacher pay, they just included all the*
>
> *people above it.*

I admit that I do not understand the compensation structure at Elise's school or in her district or neighboring districts, so I do not fully understand her commentary. However, because she made this statement, I felt Elise was not discerning between formal and informal leadership roles by stipend association, and she was instead drawing awareness to teacher compensation issues.

Elise's concerns regarding teacher compensation, while valid, are outside the scope of this study. I mention it here, in the leadership history section, because it remains possible that Elise specifically sought out leadership roles with stipends to supplement her salary, which she described as very minimal. However, the fact that so many of these positions paid little to no stipend, may suggest that Elise's passion for teaching and making a difference influenced her decision to accept these positions rather than compensation.

Overall, Elise has held a lot of formal and informal leadership roles. At her school, she has written curriculum, designed Canvas modules and orientation programs, acted as SAC Chair and Assistant Business Manager, PLC head, and more. For her district, Elise has facilitated professional learning opportunities and acted as a STEM coach.

Professional Learning History

While Elise enjoys seeking out professional learning through the National Aeronautics and Space Administration (NASA), the majority of Elise's professional learning experiences have been mandated by her school or the district, and she is not compensated for engaging in them. She clarified, "*I work for Mountain County Public Schools. They don't pay for shit. I've been force-fed PD many times on site, and it's awful.*" As previously mentioned in the section above, Elise has had *"horrendous"* experiences participating in professional learning offered by

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her district, so she tends to facilitate sessions whenever she can instead of attending them as a participant. In my research journal, I noted that facilitating professional learning is another way to engage in professional learning with the quote I frequently learned in my classroom, "the best way to learn something is to teach it."

Elise described her experience participating in a mental health training where she had a negative experience:

We were required to do this mental health thing through the state, and we got paid $15 an hour to work overtime. Wow. I'm like, "You do know that it's not half pay? It's pay and a half for overtime?" But we still got 15 whole American dollars for one of the worst PD experiences I've ever been in.

While this training intended to train teachers to become mental health first responders, Elise found the training to be poorly executed and said that the young instructors were *"very sweet, but way too young to be, one, teaching adults and, two, to be teaching something as triggering as what it was."* She continued:

I absolutely refused to take [becoming a mental health first responder] on my plate. But it's very triggering because [regarding] some of the topics they talked about, they were a little too nonchalant. When you are 22 or 23 years old, you have not experienced enough life to have had friends that have committed suicide, to have family members that have committed suicide, to have had people you know and love with substance abuse issues, all this sort of stuff. So, they did not know how to talk about it without actually causing half of us to end up in therapy the next day. Our poor social worker did in fact get overwhelmed…Again, let me go back to the fact that this was required on a Saturday morning for $15 an hour. I graded papers during it because I set up a second laptop,

especially when I saw what this was going to be and how it was going to be. I listened,

but that was it. The presenters were not at the professional level that they should have

been. So that was just a general train wreck, and it was required by the state. So, we

had no choice. You had to do it.

Elise has also participated in her school's annual professional learning. She said,

"They're videos; it's the same videos. They use a canvas module now instead of a Moodle. So

[the] nice thing [is] you just click next, but it's the exact same videos." She described the tone

of the facilitator:

It's somebody droning on with a PowerPoint in the background. It never changes. It's

"na na na na na," and it's actually like important stuff, you know, like threat assessment

and everything, but they're like talking down to you, and it's just not engaging in any

way, shape, or form.

Elise's most favorite professional learning experiences have been those she sought out

through NASA. She said:

I never get credit for [my NASA professional learning] with the district, but that's fine

because it's actually useful. And I paid to go to two conferences. I got a scholarship

from NASA the second time, but I've gone to two conferences. They were at Kennedy

Space Center, and it was three days of awesome, awesome, awesome PD.

Details of what made this professional learning so effective for Elise will be described in the next

section. Most recently, as a member of Cohort 3 of the Wilcox SEF program, Elise completed

the Year 1 V-CCLS and H-CCLS work as well as attended the monthly meetings as described in

Table 6.

In summary, Elise has typically enjoyed her professional learning sponsored by NASA, but she has had poor experiences in her school-mandated professional learning. She has also had poor experiences in the audience during district-mandated professional learning days, so she chooses to facilitate professional learning sessions instead of attending sessions.

Effective Professional Learning Beliefs

Elise first described her effective professional learning beliefs through detailing what she feels is ineffective. She began with, *"It all sucks. Except for NASA,"* but she continued on to articulate that she disliked being talked down to, as she found it disengaging and condescending: *"Ice breakers should be illegal. Do not make me get up. I am not a seven-year-old child."* She also did not like when elementary level teaching strategies are used with adults, saying:

> *I am not going to go to a professional development taught by a first-grade teacher on classroom management because what works on her six-year-olds, I promise you, is not going to work on my six-foot [tall,] 17-year-old with the ankle monitor. They are not the same. They are not. And you get tired of being told to "ramp it up." Way too much professional development is for elementary. And they just say, "Oh, just ramp it up." They're [elementary students] using crayons. They're AP students. There is no ramp this up.*

She elaborated on another elementary strategy she dislikes: *"I am not going to do a flipping anchor chart. Do not make me walk around the stupid room and write on charts. I am an adult. I'm not a child."* While Elise appreciates collaboration, she does not like mandated collaboration:

I don't want to do a group activity. I'm almost 50 years old. I don't want to do a group

activity. So sorry. And you're not just going to assign me with whoever because I can't

stand that person and I'm an adult. I don't have to be friends with everybody.

Elise culminated sharing *"some of the biggest [professional learning] peeves"* by saying, *"If you're going to read me the PowerPoint, just send me an email. I would say, of the professional development the district has sent me, most of it could have been an email. It could have been an email."*

As previously mentioned in the two prior sections, Elise's negative professional learning experiences inspired her to facilitate multiple professional learning experiences for her peers. Elise explained how, as a facilitator, she ensured that she offered effective professional learning. When Elise facilitated her own professional learning sessions, she employed a variety of techniques to ensure that participants were engaged, interactive, and provided with valuable resources. Elise tailored her material to match the subject area and level of her participants, and she ensured her participants left her workshop with practical resources to implement in their classroom:

Only half of my PD time is taken up with me presenting and answering questions. The

other half, I require everybody to bring a laptop. Because you're now going to pull up

your curriculum, and we're going to find a way for you to use this, and you're going to

leave with a lesson, including a rubric. And that way you leave, and it's one down, 179

[days of school] to go. And you didn't just waste your time because you're leaving with a

lesson, ready to rock and roll on campus with an office document the kids can

manipulate, like it's ready to go, easy to do.

Elise preferred digital resources over physical handouts, as they are easier to access and less likely to be lost. When she facilitated professional learning, she used Nearpod (a learning software) to create interactive presentations. She said,

> *I have a Gold account [with Nearpod], so I can give everybody a code, so they can go back and look at [the training] again later. It's interactive. I usually have some of my student work dropped into the Nearpod so they can kind of see, like, how does this look in a classroom?*

She also made sure she always sought feedback at the end of her trainings:

> *Personally, I do a survey at the end. I do it through my Nearpod. Was it helpful? What can I do better? What did you really like? What did you really hate? And teachers will tell you…they have no problem telling you.*

Teachers appreciated Elise's approach to professional learning, particularly her focus on practicality and provision of digital resources. Her surveys frequently showed positive feedback; she described her typical feedback:

> *I really liked leaving with a lesson, and I really liked that you didn't hand me a piece of paper for me to lose between here in the car or try to find some way to hang on to. Instead, it's digital. I can just go on Nearpod, and I have a picture of the code, like, it's all on my phone. Those are the things that I get from the people who take my PDs that they really liked.*

Elise also described her most common constructive criticism: "*Usually their one complaint is I talk too fast. I do.*" As mentioned prior, Elise feels effective professional learning is tailored to the participant's teaching level and subject. She explained that other negative feedback she has received is related to when the wrong audience takes her training:

Well, I had a couple of people who turned out to be elementary teachers, and I'm like this

specifically says high school. So I don't know why you came. Reading comprehension is

obviously an issue with that person. So that was like a you problem, not a me problem.

And sometimes people think [the PD I'm offering] is something different or whatever.

Elise felt her feedback allowed her to gauge the effectiveness of her techniques and male

adjustments accordingly.

To briefly summarize, Elise stated that she believes effective professional learning is

relevant, engaging, provides resources that can be accessed after the training concludes, and

culminates with a tangible product ready to implement in their classroom. Elise eventually also

described this summary in her own words; she felt effective professional learning occurred when

"I can do [the] professional development, [and it's something] I can use. That [the professional

learning offered] knowledge I needed, and I left with something valuable."

Research Question 1. The GPS Experience

Research question 1, "How do Wilcox SEF fellows understand their experience designing

and implementing an autonomous professional learning plan?" was answered through the same

fourteen aspect protocol that I used in the prior case analyses. Additionally, the research sub-

questions were examined according to the same protocol described the prior cases.

Awareness of the Wilcox Program. Elise found out about the Wilcox program when

"somebody told [her] about it." She later clarified that the people who spoke with her about it

were the secondary science supervisors for her district, Katherine and Tony. She elaborated, *"I*

thought that it would be something that I might be interested in, and so I signed up for it." She

did find the application experience to be quite tedious, saying: *"it took 5 hours."*

Preconceived Notions. Elise experienced excitement and anticipation waiting for the Wilcox SEF program to start because of four preconceived notions. Elise believed that (a) she would *"work with elite teachers"* and *"learn a bunch of new stuff to apply in my class;"* (b) she *"was going to get feedback to really be able to improve my practice from really great teachers;"* (c) she *"definitely [was] going to get to go to a conference;"* and (d) she was going to receive a stipend for her participation. However, once the program began, Elise experienced frustration, disappointment, and a bit of resentment. The majority of my conversation with Elise on her preconceived notions related to the fact that she expected to attend a conference, and her frustrations that she ultimately was not offered an all-expenses paid conference opportunity. Elise elaborated:

> *I also was under the false impression that you definitely were going to get to go to a conference. And I've really always wanted to go to a conference, but I literally can't afford it because I support my dad, and I pay for everything here. So, I literally like, I can't afford airfare, I can't afford a hotel…What was presented was you were definitely going to go to a conference. Like,[they said] make sure your principal is going to get a sub for you. And then, you actually don't go to a conference. They'll pay for your registration fee. Well, I still can't afford the other $700 it's going to cost…They should say the only way you're going to get to go for free is if you present and then we'll cover part of your cost. But you're going to be treated like a child and share a room with a colleague, and we're going to choose the colleague and that sort of stuff. So that's not sending somebody to a conference. I've been sent to conferences internationally. And again, though, I come from the corporate world.*

I wrote in my researcher journal:

I found Elise's thoughts about going to a conference interesting. I was there when Chris discussed taking some Cohort 1 members to present at the National Wilcox SEF conference, and one of the main points he made was that you did get your own hotel room. They did treat you like adults. I know COVID-19 made the Cohort 2 conference virtual, but it's interesting that what Elise heard contradicts what I heard. I wonder what happened.

It is possible that Elise and my understanding of Wilcox SEF program's conference protocol and financial policies are both slightly inaccurate. I admit I did not investigate them as it is outside the scope of this study.

When asked if the stipend influenced Elise's decision to apply to the Wilcox SEF program, she answered, *"Yes."* When I followed up by asking if she would have participated in the program if it was free or had a cost associated with it, she replied: *"Absolutely not. And I would have dropped out the first week."* Perhaps one reason for her frustration is that she routinely compared her experience with the Wilcox program to her previous experiences in the corporate world, but she said *"I am not going to be one of your people who had a positive Wilcox experience. I did not."* She explained that she felt the PI of the program had his *"guts fooled,"* and then revisited the conference situation:

I have to say that…they made it sound like you could choose to go to NSTA, and they pay for the whole thing, right? Wow. That's how it sounded in the paperwork that they put out to advertise the Wilcox program. But even so, going to [the national Wilcox conference,] my question is you didn't send Cohort 2 to [the national conference] or us because for last year, last summer, we had the virtual one. And then. Yeah, they haven't

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done it…Where did that money go? Yeah, where did that money go? And why was that

money not made available to us to maybe go to a different conference?...And what was it

used for? Why were we given sandwiches for our big ceremony when we never had an

induction ceremony. We never had anything. My cohort, especially because we were

COVID the whole time, the whole way through. So, I've kind of been like, where did that

money go? Why were we not given access to that money? Not just like as a stipend, but

why were we not given access to that money to either use for our classrooms or choose

for ourselves to go to training?

When I inquired about any preconceived notions Elise had at the end of the first year of

the Wilcox SEF program regarding her GPS work specifically, Elise replied that she already

knew that *"due dates were going to change randomly"* and that she would be *"overwhelmed and*

kind of screwed, glued, and tattooed more than once." She elaborated:

At that point, I was not in love with the program already and regretted joining. So, I did

not go into year two with a good attitude, honestly. And the best part about year two is

that we didn't have a bunch of wasted-time meetings, and I didn't have to literally waste

my time with a bunch of stuff because it was kind of work on your own, mostly work on

your own. And Keith, my Wilcox mentor, gave me a lot of room.

Ultimately, Elise shared she *"thought [the Wilcox program] was going to be really*

different than it was." Elise's preconceived notions that she was going to refine her teaching

practice with elite teachers, gain new ideas or strategies to implement in her classroom, receive a

stipend, and attend a conference. The majority of our conversation circled around her not being

able to attend a conference.

Experience Selecting GPS Goals. From our interview, it is clear that Elise experienced a lot of negative emotions as she selected her GPS goals, however her brainstorming document and GPS proposal suggested she also experienced positive moments of inspiration. In our interview, Elise admitted she did not feel that her GPS project was particularly valuable or meaningful. She said, *"honestly, I think my GPS is stupid AF [as fuck]...I don't even like my GPS. It's stupid…it cracks me up when everybody's like, 'Oh, you have the best GPS.' And I'm like, 'Whatever it's bullshit, but okay.'"* When I asked her how she decided on her goal, she said: *"It was the only thing I could stomach."*

Elise's brainstorming document suggested a much more positive, and dare I say, inspiring experience. Elise had a few goals she was considering for her GPS work. First, she wondered:

> How do we bring physics and astrophysics to regular students? I feel the 50% between top and bottom quartile are often left out of the conversation. I would like to find a way that a middle 50% student can learn and enjoy physics.

Elise also considered "investigat[ing] how reality pedagogy can be used to further the study of physics among our minority student populations" for her GPS work. At a later point in her brainstorming document, Elise echoed this statement:

> I also want to find a way to reach minority students and relate physics to their everyday lives. Often students view physics as a math class (and it is sometimes taught that way as well). I want to show students that physics and astrophysics are within their reach.

She received feedback on this document from her assigned Wilcox mentor, Keith, who felt inspired by her desires. Keith's written feedback said:

This is very important! Too often that middle 50% does not get the attention like the others do. Astrophysics is such a fun thing to bring to our students as well. This is the stuff that gets them excited about science!

Later in our interview, Elise described selecting her goal through a process of both identifying her passion for reality pedagogy and eliminating things she did not want to do:

I like reality pedagogy. I teach mostly minority students… More people need to be using it. There is a ton of bias in the schools. I actually have proper CRT [critical race theory] training because I have a law degree, and that is actually where you do learn CRT. So, I actually know CRT, and the research behind it, [and] not like the fake CRT thing.

She continued to explain other things she was not interested in:

And I didn't want to do anything on like a CER [claim evidence reasoning] or any of that. And I wasn't using hands-on. COVID ravaged through my classroom this year. I literally watched it move through my classrooms. There was a point where I had 70 students out with COVID, so we were not doing hands on anything because [it was] not safe. And I didn't want to do…any of that sort of stuff for my GPS project. So, I was like, well, I thought about doing citizen science, but there wasn't enough citizen science stuff earlier in the year…And I do want to get BIPOC [Black, Indigenous, People of Color] students involved in physics, astrophysics, astronomy, so on and so forth…The problem was that earth space, we don't do anything until 4th nine weeks for space.

Eventually, Elise selected a GPS goal that aligned (a) how her background had properly prepared to her address issues of bias; (b) she felt comfort knowing she could work on that goal while keeping her students safe from COVID; and (c) she could begin early in the year, instead

of waiting until the final nine-week period of school. Elise's GPS proposal showed the title of her GPS project to be: "Bring Physics, Astrophysics, Astronomy and Planetary Sciences to the 'Forgotten 50.'" She articulated that her district goal would be to "increase engagement and interest in physics, astrophysics, astronomy, and planetary sciences among students who are not part of the top 25% nor the bottom 25% of students, specifically minority students (BIPOC)." Elise then wrote a thoughtful reflection on why this goal mattered to her: "Many of our BIPOC students fall within the middle 50% and are very underrepresented in physics, astrophysics, astronomy, and planetary sciences. My goal is to open these worlds to these students and encourage them to explore these areas."

Elise's personal goal was also articulated, albeit in a lengthy manner, in her proposal document:

> To increase my knowledge of physics, astrophysics, and astronomy. I want to expand my personal knowledge and understanding in these areas. I want to learn more about astrophysics and astronomy specifically. I want to become proficient in using a telescope, learn physics to better my understanding of astrophysics and learn more astrophysics including quantum. To expand my knowledge, I also need to expand my math background.

I do not have a full understanding of what Elise's experience and mindset was like as she created her brainstorming document and GPS proposal. However, I believe that her process selecting a goal was more thoughtful than just finding *"the only thinking [she] could stomach."* In my researcher journal, I wrote:

> The thing I cannot put my finger on with Elise is that I feel like I am talking to two
>
> different people. There's the inspiring-altruistic-equity-focused-teacher-that-never-gives-

up-on-her-kids-and-is-constantly-sacrificing-for-them Elise. And then, there's the I'm-only-doing-this-for-the-paycheck Elise. And I can't wrap my head around how they're the same person.

Ultimately, through the GPS project process, which will be discussed in the next section, Elise changed her personal goal and narrowed her district goal. Her poster declared that district goal was "to increase engagement and interest in physics, astrophysics, astronomy, and planetary sciences among students who are minority students (BIPOC)" and her personal goal was "to increase my practice self-care in order to be the best version of me for my students and myself."

In summary, Elise's experience selecting her district-aligned GPS goal initially began through reflecting on the 'forgotten 50' percent of students who she feels are often overlooked as well as BIPOC students. She eventually narrowed her goal to only focus on BIPOC students and encourage these students to see themselves in the physics and space-based science communities where they are often not represented. Elise experienced a much more drastic shift in her personal goal. Originally, she considered learning more physics, math, and astrophysics for her personal goal as well as becoming certified to teach physics and learning how to use a telescope. However, Elise ultimately decided on a personal goal of engaging in self-care to become the best version of herself.

Experience Implementing a GPS. As described in the prior cases, Wilcox SEF fellows were encouraged to select one of their goals as a "focus" goal and spend a larger amount of time dedicated to achieving that goal. Elise decided to make her personal goal, increasing her self-care to become the best version of herself for her and her students, her focus goal. Elise's monthly reflection shed light on how this transition to a new personal goal and making it her focus goal occurred.

In September, Elise realized the type of students in her class did not have the typical ability level percentages that she was used to having, and she experienced a hard time trying to discern her students' academic abilities into quartiles. She wrote, "I had to change from focusing on the 'forgotten 50' to minorities in general as my students are very low level this year." Within the first month of school, she was experiencing immense amounts of stress and faced with more and more obstacles. The first challenge she was navigating was the obstinate nature of her students and attendance issues. Elise wrote, "Students are not engaging in any of the projects I am trying to begin. Students overall are not engaged in school and there are large discipline issues. Furthermore, students have been absent due to quarantines, testing, and vacations." She also addressed class size, saying, "Classes are abnormally large which has created additional challenges." Elise also described experiencing stress over having an even smaller amount of time than she was used to having, writing:

Also, time issues have become a problem as I have lost my planning period which causes me to use my "free time" on school instead of Wilcox. This has impacted my personal GPS goals as well as school goals. Many technical issues at school are also causing a loss of "free time" as well as required trainings. I haven't even had time to send in my supply list to Mike [of things I would like Wilcox to purchase for me.].

Elise reached out to her assigned Wilcox mentor, Keith, and received a lot of support from him. She described that interaction in her monthly reflection:

Keith and I discussed survey techniques which were very helpful in how to proceed. We also discussed a minority scientist board (which I am trying to implement – I've been working on it with my TA [teacher assistant] for 2 weeks... but time.) Keith gave me some great resources as well.

Still when asked what her district may be able to help her with, she described experiencing feelings of hopelessness:

> I don't think they can change anything. Our site is short staffed like everyone else. Time is what we need, and there is no way to give us that. Also, the constant tech changes are causing stress and have become incredibly time consuming. Again, our district coordinator can do nothing about that. I wish he could help…I am taking a mental health day to try to recalibrate as I am so frustrated, depressed and exhausted by this school year.

I wrote in my researcher journal: "Wow. School's been in session for just over a month and she already needs a mental health day…it sounds like a complete mess over there…her emotions are valid."

In October, Elise experienced some successes. She wrote: "My scientists of the month board with BIPOC scientists is completed…Confidence is building among my BIPOC students." However, she also described her experience narrowing her GPS work: "Kids are still struggling to come on board. I have had to abandon some of the projects due to lack of student interest overall." She, once again, relied on her mentor, Keith, for support. She wrote that they discussed "schedules and me being overwhelmed." In November, Elise and Keith discussed "changing [her] GPS." This allowed her to experience some success as she created a new personal goal to increase her self-care. She wrote, "After tweaking my project…I have completed work on my home environment as part of my self-care." With respect to her students, Elise continued to experience engagement challenges; she described a new approach to connecting with them. She wrote:

My students are not engaged in school at all. Students are struggling. I stopped

instruction for a day to have a conversation with the students to find out what was wrong.

They feel overwhelmed, too far behind to catch up, have lost hope, are angry [that]

everything is being treated as "normal" and are very frustrated. They wish school would

slow down and that people would acknowledge that things are not normal.

While Elise did not have this conversation with her students as a formal aspect of achieving her

goal, I wrote in my researcher journal that I wondered if connecting in this way with them

impacted their future behavior.

Elise skipped December's monthly reflection, but in January she did not mention any

issues with student behavior. She wrote, "I have had students discussing the monthly [BIPOC

scientist] board. Students seem more interested…students are more engaged, and classes are

doing better overall." She also experienced even more progress redecorating her living room.

She wrote, "home environment has improved with work completed over the holidays."

However, she still experienced issues with having available time to work on her GPS

project. She wrote that the challenge she kept experiencing was: "Time. Our classes keep getting

interrupted. Many students are absent with COVID or because they are concerned about COVID.

It's very difficult to do much in a 35-minute class or when students only come to class 2x a

week."

In February, Elise had an incredibly positive update. She wrote: "I have had much

success with my personal goal. I have increased time to spend on myself and been able to make

myself more of a priority which has resulted in losing weight!" Her experience losing weight

seemed to make her feel optimistic and excited in her GPS work. This was the last month where

Elise completed a monthly reflection.

One thing that Elise's monthly reflections never mentioned was her rationale for focusing on self-care as well as the amount of dedication she put into going to the gym and redecorating her house; however, this was discussed at length in our interviews. Elise's success with her personal goal was *"awesome."* In her words,

> *I went from, 'Are you sure you don't need to call 911?' to 'Good.' And I physically feel better, and I emotionally feel better. And I was finally able to have some fun with my kids. My kids did say it made me a better teacher.*

Elise reflected on her situation before implementing her GPS and where she is now. A few years prior, Elise had to purchase her father's home and move in to take care of him, but they did not have a healthy relationship. She said:

> *I went through some very severe depression…Society putting me down and work putting me down because we're never good enough at work… I let all that get to me… And that was one of the reasons I gained so much weight. I [weighed] 197 [pounds] at winter break and this morning I was 146… And the house…My dad is a hoarder, and he has not taken care of his property in 30 years. I call it the money pit because it does take every bit of money…I redecorated three rooms. I did the work myself, except for the carpet…I got my stuff out of storage because even though I've owned this house for four years now, my stuff is still in storage because he[has] the house hoarded…I've gotten a couple of rooms clean…So when I did that for the house, I started feeling like me again because I finally had some of my stuff. Yeah. And it was more because, [when] I didn't want to be at home and I didn't want to be at school, where do you go? That is what finally enables me to sit there and start saying I am worth something.*

In my researcher journal, I wrote: "I am worth something → WOW! [emphasis in original] What a powerful GPS result." Elise's portfolio also described the incredible significance of her GPS work: "My own journey has resulted in not only improving my mental/physical health and outlook, but according to my students, class is much more fun, and they enjoy it much more." Elise's poster also echoed the same sentiment: "I have learned that my personal well-being is much more important to my classroom and students than I ever thought."

Elise's monthly reflections did not include any information pertaining to how she implemented reality pedagogy outside of putting up a BIPOC scientist of the month bulletin board, but we did talk about it extensively in our interview. Elise is passionate about reality pedagogy. She said:

> *The idea behind it is you're meeting the kids where their culture is. So, it was written for urban, Black youth…I have a huge Hispanic population, and I do have a good number of mixed students. I do have some Black students… I took his basis of here are some things that you see in these communities…let's bring their community, their lifestyle, their reality, their world into the classroom…You're giving your student voice. You're letting them use their language. You're not forcing them to use other language.*

She explained what this looked like for her students: *"I tried to bring in, like, the things that are real to them, TikTok…The kids are really into TikTok. I made several assignments where the kids could film it using TikTok."* Elise also used the whiteboard in her classroom for a new purpose:

> *Originally, I was going to use it as a graffiti wall, and the kids were to put up graffiti related to whatever we were doing in class, like put in your own words and stuff or drawings, [but] that went over like a lead balloon. So, then I changed it because I saw a big mental health crisis going on in my classroom. So, I changed it to have the kids write*

up there. What would you say to your best friend if they're having a really bad day? Or

what would you want to hear somebody say to you if you were having a really bad day?

And they really took to that, like ducks to water. And they started doing some graffiti

around that and around that idea, which was fine. But the whole wall was super colorful

because I had a ton of Expo markers in every color conceivable. And the kids were really

using them. And I would see kids come in having a bad day. They go read the back wall.

In my researcher journal, I wondered if this took place around the same time that stopped

teaching for a day and talked to them about how much they were struggling with their daily life.

Elise described another way she began connecting with her students; she said, *"I started*

a dance party between classes. We would change the music between reggaeton or rap or

whatever…to bring in more culturally relevant music for them." Elise reflected on how this

compared to her prior actions:

I would play music in class before, but it was kind of a narrow selection. I never had

played a lot of reggaeton, and I didn't play between classes. Like, we literally turned it

into a dance party between class to kind of lift everybody's spirits.

Elise also admitted that she had always done some alternative assessments, but *"not in the same*

style or fashion that I do now." She elaborated, *"Most people, when they think 'alternative*

assessment,' they think, 'posters'…I do a ton where it's like, write a song, write a skit and act it

out, write a television ad" or have students design and teach a lesson. Elise believes this directly

increased her students' attendance, engagement, and academic performance. She said, *"I had*

kids that would sign in [and come to school] just to come to my class" and *"the only assessments*

they did well on for some of those kids were the alternatives." She wrote on her poster:

"anecdotally, students have informed me that they feel seen and appreciated for who they are in

my class. Students have performed better on my alternate assessments. Students like seeing scientists who 'look like' them."

Overall, Elise experienced feelings of overwhelm, disappointment, and frustration when she tried to implement her original GPS goals in an environment full of obstacles such as a lack of time, poor student behavior and attendance, and increased class sizes. Ultimately, she worked with her mentor to change her personal goal to one of self-care, and she experienced feelings of empowerment, excitement, and worthiness. She also narrowed her district goal to focus on incorporating reality pedagogy into the classroom where her experience combating student apathy was rewarded with increased engagement, academic achievement, and an interest in physics and planetary sciences.

GPS Implementation: Moments of Ease. When I originally asked Elise if she could think of what worked well or was a moment of ease in her GPS work, she replied: *"Nothing. I hated the whole process."* To her credit, there was nothing in any of the other data sources that reflected her experiencing moments of ease. However, I did locate one point in our interview, where she talked about how making self-care a priority in her life became easier for her:

Basically, it's really easy. Like you asked me [at the poster symposium], and I couldn't say it because [my boss] was within earshot. This is all confidential, right? You want to take care of yourself? Don't give a fuck. Quit giving a fuck. It's that simple. I don't care. I told my principal in January. I said, "I really don't care." And he was like, "Well, no, you care about it." I'm like, "No, I really don't." I no longer care about the district's demands or the district's expectations... I was like, the only care I have is I care about the kids that they make it through alive. I care that they graduate and learn something, and I care that I survived the school year, and that's all I care about. And

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guess what? That's all I'm going to care about next year. There is no reason to be an

exemplary teacher whatsoever. Next year. My goal is to be a mediocre teacher.

I then challenged Elise, asking her if it was possible that by being what she called a 'mediocre

teacher,' she was actually a happier, healthier, and better teacher? She replied:

I'll be a better teacher in some regards. I'll be healthier. I'll be happier because I don't

care. I'm totally burned out, and the only reason I will be showing up is for student loan

forgiveness…And my mediocre teaching is probably still above some other teachers. But

would I be proud? No, I won't be proud of the job I'm doing…because I always want to

give my kids the best. I always want to give them the most engaging [class]. I always

want to give them the best chance. I want to get them excited about something every

single day…so just trying to survive… That's not how I like to operate. I want to be

proud of what I do for a living. I want to look forward to going to work instead of

driving by going, "Shit it didn't burn to the ground last night." I don't want that. I don't

want that. And that's not a healthy environment for anybody.

To briefly summarize, Elise's work with reality pedagogy was rewarding, but she never

considered it easy. In terms of her personal goal to increase her practice of self-care, she only

found that her experience was easy once she stopped caring about disappointing or letting down

others and living up to the previously high recommendations she set for herself. However, even

this was a dichotomous experience. She needed to stop caring about others in order for it to be

easy for her to practice self-care, but she grappled with deeper feelings of knowing that what she

really desired was for her to be able to work in an environment where she could be proud of both

her self-care and about her career instead of having to choose herself over her career. She

suggested, *"That actually would be really good PD because that's what everybody's big*

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question for me [at the poster symposium] was - how do you stop working?" noting that her

colleagues also experienced conflicted feelings navigating work-life balance.

GPS Implementation: Moments of Challenge. Elise experienced numerous

difficulties and challenges while working on her GPS project. Many of these were discussed

previously as they were directly related to her changing her personal GPS goal. The first thing

Elise mentioned when I asked about her moments of challenge was, *"There were issues with the*

kids just even wanting to be involved or do anything." This echoes what was previously

discussed; Elise experienced her students being disengaged, poorly behaved, and, as a whole,

performing on a lower academic level than the students who were in her classes in prior years.

However, Elise also felt that because she made her students feel comfortable, and because the

students knew they could not pass every class, they selected her class to fail. She described this

experience:

> *But it's also, the kids have changed. I had seven kids tell me that they failed my class just*
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> *to have me next year. And then I get in trouble for kids failing, but they're failing*
>
> *because they hate so many of their other teachers. And they've decided that they only*
>
> *have so much bandwidth to do schoolwork. So, they choose their favorite teachers, fail*
>
> *those classes to take those classes again and do the work…And they really did learn the*
>
> *material, but a lot of them failed on purpose to take me again next year.*

Elise also believed some of the lack of engagement from students she has experienced is because

some parents do not hold their children accountable:

> *I mean, I literally had a parent whose kid had a 2% be like, "You need to fix it." And*
>
> *they emailed me after school got out, and I'm never going to reply, but because that goes*
>
> *in the DGAF [don't give a fuck] pile. And they were like, "You didn't contact me all*

year." And I was like "I sent you 47 freaking emails." You have very entitled parents

and kids, and nobody wants to do any work. We're supposed to do all the work. And it's

too much.

As mentioned in her monthly reflections, Elise also struggled with having enough time to

conduct her GPS project. Elise expressed she did not feel the Wilcox SEF administration

understood how many responsibilities teachers have when designing the program:

> *I have 180 [students]. This is what they don't understand. They're used to college. I*
>
> *don't have TAs doing stuff for me. I don't have free volunteers doing stuff for me. I have*
>
> *180 students. I have responsibilities to my students and to my site…I have*
>
> *responsibilities to my family. I have all this other stuff that I don't have time [to do my*
>
> *GPS], like legitimately. There's not enough hours to do a presentation, or whatever…I*
>
> *was not willing to do that because my focus is the kids.*

Elise later added that she felt the Wilcox program did not accurately advertise how much work it

was, so she could not have foreseen this being such a large challenge for her:

> *Be honest with what the program is. The number of hours they said the program was*
>
> *[when it was advertised], I spent that much in the first year. Yeah. So, they need to*
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> *change the hours drastically and really be honest. They need to realize that Wilcox is*
>
> *like the 18th thing on our list. They need to look at changing dates to not coincide with*
>
> *our busiest times of the school year, which is what they've done because they're running*
>
> *the same as our semesters where we're teaching. It becomes a problem for us. It*
>
> *becomes difficult for us.*

In addition to her experience being *"overwhelmed"* by the requirements of completing her

program, at the time of our final interview, Elise admitted, *"I haven't done anything for the*

portfolio…I haven't downloaded student work. I haven't uploaded any student work. I haven't

started writing the ridiculous novel that they want us to turn in."

As described above, Elise felt she experienced challenges with student engagement for

two reasons: (a) because their parents did not hold them accountable; and (b) they were content

to fail her course and retake the course as long as she was the teacher. The other main challenge

she faced was the amount of required work built into the GPS project, and the lack of time she

had to complete it given her many other responsibilities.

Reliance on Support Systems. Elise relied on three of her Cohort 3 fellows that she

talked with regularly for support: Kassy, Shari, and Callie. She said:

I would also talk about [my issues] with a couple of the fellows that were my

friends…everybody was basically having the same issues. I remember I was in one

meeting where, literally, I was breaking down, and I was sobbing [because of the

challenges I was having]. And Callie, bless her heart, she went through about ten

different things [I could try to fix my issue], and I had tried all of them. And she was,

like, "Okay." So that issue just never got resolved, really.

Elise also relied on her mentor, Keith, and her colleague Kassy:

As far as changing my GPS, I talked about it with Kassy. We were talking about it every

day at school. And then I talked about it with Keith, and he was like, yeah, you can

change it, and gave me, like, a little bit of ideas of words of how to change it or whatever.

And so, I changed it…And he was like, "Actually, this is a better choice than your

original one anyway."

According to her monthly reflections, Elise also relied on Keith for strategies to implement her

district GPS work, such as the BIPOC scientist of the month bulletin board. Elise's portfolio

echoed that Elise formed close relationships with colleagues both in her district and neighboring districts; she wrote, "I also cherish the new friendships I have made as well as the connections to other districts in the area."

Elise acknowledged relying on Dr. James, who presented at one of the Wilcox monthly meetings, for her guidance on reality pedagogy. However, Elise never acknowledged working with her district supervisor or her GPS affinity group. It is highly likely that she did work with them, as their support is built into the design of the GPS structure, but she did not acknowledge this in any of the data sources. Ultimately, Elise relied heavily on the friends she made in her cohort for support as well as her assigned Wilcox mentor, Keith, and Dr. James, who introduced her to reality pedagogy.

Sharing Knowledge: Poster Creation Experience. Elise's experience creating a poster was one of embarrassment and confusion regarding the inclusion of poster symposiums in academia. She said:

> *I come from a very different world. The poster was hysterical. I was crying. I was laughing so hard. I'm like, I'm in fucking 10th grade again because I would have been thrown out of any program if I had done a stupid poster. So, this was a very different experience for me because the world I come from doesn't do posters.*

When I discussed with her the fact that posters were a common thing in academia, she replied: *"This is why education is such a train wreck, because they're 30 years behind everybody else."*

Elise did not offer any insight into how she created her poster, but she did follow the provided template. The focus of her poster was on her personal goal of increasing self-care. She included images of her living room before and after she redecorated it as well as visuals to represent her physical fitness. She had a bar graph to show both her weight loss and calories

burned, and she had line graphs showing the decrease in her body measurements as well as the number of steps she took each day. She also included a screen shot from her gym membership software that showed her checking into the gym daily. For her district goal, Elise included pictures of her BIPOC scientist of the month bulletin board as well as two images of instructions for alternative assessments she provided to her astronomy students.

In short, Elise's poster focused primarily on how she achieved her personal goal, and the importance of self-care in her physical and mental health. Her poster also conveyed the importance of representation from reality pedagogy and described examples such as playing "their" music and having a bulletin board of BIPOC scientists.

Sharing Knowledge: Presentation Experience. Elise has had many experiences facilitating training sessions for the district, and she had *"no problem with public speaking or talking to other people."* She enjoyed presenting her work at the poster symposium and noted how many people were impressed with her personal goal, saying: *"that's the part of my GPS everybody has been interested in."* The experience of sharing her findings did not change her likelihood of doing presentations in the future, as she already has plans to continue offering district trainings. Elise has always experienced confidence when public speaking, and the poster symposium did not impact her willingness to engage in future presentations, as she already has plans to do so.

Launch: The GPS Propulsion. Engaging in her GPS work had a significant impact on Elise's life. She made incredible changes to her health, and she credited her GPS project saying it was *"the only thing that held me accountable for my lifestyle goals that I made, period."* She continued to describe the immense impact this has had on her:

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But prioritizing myself, that did keep me healthier because honestly, I had chest pains for

three months straight. So, if I hadn't made some significant changes in my life, I don't

know where I would be. But I wouldn't be a teacher. We wouldn't be having this

conversation. That I can assure you, because it was really negatively, seriously

negatively, affecting [my health].

At this point in my researcher journal, I wrote "powerful." Elise continued:

[Having done my GPS] does make me happier. And I guess it sort of pushes me, helps

me push through the next couple of years. So, I guess in that way it impacts my job. It

also is pushing me to get out of my job. I'm worth more. Yeah.

This is the second time Elise mentioned that her GPS work made her feel her worth; as

previously mentioned, she also said her GPS project made her realize, *"I am worth something."*

While Elise said that realizing her worth is pushing her out of her teaching career, it is

also possible that this decision is related to financial concerns. Elise indicated she plans to leave

her teaching career after fulfilling the requirements for the nation's Public Student Loan

Forgiveness program. Elise stated, "*They forgive all of your loans. I have $185,000 in student*

loans that'll get forgiven." She explained:

You have to do ten years of payments. 120 payments…You have to work for a nonprofit

or government. And public school is obviously [classified as] government. And I'll be

totally honest with you, for my [science] department, if they were to just forgive student

loans tomorrow, they would lose three quarters of my department. They would be gone

the day after…As soon as my student loans are forgiven, peace out. I'm gone.

Elise also expressed remorse that this is the case, saying, *"And I would miss teaching and I would miss the kids and I would miss the actual job of teaching, but I would not miss anything else."* She continued to explain her conflicted feelings:

I feel like I'm in a relationship [where] I'm staying because he's paying part of the rent, and I don't stay in those relationships. And I'm already working on my exit plan. I'm already dreaming about how I'm going to go. And that's really sad because I'm a good teacher. I am a damn good teacher. I have stopped nine kids from committing suicide. I saved nine lives. I have sparked interest in I don't know how many kids that are now finishing college degrees, going into careers related to Earth or space. I have so many of my former students that still contact me all the time that I go see. I have lunch with…I have fun with my kids…I have several kids who call me their trusted adults. I am a good teacher. I relate to the kids. I support the kids, and [the] kids like taking my class. They like being in my room. They feel safe. My students feel safe. They know that I accept them the way that they are. They know that I forgive them when they make a mistake.

I asked Elise if she would be interested in staying in teaching if the imbalance between the amount of work expected and the pay received was resolved. She said:

You can put up with a lot of bullshit for money. If the bullshit level and the income level don't meet...the financial level needs to come way up to where I can put up with all this…they need to meet somewhere into some sort of equilibrium, reasonable equilibrium, because the expectations are above, beyond, and ridiculous. For the last several years, [I am] working 60 to 70 hours a week and [I am] working most of the summer, but you are paid for 38 hours a week for ten months.

Elise also criticized the lack of incentives and respect for teachers. She said, *"a teacher*

who is performing as a mediocre teacher is paid the exact same as somebody who is an

exemplary teacher. And that needs to change. That needs to stop." She questioned the

motivation for teachers to excel when there is no reward for their hard work, saying, *"Where is*

the incentive for me to be a [better]? She also countered the notion that more teachers would

stay in the feel if they felt respected:

> *I know that there are people that say, oh, if we got respect, it would be okay. No, it*
>
> *wouldn't. Gas is expensive. I can barely pay my bills. That's a whole other stress. Most*
>
> *of us work side gigs…I'm not working this summer. I'm refusing to. I'm just going to*
>
> *use some savings. But no, we need to be paid more. We need to have decent health*
>
> *insurance. Our health insurance is junk. We are the most disrespected of anybody in*
>
> *[our state] retirement system.*

This section is intended to discuss the ways that engaging in GPS work has impacted

Elise's career, leadership roles, or perhaps shaped her life in some way. I originally omitted

Elise's concerns about teacher compensation and work-life balance, identifying it as outside the

scope of this study, but in my researcher journal, I wrote: "her mind seems made up, and her

concerns are valid. I don't think any GPS would have been able to change the course of that

ship." This is a significant reflection and, to compare it to Maslow's hierarchy of needs, unless

Elise entered her GPS work feeling financially secure and respected, she will struggle to engage

in the GPS work in the way it was intended. What I find remarkable is that, despite Elise's GPS

work being conducted in an atypical way, it is clear that her personal goal ultimately helped Elise

find more happiness and contentment in a teaching career where she is surrounded by many

negative things outside of her control.

In terms of her district goal, Elise shared that, *"I already did some of that stuff to begin with. I already brought in a certain amount of culture just because I respect diversity."* However, she acknowledged one speaker from a Wilcox SEF monthly meeting, Dr. James, for introducing her to a book and a person that changed her teaching. She said, *"One speaker introduced me to one book, to one person, and that's what all that is based off of."* When I asked her if she thought Wilcox had influenced her teaching, she replied:

> *So had I met her, which we have several friends in common, so chances are pretty good*
>
> *that I would have, I would still have gotten to where I am without Wilcox. I just needed*
>
> *the name, and, so, no. I'm going to go with no.*

Elise did credit her GPS work with reality pedagogy for shaping her teaching, but she held onto the fact she may have also engaged in this work later in her career had she never entered into the Wilcox SEF program.

In summary, engaging in GPS work had a multifaceted impact on Elise's career. In her classroom, the addition of reality pedagogy into her curriculum shaped her connections with students which made her interactions with her students more enjoyable, and, as discussed in the next section, may increase student outcomes. With respect to her personal goal, Elise dedication to self-care created a most profound impact on her life. She became happier, healthier, and embarked on a path to overcoming a severe depression. With her new routine and confidence in self-care, she was prepared to make the most of wherever her next steps take her.

Benefits of Engaging in GPS Work. As mentioned previously in the prior cases and Chapter 2, student outcome benefits and career cycle benefits have been used as a method for identifying effective professional learning. As described earlier, Elise experienced profound benefits through her GPS work as she embarked on a journey where she overcame depression

realized her worth, and *"started feeling like me again."* Since her GPS work, Elise decided to apply for a district job. She said:

> *They wanted to know everything you had done at your school and at your district. [My application] was seven pages. And I said, "Oh, no wonder I'm so tired." And then I looked at all the stuff that I do, and I looked at the relatively short amount of time that I've been a teacher, but the responsibility I've been given, the number of teachers I support, the number of people who come to me. And I was like, "Wow, I am actually pretty respected in my field, and I actually do have quite the career here built up." And that's what started making me think I am better than what society tells me, what my admin tells me, what the kids will sometimes say. I am better than that.*

With respect to student outcomes, Elise presented a clear relationship between her happier disposition and her students' engagement and behavior. As she emphasized on her poster, "students say class is much more fun, and they enjoy it more." In my researcher journal, I acknowledge the quote by A. L. Mercier, "what is learned in pleasure, we never forget" and wrote, "They say happy wife, happy life…maybe it's happy teacher, happy students!" Her district goal also directly benefited her students. As previously mentioned, incorporating reality pedagogy into her classroom created increased engagement, academic achievement, and an interest in physics and planetary sciences.

In terms of reflecting on career cycle benefits, Elise did apply for a district job, as described above, but for now has decided to remain in the classroom. Her GPS work reenergized her enough that she still intends to teach for the next few years. Next year, Elise is not seeking any additional formal or informal leadership roles, and instead, she is looking to take things off her plate so that she can maintain the work-life balance she created through her GPS work. In

short, Elise's primary GPS benefits were regaining a strong sense of self and embarking on a journey to become the happiest and healthiest she has ever been, and her students benefited from her journey as well as her incorporation of reality pedagogy into their curriculum.

Barriers Preventing Prior GPS Investigation (Research Question 1b). While Elise had been frustrated with her career and lack of work-life balance for a while, she had never intentionally set out to address this issue. Elise did not explicitly offer a reason for this in our interviews, but other data suggested she experienced insufficient time to embark on her goals prior to doing so in the Wilcox SEF program. In every one of Elise's monthly reflections, she addressed not having enough time or mental energy as a challenge to completing her current GPS work. So, there is a high probability that she did not have the dedicated time or mental energy to engage in her GPS work before the Wilcox SEF program. Also, as she said, *"I'm always supporting other people,"* so if she did have available time, it would not be uncommon for her to spend it helping someone else instead of focusing on her own self-care.

Elise also felt as though her administration was not supportive to her GPS work. Referring to her school administration she said, *"They're not supportive in any way, shape, or form, nor was my district. [My district supervisor] didn't even say 'Hi' to me [at the poster symposium."* She elaborated, saying that her administrators would:

> roll [their] eyes if you even brought [your GPS] up…I sent [my district supervisor] emails a couple of times…he didn't [reply] because it was something he didn't want to deal with. And we got no support from anybody in the district. There was no support. I did this all on my own.

Another reason Elise may have never looked into her GPS work is that she was unaware of her goals, and, as previously described, you simply cannot inquire into something you are

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unaware of. Before Elise met Dr. James in a Wilcox monthly meeting, she was unaware of reality pedagogy. Ultimately, the barriers that prevented Elise from engaging in a formal self-care plan or implementing reality pedagogy into her curriculum prior to the Wilcox SEF program were a combination of a lack of time, mental energy, and awareness.

Conceptualizing GPS Work Through a Practitioner Inquiry Lens (Research Question 1c)

As described in the prior cases, research question 1c, "Did the fellows' processes designing and implementing their GPS work contribute to an understanding of their work as practitioner inquiry, and, if so, how?" was answered by analyzing the fellows' prior knowledge of practitioner inquiry, potential identification of their GPS work as practitioner inquiry, attitudes displayed towards practitioner inquiry, and any future intention to engage in practitioner inquiry work.

Prior Knowledge of Practitioner Inquiry. Elise's initial familiarity with the terms action research and practitioner inquiry was nonexistent, as she said, *"No"* when asked if she was aware of those terms. After being provided definitions for both action research and practitioner inquiry as described in Chapter 2, she confirmed that she was unaware of those definitions until this point.

Identification of GPS as Practitioner Inquiry. Elise acknowledged she felt her GPS work could be considered action research or practitioner inquiry, stating, *"to a small extent, yes."* She did not go into more detail as to why she felt this way at this point in the interview, but she did explain it more when she was describing how practitioner inquiry *"was already part of my practice."* When Elise was asked if she had ever engaged in formal or informal practitioner inquiry in the past, she said: *"Oh, definitely. I mean, to me, that's good practice. You should*

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always be doing that to an extent, if not completely." She described her past experiences with practitioner inquiry as both informal and formal:

> *It was a mix because we're required to use data, so we're required to sit down and look*
>
> *at that data. And if you want to know how well something works, [a] great way to do it is*
>
> *to look at the data. And especially my first two or three years teaching, I would survey*
>
> *my kids fairly often. How did you like this assignment? What did you love? What did*
>
> *you hate? Blah, blah, blah. And that's kind of similar to the GPS thing. So it was*
>
> *already part of my practice.*

Overall, Elise identified her GPS as practitioner inquiry due to its reflective, exploratory nature. She felt the process of collecting data, whether through student surveys or other methods, and then looking inward to reflect on what worked well and what was enjoyable for the students was similar to her GPS work.

Attitude towards Practitioner Inquiry. Elise has a positive attitude towards practitioner inquiry. As mentioned prior she said, *"that's good practice. You should always be doing that."* She added, "*I see the value in it. I agree. There's huge value in it. There would be huge value for teachers if they knew how to do it and to do it with fidelity, but they're not probably going to."* The fact that Elise believed teachers are not able to engage in practitioner inquiry with fidelity is why she felt it was an inadequate opportunity to engage in professional learning. She elaborated:

> *Because the last thing teachers need is anything else on their plate. And many of these*
>
> *teachers don't know how to do [practitioner inquiry] to begin with. And [they're]*
>
> *already having specific requirements of data dives and data crunch being shoved down*

their throat by their sites and by their district. And so just adding more data work on top

of what [they're] already doing is a nightmare.

She elaborated on her experience with many teachers that have not learned how process data, let alone engage in a formal inquiry with it:

And many teachers I find…don't even know how to look at data. They don't

understand... [Teachers] need to not be looking at so much data and start looking at

[their] damn students. They're not a freaking number, right?

Elise then explained why the barriers previously discussed, such as a lack of time and mental energy as well as increased demands made by her district, caused her to limit her engagement in practitioner inquiry:

I've actually backed off from it because things have been crazy because the district is

asking more and more. So, I don't have time for it. But if I do [engage in practitioner

inquiry], it is because it's integrated as part of my work that I've done. It's been part of

my work life for decades.

However, for teachers without past experience or education in practitioner inquiry, she did not believe it was beneficial:

But for somebody that it hasn't [engaged in practitioner inquiry before]. Absolutely not.

They're going to have to waste their time going to PD to learn how to do it. Then they're

going to waste a ton of time looking at yet more data that they don't understand and

don't know how to apply. No, leave them alone. Leave the damn teachers alone.

In summary, Elise believed that there is great value in practitioner inquiry, but only *"if*

we [have] the time, but we don't and we are barely surviving." She felt it was especially

ineffective for teachers with no prior experience or training in practitioner inquiry to spend time

learning how to conduct a practitioner inquiry study with all their other district responsibilities.

Future Engagement with Practitioner Inquiry. Elise admitted in the section above that she is limiting the amount of future practitioner inquiry she engages in as a result of her focus on maintaining better work-life balance and practicing self-care. However, she expressed her intent *"to continue surveying my kids. I'm going to continue using my reality pedagogy…I'm actually going to continue without Wilcox."* Elise also planned to collaborate with other teachers at her school for cross-curricular projects involving reality pedagogy. She explained:

> *There are two other teachers actually at my school…I have already talked [with one teacher], and she wants to try using some reality pedagogy and stuff. And we want to do some cross-curricular next year that we've already discussed…we're debating if we want to even put in for [a Wilcox Phase 2 project] and we're leaning toward no because of the deadlines and the pressure of having to perform roles … we're probably going to do it anyway without the pay and without being connected with Wilcox.*

Elise also clarified that her intent to engage in practitioner inquiry was not a result of her GPS work; she declared *"It made no difference"* and explained that her prior experience and understanding of the value of practitioner inquiry is what contributed to any future engagement. In my researcher journal, however, I noted that the practitioner inquiry she planned on engaging in next year was a continuation of her district GPS goal, so it is unlikely that her GPS work truly did not impact her future practitioner inquiry engagement.

To briefly summarize, Elise intends to engage in practitioner inquiry next year, as she typically does, and also continue working on her district GPS goal through doing practitioner inquiry with a colleague. Elise claims, however, that her GPS work did not make her more likely to engage in practitioner inquiry in the future.

Chapter Summary

In this chapter, I presented the findings from five comprehensive case studies, each commenced with an overview of the participant's educational background, teaching journey, leadership experience, professional learning history, and beliefs regarding effective professional learning. The chapter progressed to explore the main research question, delving into the participants' awareness and preconceptions of the Wilcox SEF program and their GPS work, as well as sub-question 1a, the process of GPS goal selection and its implementation. It further illuminated moments of ease and challenge, reliance on support systems, and benefits derived from engaging in GPS work. Subsequently, findings related to the sub-question 1b were presented, addressing the barriers that prevented the fellows from trying to achieve their GPS goals prior to the Wilcox SEF program. The chapter culminated with the findings for sub-question 1c, focusing on the participants' understanding of practitioner inquiry, their recognition of their GPS work as such, their attitudes towards practitioner inquiry, and their plans for future practitioner inquiry engagement.

Chapter 5: Cross-Case Analysis

In this cross-case analysis, I answer the research questions by uncovering commonalities, individualities, and themes present among the individual cases. Mimicking the format of the individual case analysis, I assessed research question 1 and research question 1a first, through a cross-case analysis of educational backgrounds, teaching journeys, professional learning histories, and effective learning beliefs that the participants brought with them as they entered the Wilcox SEF program. I will explore their longitudinal GPS experience, following their journey from their initial awareness of the Wilcox SEF program, through the application process, and ultimately to their acceptance. I next examine their GPS experiences, starting just before the start of Year 2. This includes exploring their preconceived notions regarding GPS work, their process for selecting GPS goals, implementation of GPS project, and presentation of their GPS results. Subsequently, I evaluate any potential ways in which their GPS work has catalyzed shifts in their career trajectory or personal growth.

Upon concluding the longitudinal exploration, I answer research question 1b by identifying recurring themes that emerged from the barriers depicted in the individual case studies. For research question 1c, I employed a temporal analysis process to spot themes through a cross-case analysis of the participants' previous knowledge of and experiences with practitioner inquiry, their potential recognition of their GPS work as practitioner inquiry, attitudes towards practitioner inquiry, and future intentions to engage in the process. Throughout this analytical journey, I formulated nine assertions, which I briefly outline in Chapter 5 and elaborate upon in Chapter 6.

Participant Background

  A cross-case analysis of the respective backgrounds of the five participants is below.

Educational Background

  The five participants provided a range of educational backgrounds that ultimately led to a career in secondary science education. While each participant had individual experiences, there are some similarities and differences worth noting. In every case, the participants did not initially desire a career in education. Out of the five, Chanley was earliest to make the transition to education; she did so early in her college career, making her the only participant to earn an undergraduate degree in education. Four out of the five cases had a background in science and were considering careers in medicine or research before deciding to pursue teaching. Georgette had plans for a career in pediatric oncology, Izabella planned to go to medical school, Shari desired to be a research biologist, and Chanley was initially interested in a career in pharmacy. Elise was the only participant who had an undergraduate career outside the field of science, graduating with a degree in political science and going on to get a degree in law.

  All the participants except for Georgette had a graduate level degree. Izabella earned a Master of Arts in Teaching degree and became certified to teach through that program. Chanley earned a Master of Education degree, but she already had earned her teaching certification through her Bachelor of Arts in Science Education degree. Shari earned her Master of Arts in Teaching in Science Education after she began her teaching career; she became certified through her district's Alternative Certification Program (ACP). While Elise held a law degree, she, along with Georgette and Shari, pursued teacher certification through the ACP program. Three of the five participants became certified through their districts' ACP program which correlates with an

identified trend of increasingly recruiting science teachers through alternative certification programs (Abell, 2006).

All five participants also had a personal connection or experience that influenced their decision to become a teacher, whether it was caring for a family member (Shari and Elise), a connection with their parents (Chanley), self-awareness of making motherhood a priority (Georgette), or experiencing racial segregation and a lack of representation (Izabella). It is interesting the influences for teaching were personal in nature and not tied to a desire for status or wealth.

Out of the four participants that transitioned to teaching, they did not necessarily foresee education as a long-term career plan when they took their first job. Izabella intended to take a teaching job *"while I tried to figure out what I was going to do with my life."* Elise took a substitute position because *"it was really flexible, brought in a little bit of money and allowed me to figure out what I wanted to do."* Shari said, *"I'll just put [being a research biologist] on the backburner, and I'll start teaching."* For Georgette, when she first joined her school, *"it was another small, just part-time job, along with still applying everywhere."* This is important because it unveils that when the participants first entered their classrooms, they may have been open to teaching as a career, but they were not solely focused on that as a career path. All participants are established teachers now, and the participants shared it was the physical experience of teaching students that caused them to pursue a career in education. Elise said, she *"really took to it like a duck to water."* Georgette echoed with *"I realized I really like doing this,"* and Izabella admitted she *"just kind of fell in love with it."*

In summary, the five participants in this study held diverse educational backgrounds before transitioning to secondary science education, with three originally pursuing careers in

medicine, one in law, and one in education. Although they did not initially plan for careers in education, personal connections and experiences influenced their decision to become teachers. As they began teaching, their focus shifted from viewing it as a temporary job to embracing it as a long-term career, with the physical experience of teaching students playing a significant role in this development.

Teaching Journey

Georgette, Shari, and Elise all began their teaching careers in substitute teaching positions and, as mentioned above, earned their certifications through ACP. Izabella and Chanley entered the teaching profession directly and had a traditional teaching certification path through their respective degree programs. The start of Georgette's, Shari's, and Elise's teaching paths through substitute teaching further supports the notion that it was the act of teaching and coaching itself that encouraged them to pursue a career in education. Shari and Chanley both acknowledged the importance of mentorship in their early teaching careers, and Chanley also credited student connection directly for providing her with resiliency in tough times. With respect to the number of school environments they have worked in, Elise and Georgette's entire teaching careers have taken place at the same school. While Chanley has taught at two schools, she has been at her current school for over 15 years. Izabella and Shari have both spent the least amount of time at their current school, and they have both taught at three or more schools.

All the participants teach secondary science; combined they have experience teaching in almost all the secondary science subjects: biology, chemistry, physical science and earth-space science, and research. Secondary science courses are typically tracked according to three rigor levels. First, are the 'regular' level classes which can also be referred to as college prep or general education courses. The next level of rigor are 'honors' and 'gifted' level courses, and the

most challenging level of courses are 'Advanced Placement' (AP) and 'International Baccalaureate' (IB). Elise had experience teaching regular and honors level while the other four participants have experience teaching AP or IB courses.

As described above, the participants in this study began their teaching journeys through different paths, with three starting as substitute teachers and earning certifications through ACP, while two pursued traditional certification routes through degree programs. They all taught secondary science across various subjects and levels of rigor. Mentorship, student connection, and hands-on teaching experience played essential roles in their career development.

Leadership History

All participants held formal or informal leadership roles prior to beginning the Wilcox SEF program. As mentioned previously, four teachers had experience teaching AP or IB level; being offered that teaching assignment, at the highest rigor level, can be considered an informal leadership role. Formally, Chanley and Elise were both appointed to content expert roles, Chanley as chemistry lead and Elise as earth-space science lead. Shari and Chanley, also served as department chair for their science department. Izabella and Elise have helped to develop curriculum acting as curriculum writers for their district, and Izabella, Elise, and Chanley have all facilitated professional learning opportunities for their districts. A common formal leadership role among all five cases was the role of PLC facilitator; however, the meeting frequency and organization of PLC meetings varied across the cases, this is the one formal leadership role that all members of the study held.

Also, all the fellows have worked with technology in their classrooms. While Izabella had direct teaching experience with a virtual school, all other fellows pursued leadership opportunities with technology. Chanley was a designated ambassador for a technology software

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company while Elise and Georgette constructed courses on two different technology software platforms. Chanley, Elise, and Shari also demonstrated technology software when they facilitated workshops helping to spread awareness and confidence with educational technologies. Many other leadership positions were also observed, such as facilitating new student orientation or acting as a science coach and mentor. The motivations for the participants taking on these leadership roles varied. Sometimes the leadership roles may have been pursued as a result of (a) the stipend associated with it; (b) in exchange for another responsibility, such as having to attend a professional learning seminar; or (c) to enhance their resume. Other times, it was a result of sharing an area of passion or expertise with others.

In summary, all participants held formal or informal leadership roles before joining the Wilcox SEF program, including serving as department chairs, content experts, curriculum writers, and PLC facilitators. They also pursued various technology-related leadership opportunities, such as acting as ambassadors for software companies, creating courses on learning management software, and facilitating technology-focused professional learning opportunities. The motivations for assuming these roles varied from financial incentives to sharing expertise and passion, but the diverse leadership experiences of the participants showcased their commitment to education, professional growth, and sharing their knowledge and expertise with others in the field.

Professional Learning History

All the participants experienced district mandated professional learning experiences as well as sought out and engaged in self-directed professional learning experiences. A theme emerged that the participants all preferred the professional learning they sought out for themselves to the district mandated experiences. This suggests that autonomy in professional

learning creates a positive and pleasant experience for participants. Because all the participants were members of Cohort 3 of the Wilcox Science Education Fellowship program, the most recent professional learning experience for all the participants was Year 1 of the Wilcox SEF program which uses the Collaborative Coaching and Learning in Science (CCLS) model described in Chapter 2.

When analyzing their elective professional learning experiences, outside of the Wilcox SEF Year 1 experience, all the participants displayed different preferences for their professional learning content. Some desired to engage in formative assessment education while others sought out content specific education. Some sought out professional learning related to equity while others found education directly focused on strategies for emerging language learners. This illustrates that the needs and desires of education are individual to each teacher. Most of the participants had also facilitated professional learning experiences for their school or district.

In short, all participants experienced district mandated professional development programs, but they also sought out self-directed professional learning opportunities with Year 1 of the Wilcox Science Education Fellowship program being shared experience. Outside of this, the participants differed in their preferences for professional learning topics and how effective they considered those experiences to be. The varied preferences for professional learning content among the participants indicates that individualized approaches to professional learning may be necessary and valuable. Most participants also had experience facilitating professional learning experiences.

Effective Professional Learning Beliefs

In discussing professional learning histories, including what worked well and what was less effective, as well as their style and rationale for facilitating professional learning, it was

possible to discern the participants' beliefs regarding what characteristics were necessary for effective professional learning to occur. Several common themes emerged in analyzing the participants effective professional learning beliefs including: (a) engaging and interactive experiences; (b) practical application and relevance; (c) collaboration and networking; (d) autonomy and choice; (e) ongoing and sustained learning; (f) diverse learning approaches and modalities; and (g) expertise and outside perspectives. Each of these components were found within their GPS work which is later discussed as assertion three in this study.

All participants emphasized the importance of engaging in interactive learning experiences where hands-on activities and opportunities to actively participate in the learning process were more enjoyable and more effective than passive, lecture-based sessions. In one example, Izabella recalled a session where she built a protein using beads. Each of the participants also stressed the importance of professional learning experiences offering practical applications that are relevant to their specific teaching needs. For example, Shari emphasized the importance of subject-specific professional learning that provided strategies and resources that could be directly applied to their classrooms while Elise made sure to provide participants with practical resources for immediate classroom use in any workshop she facilitated. Georgette clearly articulated this saying, *"I need to be able to apply it to what I do."*

Izabella, Shari, and Chanley highlighted the value of collaboration and networking in professional learning experiences. They believed that connecting with peers, sharing best practices, and working together on projects was critical. Izabella emphasized the value of networking with colleagues from all over the county in her district workshops while Shari spoke on collaboration being a key factor in the effectiveness of her bilingual learner training. Meanwhile, all the participants, being a part of the same Wilcox SEF program, named working

alongside teachers from neighboring counties as being particularly beneficial. Izabella summed it up nicely saying it was *"neat to see how other districts were doing things and what PD other districts were offering."*

Georgette and Izabella both discussed the importance of autonomy and choice in professional learning experiences. They appreciated the opportunity to engage in professional learning that aligned with their personal interests and teaching needs. Georgette said she found it useful when she *"really got to focus on something that I wanted,"* while Izabella described the freedom to choose sessions as *"lots and lots of fun."* Shari and Chanley both emphasized the significance of ongoing and sustained professional learning experiences. They felt that longer-term programs had a more significant and lasting impacts on teaching practices than shorter sessions. They also believed employing multiple modalities and diverse learning approaches in professional learning enhanced its effectiveness. Chanley asserted that showcasing diverse learning approaches made teachers more confident in trying new things in the classroom.

All the participants valued contributions from outside companies and experts in their professional learning experiences. They discussed that the additional perspectives and resources external companies could provide enhanced the learning process and offered valuable insights into their teaching practices. In addition to the fact that all the participants were in the Wilcox SEF program, which is funded by a grant provided by an external partnership. Izabella, Elise, Chanley, and Georgette had also engaged in prior professional learning opportunities provided by external companies.

The participants believed their most effective professional learning experiences utilized engaging, interactive, and practical learning experiences, as well as offered collaboration, networking, and autonomy. Furthermore, they valued ongoing, sustained learning opportunities

that employed diverse learning approaches and modalities, and incorporated expertise from outside sources.

Participant Background Summary

Overall, the education, teaching journey, leadership and professional learning histories, all contributed to the implicit biases and experiences the participants had coming into the program. While they all come from different backgrounds and experiences, they are all very well educated and were similarly prepared to complete the Wilcox SEF program.

Research Question 1: The GPS Experience

The cross-case analysis used to answer the main research question is below.

Cross-Case Experience Aspects

The first research question in this study, "How do Wilcox SEF fellows understand their experience designing and implementing an autonomous professional learning plan?" is answered below through a cross-case analysis of the participants' experience during multiple aspects of their Wilcox SEF journey. I began the cross-case analysis by identifying the specific aspects of the GPS journey experience I wanted to analyze. I identified nine aspects for GPS analysis that temporally corresponded with the GPS program stages. These aspects are represented in Table 7 on the next page.

In addition to analyzing the aspects of the participants' experiences that correspond with stages in the Wilcox SEF program, I identified an additional five aspects I wanted to consider for cross-case analysis. Aspects 10-13 occurred on a continuum throughout the program stages or manifested at multiple points within the phases. Aspect 14, however, is a reflective consideration and was primarily analyzed to answer research question 1b, though at times it

Table 7

GPS Experience Aspects for Cross-Case Analysis

Aspect Number	Experiential Aspects for GPS Cross-Case Analysis
1	Wilcox SEF Program Awareness
2	Wilcox SEF Preconceived Notions
3	Wilcox SEF Application Process
4	GPS Preconceived Notions
5	GPS Goal Selection
6	GPS Description and Implementation
7	GPS Academic Poster Creation
8	GPS Poster Symposium Presentation
9	Personal Impact After GPS Culmination

occurred within the program stages as well. These five additional aspects for cross-case analysis

are found in Table 8 below.

Table 8

Additional Aspects for Cross-Case Analysis

Aspect Number	Additional Experiential Aspects for GPS Cross-Case Analysis
10	Moments of Ease
11	Moments of Challenge
12	Reliance on Support Systems
13	Benefits of Engaging in GPS Work
14	Barriers Preventing Prior GPS Investigation

A cross-case analysis over these 14 aspects answered research question 1, but it also

answered two of the three sub-questions. Research question 1a, "How did the fellows come to

identify and articulate their growth plan system (GPS) goals?" was answered through looking

primarily at aspect 5 in Table 7. Research question 1b, "What barriers, if any, prevented the

fellows from investigating their GPS goals prior?" was answered primarily through assessing

aspect 14 in Table 8.

Experience Phase Development

After I completed the cross-case analysis, I identified distinct experiences that all the participants encountered as they designed and implemented their GPS projects. These experiences all occurred at similar phases of the GPS journey, so I have described these common experiences and named the phase of the journey they are connected to in Table 9 below.

Table 9

GPS Experience Phase and Factors Affecting Mindset

	Experience Phase	Factors Affecting Mindset
A	Awareness	Intrigued or excited by fellowship product, stipend, and colleagues
B	Application	Lengthy and tedious application process
C	Wait	Application is submitted; hopeful of acceptance and opportunity
D	Acceptance	Excited and eager to embark on journey; very motivated
E	Realization	Realization a lot of work and time will be required
F	Development	Early stages of grappling with GPS project goals
G	Overwhelm	Struggle to visualize completed project; major goal changes; overwhelming workload; strong reliance on support systems
H	Homeostasis	Back-and-forth communication with support systems; reassurances from support systems; begin to see "light at the end of the tunnel"
I	Ramp	Reassurances from data; begin to visualize project
J	Launch	Full buy-in; GPS project "takes off;" participants see fruits of their labor; academic poster, portfolio, and poster symposium preparation occur
K	Conclusion	Project completion; move on to phase L, M, or somewhere in between
L	Impact Point 1	GPS culmination plateaus; feeling of completion
M	Impact Point 2	GPS culmination jumpstarts future endeavors; new jobs, ideas, inquiries; increased confidence and feelings of pride

I introduced Table 9 now, in advance of the detailed analysis results, as referencing the table and seeing an overview of the sequential order of the phases enhances the understanding and interpretation of the findings and facilitates a more comprehensive and meaningful engagement with the cross-case analysis. I began the development of the Table 9 by reflecting

on the structure of the Wilcox SEF Program. The GPS process in the Wilcox SEF program unfolds in several stages. The program had a recruitment stage, where the fellows became aware of the program, applied, and were ultimately accepted to the program. Experience phases A – D, as seen in Table 9, occurred in the recruitment stage.

Once the program began, it occurred over two years. The structure of Year 1 was previously described in Chapter 2, but the participants' Year 1 experiences are outside the scope of this study. The structure of Year 2 of the Wilcox SEF program is focused on the development and implementation their GPS which has previously been described in Chapters 2 and 4. The sustained duration of both the Wilcox SEF program and the year-long GPS project reflects a tenet of effective professional learning as discussed in Chapter 2; the fact that the GPS work is a form of effective professional learning is the third assertion of this study and will be discussed in more detail later.

The GPS development stage, which commences towards the end of Year 1. During this stage, Cohort 3 fellows observe presentations by their Cohort 2 counterparts. This is where the fellows first begin forming preconceived notions regarding the GPS process and contemplating what goals they may want to address in their GPS work. As Year 2 begins, the GPS development phase continues, with fellows engaging in a collaborative brainstorming process to articulate their GPS goals. Once these goals are articulated in a GPS Proposal, the GPS development stage draws to a close. Ultimately experiences phases E and F, in Table 9, occur in the GPS development stage.

At this point, the GPS Implementation stage begins. During this stage, fellows actively implement their GPS projects, putting their plans into action. Upon completion of the GPS Implementation stage, fellows create an academic poster and portfolio showcasing their GPS

work, and they prepare a presentation for, and ultimately present at, a poster symposium. Experience phases G – J, as seen in Table 9, occur during the GPS Implementation stage. Experience Phases K – M represent endpoints that occur after the GPS work is complete.

After identifying the temporal aspects of the program stages and experience phases, I reflected on the experiential elements of each participant as they progressed throughout the different program phases. Remarkably, the multiple case analysis showed that all participants experienced roughly the same mindset changes throughout their GPS journey. This consistent, conceptualized experience forms the primary assertion in the study, and it will be discussed in more detail in Chapter 6.

Program Awareness and Preconceived Notions

The awareness experience (referenced as Aspect 1 in Table 7) typically began when participants learned about the Wilcox SEF program, usually through an informative flyer they received via email. After seeing the flyer, the participants often sought out a conversation with a friend or colleague who was either affiliated with the program, perhaps serving as a district science coordinator, or who might have previously participated in the program. The participants experienced piqued curiosity and interest, but rarely were they interested enough to go ahead and apply. Instead, the participants reached out to others to get more information about the program.

A common theme emerging from the cases was that the participants ultimately applied for the program after receiving encouragement from others. Assertion 5 in this study, support is essential for success, will be discussed in detail later, but I mention it here as this is the first time informal support systems were seen being used in the study. Elise, Shari, Izabella, and Chanley all spoke to their district supervisor before applying for the program. One of the program's district science coordinators told Georgette, *"I think you'd be great for it!"* Izabella was told she

would be *"amazing at this!"* by her district supervisor. Chanley found out a colleague who was in a prior cohort *"liked the experience."* Oftentimes, these conversations happened to address preconceived notions the participants had about the program.

Three participants experienced concern regarding the program intensity and time commitment (referenced as Aspect 2 in Table 7). Georgette had been warned *"it is a lot of work"* and Chanley had colleagues tell her that *"they couldn't finish it."* Meanwhile, Izabella, experienced self-described *"imposter syndrome"* and was concerned she *"would get kicked out of the program because I just wouldn't be good enough. I wouldn't be able to keep up."* This is the first time we see the theme of stress caused by a lack of time emerge. Despite some trepidation, all the participants were enthusiastic about possibly joining the program. Elise couldn't wait to start *"working with elite teachers,"* and Shari was just as eager to begin *"perfect[ing] her science leadership."*

Chanley was the only participant who directly expressed a concern related to COVID-19 as a preconceived notion. Chanley applied to join Cohort 3, and COVID-19 first appeared near the end of Cohort 1. Chanley knew multiple colleagues that were members of Cohort 1 and 2 who shared their experiences meeting virtually instead of in-person as the program was originally designed.

Another theme that emerged was the appreciation for the stipend associated with the program. While Izabella did not say that the stipend was a motivating factor in her application, the other four participants acknowledged that, while it was not the primary factor in their decision to apply, it was a consideration. Georgette said, *"it didn't hurt"* her decision while Chanley called it *"an added bonus."* Shari said that she and her husband discussed she would no longer participate in professional learning opportunities *"unless I'm compensated."*

The participants' awareness and pre-conceived notion experiences can be referenced in Table 9 as Experience Phase A, the Awareness Phase. They have just become aware of the Wilcox SEF program, and the participants are experiencing excitement and intrigue. There is excitement over the potential of the program, the stipend, but also apprehension over the time involvement. The participants reach out for reassurance regarding their apprehensions, speaking to colleagues, district supervisors, trusted friends, or prior program participants, and receive positive feedback. They are increasingly excited for the program and decide to apply. Ultimately, all the participants had positive, optimistic feelings as they embarked on completing the application for the program.

Experience Applying to the Wilcox SEF Program

After gaining additional information about the program, participants experienced the application process (referenced as Aspect 3 in Table 7). I never directly asked the participants about their application experience; however, it organically came up in three interviews: Izabella, Chanley, and Elise. All of those participants shared a negative experience completing the application based on its intensity and length. Elise, in an exasperated tone with a look of annoyance on her face said, *"It took 5 hours."* Izabella's experience was most impacted by the length and rigor of the application as she actually could not finish the application in time for the deadline. Then, the application reopened, and she again had intentions to apply, but she missed that deadline too. Luckily, the application reopened for a third time, and she was able to complete it, and she submitted it "*literally the day before the application was due."* Chanley was colorful when describing her experience of disbelief at the intensity of the application. She described her experience thinking, *"Holy crap! I [have] to write all this?!"* and described the application by saying, it *"was a beast, by the way."* Here the theme of having insufficient time

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emerges again, this time in actuality instead of preemptive worry. Regardless of the effort required by the application, they expressed feeling a sense of relief and hope when the application was submitted; in our interview, Izabella said, *"I did it!"* and had held up crossing fingers representing hope.

There was also a sense of pride expressed by all the participants when they mentioned being accepted to the program or starting the program. As mentioned in the last chapter, Elise said, she was excited to "*learn a bunch of new stuff to apply in my class…[and] get feedback to really be able to improve my practice from really great teachers.*" Based on Izabella's experience, it is possible that the application process dissuaded others from applying to the program. Submitting the application provided an experience of relief and hopefulness of acceptance to all participants, and their acceptance brought excitement and eagerness to *"perfect science leadership"* and *"work with elite teachers."*

To briefly summarize, the application process for the Wilcox SEF program was perceived negatively by the participants due to its intensity and length, with some, like Izabella, missing multiple deadlines before eventually completing the application. All three participants who discussed their application experience shared feelings of exasperation or disbelief at the rigor of the process, such as Chanley's colorful description of the application as a *"beast."* The theme of insufficient time emerges again in this context, as participants struggled to balance the demands of the application with their other responsibilities. Despite these challenges, submitting the application brought relief and hope for acceptance, which was experienced during the wait time (referenced as Experience Phase C in the Table 9). Upon acceptance, the participants expressed pride and excitement for the opportunity to learn from and collaborate with exceptional teachers and hone their science leadership skills.

The entire application process can be visualized as participants going through Experience Phases B, C, and D in Table 9. During Experience Phase B, the Application Phase, the participants are experiencing stress due to the intensity and length of the application coupled with time constraints and trying to maintain work-life balance. During Experience Phase C, the Wait Phase, the participants are experiencing relief from submitting their application and the end of the tedious Application Phase. They are also experiencing hopefulness as they await their acceptance.

During Experience Phase D, the Acceptance Phase, the participants are experiencing a great sense of excitement and motivation. They are optimistic for the journey they are about to embark on, and looking forward to gaining science leadership skills, collaborating with elite colleagues, bettering their practice, and potentially attending a conference, and receiving the stipend.

Preconceived Notions of the Year 2 GPS Project

Temporally, this analysis now jumps from their acceptance to the Wilcox SEF program to immediately preceding Year 2. It skips over Year 1, but at times commentary references the CCLS work the participants completed in Year 1. An overview of the Year 1 process is detailed in Chapter 2. At the end of Year 1, Cohort 3 members were able to attend a few presentations on the GPS projects that members of Cohort 2 had just completed. After being in the Wilcox SEF program for a year, and having just witnessed some GPS projects, the participants shared any preconceived notions they had as they were about to embark on their GPS experience. Two main themes emerged. First, participants experienced anxiety regarding the amount of time the GPS project would require and, second, participants experienced apprehension with respect to being able to select a GPS goal.

As mentioned in the prior chapter, Elise spoke most passionately regarding her anxiety with insufficient time saying, *"I did not go into year two with a good attitude, honestly…I already knew…I was going to be overwhelmed."* The other four participants seemed to be in good spirits as they approached Year 2. Chanley articulated her apprehension with identifying a goal saying, *"when they said a personal goal…I'm like, well, what is my passion?"* but was nevertheless excited to create her own *"awesome"* GPS project. Georgette's apprehension regarding her GPS goal was a result of watching Cohort 2 GPS projects that were done by elementary teachers. Georgette said, *"The only GPS that I got to see were elementary school teachers…so I was like, 'What am I going to do?'"* Izabella also made a statement clearly articulating both of the themes: *"I'm really excited about what I'm going to learn, but I'm worried about, like, what I have to do at the end because I don't know if I can do that."*

In summary, the participants experienced anxiety over the amount of work involved in completing a GPS project and having insufficient time to complete their GPS work. They also experienced apprehension over how they were going to select their GPS goals, feeling pressured to come up with both a personal goal and district-aligned goal. Despite these anxious feelings, some of the participants were still relatively excited and happy about the prospects of moving forward with the program.

This collection of feelings was represented in Table 9 as Experience Phase E, the Realization Phase, where the participants are experiencing concern and realizing how much work will be required to complete their GPS project. They have just witnessed Cohort 2 present their GPS projects and they have just completed Year 1, so they know the high time commitment and amount of work that was required over the past year. The main concerns remain how the

participants will accomplish the GPS work given their time constraints and desire for work-life balance as well as how they will select their GPS goals.

Experience Selecting GPS Goals (Research Question 1a)

The main theme that emerged when analyzing all the participants' process selecting their GPS goals (referenced by Aspect 6 in Table 7) is that they experienced struggle, frustration, and confusion, ultimately relying on mentors to refine and articulate their GPS goals. This is another example Assertion 5, formal and informal support systems are essential, appeared in the data. Experiences of struggle were primarily due to initially selecting overly broad or ambitious goals. For example, Georgette realized her initial focus on helping new teachers was too broad, and Izabella had difficulty narrowing her focus to one specific area. Chanley also grappled with trying to achieve too much with her GPS project, before eventually honing in on two specific goals.

In all the cases, assigned Wilcox SEF mentors played a pivotal role in helping the participants refine their goals. As previously described in Ch. 4, Georgette relied on her Wilcox mentor, Miranda, for guidance in shifting her goal from assisting other teachers to working on her own interests, eventually leading her to a student-centered goal. She said, *"Picking the topic was the most daunting thing for me…it was thanks to Miranda (her assigned Wilcox mentor) I finally got here."* Miranda's feedback also aided Izabella in overcoming her *"biggest struggle [with] narrowing down a focus."* Shari found guidance from her mentor, Chris, who suggested she choose a goal she was genuinely interested in, while Chanley's and Elise's mentors also assisted in narrowing their focus to manageable goals.

All the participants experienced a degree of evolution in articulating their GPS project goals. Through triangulating multiple data sources (interviews, brainstorming documents with

mentor feedback, GPS proposal, and final GPS poster and portfolios), I was able to track the evolution of each participant's GPS personal and district goals. All the participants changed at least one if not both of their goals from how they were initially described in the brainstorming document; however, the path they took to ultimately articulating their goals was varied. For some, it was relatively quick; Shari was able to articulate her goals with minimal feedback in a short time frame. For others, such as Elise, the process lasted months; in the middle of experiencing overwhelm trying to force herself to address her former GPS goal, she worked with her mentor and developed a new goal that was attainable. While other participants were able to articulate their goals at an expedited pace, it remained one of the most arduous parts of their GPS experience.

The degree to which their goals changed varied, but the fact that all of the goals did change resulted in the seventh assertion in this study, which is that none of the participants were self-aware of their GPS goals prior to engaging in this iterative process. Georgette's goal evolved from helping other teachers to a focus of renewing student curiosity by increasing their questioning skills. Elise shifted her personal goal to self-care, focusing completely on herself and not referencing her teaching practice directly. Chanley's GPS goal evolved from developing a food science program to incorporating argumentation in her curriculum. Shari's GPS work migrated from establishing a greenhouse to spiraling the biology standards through acceleration and real-world applications. Izabella's goal evolved from using storylining as a lesson strategy to designing a workshop on addressing bias and equity in the secondary science classroom.

As mentioned in Chapter 2 and 4, the participants articulated both a personal and district goal, and it was assumed that one of those goals would become their 'focus' goal where they would spend most of their time working towards achieving that goal. A theme emerged where

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the majority of the focus goals were their personal goals rather than their district goal. Shari spent equal time on both her district and personal goals, but the Georgette, Chanley, and Elise all focused on their personal goals as seen in Table 10 below.

Table 10

GPS Personal, District, and Focus Goal by Participant

Name	Personal Goal	District Goal	Focus Goal
Georgette	Focus on renewing student curiosity by increasing student confidence in recognizing and asking scientific questions as well as defining problems.	Design Canvas courses that streamline secondary student or teacher interaction for increased STEM Fair participation.	Personal
Izabella	Learn about NGSS, and research how to incorporate NGSS with the IB standards for SL Biology	Design and facilitate professional development sessions for science teachers that cover both science content, as well as culturally responsive teaching as it relates to the science classroom.	District
Shari	Real-World Applications to Enhance Learning in the Biology Classroom	Acceleration through Teacher-Led Small Group Instruction	Both
Chanley	Be able to teach students and educators how argumentation helps to strengthen our ability to communicate.	Increase awareness of AP Capstone & STEAM at my school through argumentation lessons.	Personal
Elise	Increase my practice of self-care in order to be the best version of me for my students and myself.	Increase engagement and interest in physics, astrophysics, astronomy, and planetary sciences among students who are minority students (BIPOC).	Personal

Also, it is worth mentioning that Izabella's declared 'personal goal' addressed a district initiative, and her 'district goal' also fulfilled her personal passion regarding professional learning and equity. While Izabella technically focused on her district goal, it was also highly personal to her.

Overall, all participants experienced a dynamic and multifaceted journey, filled with frustration and overwhelm when designing their GPS goals and deciding which goal to focus on. The adjustments and revisions made to their goals, with the help of support systems, reflects the iterative nature of their goal selection process as well as brings to light the fact that none of the participants were fully self-aware of their desire to achieve the articulated goals at the start of Year 2 of the Wilcox SEF fellowship. This theme will be revisited when addressing research question 1b.

These goal selection experiences are referenced in Table 9 as Experience Phase F. During Experience Phase F, the Development Phase, the participants are experiencing confusion. They are in the early stages of grappling with selecting their GPS goals. They completed brainstorming documents and received feedback from their mentors. The duration of this phase is longer for some, shorter for others. This phase culminates with the submission of their GPS proposal documents and two articulated GPS goals (referenced in Table 10).

The cross-case analysis also uncovered the process the participants underwent to select their GPS goals to answer research question 1a. Their prior professional learning experiences did not adequately address their needs, specifically in the area of area of equity or questioning and argumentative discourse, which is assertion four in the study. Teachers, such as Izabella and Elise, identified that issues of bias and equity are still largely present in their schools and even their classrooms, and they were in need of distinct strategies to create a more equitable learning

environment. The need for support in the areas of questioning and argumentative discourse was seen in Georgette's, Shari's, and Chanley's goal selection process. Here, students being increasingly grade-focused combined with a fear of failure has caused a reduction in natural curiosity; the lack of this natural curiosity has made questioning skills and argumentative discourse skills suffer, and the participants were in need of strategies to address this change in learner mindset.

Experience Implementing a GPS

Once the participants' final GPS goals were articulated (referenced in Table 10), the program's GPS development stage ended, and the GPS implementation stage began. The GPS implementation stage is the longest of all the stages in the GPS journey, spanning no less than five months.

The individual case studies dedicated a section to describing the moments of ease and moments of challenge that occurred when implementing their GPS projects. In those individual case studies, I described the moments of ease first, and then I discussed the moments of challenge. I oriented the discussion this way because immediately after discussing the moments of challenge, I discussed the way the participants relied on their support systems. As shown in Chapter 4, it was often a moment of challenge that caused the reliance on support systems. However, when the data is assessed temporally, it is interesting to find the opposite orientation is true; the participants experienced almost all of their moments of challenge before experiencing their moments of ease.

Experience with Moments of Challenge. Across all cases, the recurring theme of insufficient time emerged as a challenge (referenced as Aspect 11 in Table 8). This challenge manifested in different ways, such as struggles to balance workloads or finding time to develop

and implement project components. Georgette struggled to find time to work on her GPS project during the school week and relied on school breaks to make progress. Izabella reinforced this saying, *"I got behind on all of my GPS stuff…The project itself was a difficulty. Not because the project was necessarily hard per se, but just time."* Chanley was a bit more succinct, writing in a monthly reflection, "TIME is the challenge every day." Shari specifically struggled with the time-consuming nature of planning data-driven small group instruction, writing in one monthly reflection: "Time is always the challenge. Planning meaningful instruction takes time and with all the expectations placed on teachers, it can be a struggle."

Coupled with time-constraints, all of the participants experienced an initial challenge in working with their project participants. Izabella tried to offer two professional learning seminars and could not recruit participants. She ended up changing the format, making it hybrid, and still had a rather small turn out. Chanley had a similar problem, rescheduling a workshop she intended to offer after school on argumentative discourse multiple times and eventually settling for offering a shortened version of it during the lunch period. Georgette, Shari, and Elise all experienced challenges with their students at first. Georgette recalled how uncomfortable and frustrated her students were with inquiry labs; Shari described the challenge of making sure the rest of her class had a meaningful assignment they were capable of completing without her while she did small group instruction. Elise found that her students were increasingly unmotivated and disengaged.

These types of challenges are represented in Table 9 as Experience Phase G, the Overwhelm Phase, where the participants are experiencing overwhelm, frustration, and angst. Some have tried to implement their GPS projects only to be met with barrier after barrier. Projects that required the recruitment of teachers experienced a lack of signups. Projects that

required student engagement experienced a lack of buy-in. Stress was compounded by time constraints, increasing workloads, and a true lack of work-life balance. At times, sobbing break-downs occurred. Major goal changes also occurred for one participant, aborting one of the goals on her GPS proposal document and starting over with the goal development process. These challenges were manageable through a strong reliance on support systems; mentors, colleagues, and GPS affinity groups were critical during this phase.

  Reliance on Support Systems. As previously mentioned, support systems (referenced as Aspect 12 in Table 8) were critical in the GPS development and GPS implementation stages, specifically during the Development Phase and the Overwhelm Phase (referenced as Experience Phase F and G in the Table 9). All participants utilized assigned Wilcox SEF mentors, affinity groups, district science coordinators, colleagues, and fellow Wilcox SEF Cohort 3 members as support systems. The assigned Wilcox SEF mentors supported the participants throughout their Wilcox SEF journey, but they were most heavily utilized during the GPS development stage of the program, and all participants relied on feedback from their mentors to articulate their GPS goals. The district science coordinators also offered the majority of their support during the GPS development stage. Affinity groups were assigned by the Wilcox SEF administration following the submission of participants' GPS proposals. The administration considered the focus areas of the GPS work, such as equity or argumentative discourse and questioning, and grouped participants with similar objectives. These affinity groups offered a significant opportunity for collaboration and problem-solving and were most heavily used during the Overwhelm Phase (referenced as Experience Phase G in Table 9). Chanley demonstrated this as she relied on her mentor, Rosie, primarily in the GPS development stage of the program, but shifted to relying on her affinity group near the end of the GPS implementation stage of the program.

It is worth noting that while there were some trends associated with when certain types of support systems were used within the stages of the program as discussed above, in general the participants relied on different support systems to various extents. Georgette and Elise leaned most heavily on their Wilcox mentors, Miranda and Keith, respectively, for assistance and guidance throughout their project while Izabella relied on her mentor for occasional support but found her affinity group to be an essential resource. All the participants felt their fellow cohort members provided valuable support, encouragement, and camaraderie. While the district science coordinators were sporadically used for support, they were among the least relied upon of all the support systems.

During the Homeostasis Phase (referenced as Experience Phase H in Table 9), the participants are experiencing reassurance from their support systems, and the communication with the support systems remains consistent. The GPS projects, now likely in a somewhat altered fashion from how they were envisioned at the beginning of Experience Phase G, are beginning to be implemented. There is a glimmer of the "light at the end of the tunnel" mentality.

In contrast to the support systems of the mentors, there were also moments where the participants found encouragement from their data. During the Ramp Phase (referenced as Experience Phase I in Table 9), the participants are experiencing encouragement and reassurance from their data, an important distinction from the reassurances offered by their support systems which occurred in Experience Phase H. In the Ramp Phase, the reassurances from their data allowed the participants to begin to be able to visualize the completion of their GPS work. They experience increasing levels of confidence throughout this phase. Ultimately, both formal and informal support systems are critical to GPS success.

Experience with GPS Moments of Ease. Moments of ease (referenced as Aspect 10 in Table 8) were primarily experienced in the Ramp Phase (referenced as Experience Phase I in Table 9) and Launch Phase (referenced as Experience Phase J in Table 9). During the Launch Phase, the participants experience a GPS propulsion! Their GPS projects 'take off,' and the participants are nearing completion for some or all aspects of their project. They are fully committed to the process and experiencing a high level of confidence. The colloquial "fruits of their labor" are realized, and they are able to articulate benefits of their GPS work. In this phase, the participants construct academic posters, portfolios, and present their findings in a poster symposium presentation.

Two primary themes emerged when participants described the positive aspects of their GPS journey. First, participants emphasized the remarkable benefits of autonomy, along with the accompanying flexibility, in their GPS work. This autonomy made the GPS experiences more enjoyable to implement and ensured the knowledge gained was directly relevant to their current teaching or classroom needs. Georgette acknowledged her appreciation of autonomy saying, *"I like the fact that I really got to focus on something that I wanted and that I had resources provided to help me excel in it"* while Izabella commented on the flexibility: *"If I had strict deadlines, nothing would have gotten finished because I would have been freaking out the whole time."*

The second theme that emerged concerning the positive aspects of the GPS journey was the presence of built-in support systems. As previously discussed, all participants relied heavily on formal support systems such as assigned Wilcox mentors, district science coordinators, and GPS affinity groups.

Upon the conclusion of their GPS work, all participants constructed an academic poster, completed a portfolio, and presented at a poster symposium. As discussed in the benefits, all the participants credited the presentation experience with bolstering their confidence and encouraging them to engage in more presentations, whether pertaining to their GPS project or a workshop on a different topic, in the future.

Experience Creating a GPS Academic Poster

All the participants created an academic poster for the poster symposium that showcased their individual GPS journey, goals, and distinct strategies they utilized. The Wilcox SEF program provided a poster template, ensuring that all posters incorporated the participants' personal and district goals while emphasizing the tools, methods, and strategies that promoted growth and development in their respective areas. Many participants also looked at Cohort 1 and Cohort 2 posters for inspiration, which were made available by the program. Shari found having a template to amend made the process straightforward. While Chanley felt the process was complicated by the vast amount of evidence she wanted to include. The posters also had a "participant" section in the template. Intriguingly, the participant section of the posters often included the support systems employed behind-the-scenes of their GPS work in addition to students or participants in more visible roles. Despite varying experiences, all participants effectively displayed their GPS work and its impact on their students, themselves, or fellow educators.

Experience Presenting at a GPS Poster Symposium

The Wilcox SEF program offered participants the chance to present their individual GPS work and reflect on their experiences through a poster symposium held at a Mountain district professional learning event. In addition to having other Cohort 3 fellows watch their

presentations, the attendees included district science teachers, family, friends, as well as administrators from their schools, districts, the Wilcox SEF program, and local universities. Although some of the participants had never presented in academic poster symposiums before, all of their experiences were positive. Georgette was initially nervous, especially in the presence of district personnel, while Izabella and Elise were excited. Shari discovered she was more comfortable presenting than she anticipated, and Chanley found that the experience increased her confidence in presenting.

Overall, the poster symposium experience proved to be positive for all participants. Shari and Izabella stated that the experience opened them up to the possibility of presenting more in the future. While Georgette, Elise, and Chanley may not be planning additional formal poster presentations, they credited the confidence they gained from presenting with their intention to offer workshops and share their GPS work with their respective schools and districts. These diverse intentions highlight the valuable impact of the Wilcox SEF program on participants' professional development and future presentation opportunities.

Experience After Completing the GPS

The Conclusion Phase (referenced as Experience Phase K in Table 9) is an endpoint rather than a true phase. Here, the participants have completed the implementation of their GPS projects. After this GPS endpoint, the participants proceed to either Impact Point 1 (referenced as Experience Phase L in Table 9), Impact Point 2 (referenced as Experience Phase M in Table 9), or somewhere in between. The exact end point for each participant is reflective of the impact their GPS work, as well as the overall Wilcox SEF program, has had their personal growth.

As previously described in Chapter 4, each participant experienced valuable career cycle benefits in addition to the other benefits previously discussed. The Launch Phase (referenced as

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Experience Phase J in Table 9) propels the participant past the Experience Phase K endpoint to an Impact Point.

As mentioned above, the Impact Point is meant to serve as a representation of the personal growth achieved by the participants after engaging in their GPS work. Impact Point 1 (referenced as Experience Phase L in Table 9) is the lowest impact point that a participant has been propelled to via the Launch Phase. Participants at this endpoint are experiencing a feeling of completion and satisfaction from their GPS work. They have gained new skills; however, the momentum they gained during the Launch Phase has plateaued. Impact Point 2 (referenced as Experience Phase M in Table 9) is an alternative endpoint that represents where the Launch Phase may have propelled a participant. Participants at this endpoint are experiencing a feeling of increased confidence, pride, and ambition. Their GPS work has jumpstarted future endeavors, and they may have new ideas and inquiries they are ready to investigate or even promotions and new jobs to embark upon. The GPS experience may propel a participant to any Impact Point on a continuum between Experience Phase L, where they feel completion and satisfaction, and Experience Phase M, where they experience increased confidence, pride, and ambition, representing a range of possible outcomes following the Launch Phase.

All the participants, regardless of whether they had a personal Impact Point closer to that of Impact Point 1 or Impact Point 2, have completed their GPS work with clear benefits and an increase in self-efficacy. The fact that the overall GPS experience was beneficial is the second assertion in this study. A word cloud is seen on the next page in Figure 1; this word cloud was generated by the N-Vivo software program to reflect the most used words from the sections of all transcripts that were coded with the higher-order heading 'benefits.'

Figure 1. Word Cloud Representing Most Common Benefits

Model Development

As previously described, as the participants progressed throughout the different

experience phases in their GPS journey, their mindset would ebb and flow. At times, the

participants experienced positive, optimistic, and encouraging feelings. Other times, the

participants described experiencing negative feelings of frustration or overwhelm. As mentioned

above, the positive and negative experiences for all participants seemed to consistently occur

during similar phases of their GPS journey. To offer an illustration regarding how the mindset of

the participants may have oscillated throughout different experience phases, I developed a

model. This model is seen in Figure 2 below.
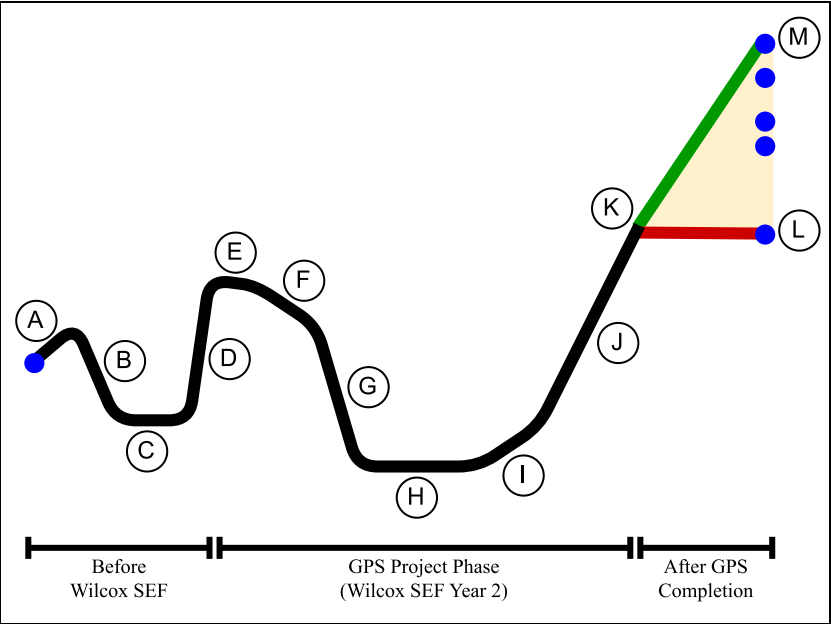
Figure 2. The Conceptualized Common GPS Experience Model

To construct this model, I first drew a dot, representing the starting point of their experience in the recruitment phase of the Wilcox SEF program. Next, I drew a line, representing their journey, longitudinally, through the program. Instead of drawing a flat line, I drew a line that ascended and descended, with the slope of the line representing whether the mindset of the participant was positive or negative. To illustrate the more intense emotions described by the participants, such as moments of overwhelm, the slope of the line is steeper. Eventually, as the GPS journey ended, I put another dot representing an endpoint.

It is important to reinforce the notion that this model was constructed to provide a general overview of how the mindset of a fellow may change as they go through the different experience phases in the Wilcox SEF program. This model is not to be interpreted in a quantitative sense or as reflection of a specific participant's experience. Also, while the temporal nature of this diagram spans from the time period in which they first learned about two-year fellowship program to after its completion, the participants' experience in the first year of the fellowship program, which focuses on horizontally-aligned and vertically-aligned coaching and collaborative learning in science protocols, is outside the scope of this study and thus omitted in this model. Inclusion of this time period would be beneficial for a future study. It is also important to understand how the information provided previously in Table 9 relates to the model. Table 11, on the next page, expands on Table 9 to show how each of the experience phases correspond to the model and the stage of the program.

Interpreting the Model Through a Self-Efficacy Lens

The oscillating mindset, represented in the model, that is experienced by the participants showcases Bandura's (1997) self-efficacy theory at work. For example, there is a positive slope in the model during the Application Phase (referenced as Experience Phase A in Figure 2 and

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Table 11

Factors Affecting GPS Experience Phase Mindset Organized by Model Phase

Section of the Model	Program Stage	Model Phase	Experience Phase	Experience Aspects Addressed	Factors Affecting Mindset
Before	Recruitment	A	Awareness	1, 2	Intrigued or excited by fellowship product, stipend, and colleagues
Before	Recruitment	B	Application	3, 11	Lengthy and tedious application process
Before	Recruitment	C	Wait	3	Application is submitted; hopeful of acceptance and opportunity
Before	Recruitment	D	Acceptance	3	Excited and eager to embark on journey; very motivated
During	GPS Development	E	Realization	4, 11	Realization a lot of work and time will be required
During	GPS Development	F	Development	5, 11, 12	Early stages of grappling with GPS project goals
During	GPS Implementation	G	Overwhelm	6, 11, 12	Struggle to visualize completed project; major goal changes; overwhelming workload; strong reliance on support systems
During	GPS Implementation	H	Homeostasis	6, 12	Back-and-forth communication with support systems; reassurances from support systems; begin to see "light at the end of the tunnel"
During	GPS Implementation	I	Ramp	6, 10	Reassurances from data; begin to visualize project
During	GPS Implementation Presentation	J	Launch	6, 7,8,10, 12, 13	Full buy-in; GPS project "takes off;" participants see fruits of their labor; academic poster, portfolio, and poster symposium preparation occur
End	End	K	Conclusion	8, 9	Project completion; move on to phase L, M, or somewhere in between
After	Post	L	Impact Point 1	9, 13	GPS culmination plateaus; feeling of completion
After	Post	M	Impact Point 2	9, 13	GPS culmination jumpstarts future endeavors; new jobs, ideas, inquiries; increased confidence and feelings of pride

Table 11) indicating a positive mindset. During the Application Phase, participants described speaking to prior Wilcox cohort members who shared their positive experience in the program. Bandura's (1977) second component of self-efficacy theory, vicarious experience, suggests that seeing colleagues succeed may cause someone to be more likely to believe that they, too, can succeed. This same concept can account for the optimism the Cohort 3 participants experienced after watching Cohort 2 present their successful GPS projects.

The model shows a steep, negative decline in the slope during the Overwhelm Phase (referenced as Experience Phase G in Figure 2 and Table 11) indicating a strongly negative mindset. This is supported by self-efficacy theory's fourth key component, physiological and

emotional states (Bandura, 1977) which explains that when a person is feeling overwhelmed, stressed, or anxious they may doubt their abilities, which if left unaddressed, can hinder their ultimate professional growth. During the Overwhelm Phase all the participants were experiencing feelings of overwhelm resulting from time constraints, challenges recruiting participants, responsibilities to competing priorities, and struggling to visualize their completed GPS work.

Self-efficacy theory suggests that it is crucial to consider the teacher's emotional well-being and provide resources and strategies to help overcome any negative emotions and stress and allow for self-efficacy to occur (Bandura, 1977). This model shows the slope of the model shift in the Homeostasis Phase (referenced as Experience Phase H in Figure 2 and Table 11), which indicates necessary resources and supports were provided, and the main support that was used to overcome the negative mindset directly connects to self-efficacy theory's third concept: verbal persuasion. Verbal persuasion states that positive feedback and encouragement from peers and supervisors can enhance teacher's beliefs in their abilities to implement new learning (Bandura, 1977). As previously discussed, the mentors and GPS affinity groups offered an incredibly supportive and affirming environment ultimately increasing the participants' self-efficacy enough overcome their negative experiences in the Overwhelm Phase and move through the Homeostasis Phase. The model also shows a slight positive slope, indicating the reemergence of a positive mindset the Ramp Phase (referenced as Experience Phase I in Figure 2 and Table 11). I previously discussed that in this phase the participants started feeling reassured by their data. This is directly supported by Bandura's first key component of his self-efficacy theory, performance outcomes, which suggests that as teachers engage in professional learning and begin to implement new strategies and techniques in their classrooms, their belief in their

ability to effectively use these methods can be significantly impacted by early moments of

success. Conversely, moments of failure can decrease their self-efficacy. Here, we see that as

the data begins to reflect positively on their efforts, they experience a great increase in self-

efficacy and positive mindset.

The Launch Phase (referenced as Experience Phase J in Figure 2 and Table 11) has the

longest and steepest positive slope in the model; this is where the participants had the most

positive mindset. Here, I suggest that the participants experience a significant increase in self-

efficacy as a result of all the self-efficacy theory key components occurring simultaneously

creating a compounding positive effect (Bandura, 1997). In this stage we see performance

outcomes (for example, when the data shows an increase in student outcomes), vicarious

experience (when watching colleagues in their GPS affinity groups also have success), verbal

persuasion (when the participants receive continued encouragement from their formal and

informal support groups), physiological and emotional states (when the participant's competing

priorities and thus stress reduces as they near the end of the project and have less to do than

earlier in the project), and setting challenging goals (when progress towards achieving their goals

is reviewed and celebrated). Through this framework, it is clear the participants have an overall

increase in self-efficacy as they complete their GPS projects.

In summary, the fact that the participants conceptualized their experiences consistently is

represented by the model in Figure 2, and it is also the primary assertion in this study. The

experience phases in the model align with a distinct phase in the GPS process as well as factors

that affected the participant's mindset at that state as referenced in Table 11. Since the GPS

experience is beneficial, due in part to increasing their self-efficacy through GPS work (Bandura,

1997), Impact Points 1 and 2 are both located at a higher vertical location than the starting point in the model.

Barriers Preventing Prior GPS Investigation (Research Question 1b)

As previously mentioned, the majority of the GPS goals accomplished by the participants were personal in nature. With such a personal desire to achieve these goals, I wondered why the participants had never sought to address the underlying issues behind their goals before. The cross-case analysis revealed barriers that contributed to why the first time the participants tried to achieve these GPS goals was during the Wilcox SEF program. The barriers uncovered were insufficient time, lack of mental energy, lack of administrative support, lack of funding, and a lack of awareness. While my questions to participants were with respect to their GPS work, many of the exposed barriers, such as a lack of time, mental energy, administrative support, and funding, would be barriers to implementing any form of practitioner inquiry into their practice. However, the lack of awareness barrier was specific to their actual GPS work. A word cloud is seen below in Figure 3; this word cloud was generated by the N-Vivo software program to reflect the six most used words from the sections of all transcripts that were coded with the higher-order heading 'barriers.'
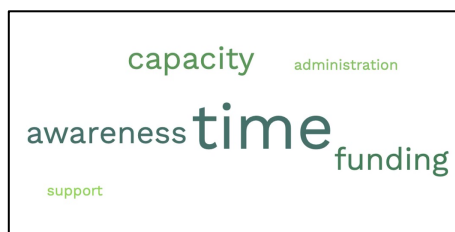
Figure 3. Word Cloud Representing Most Common Barriers

The main theme that emerged throughout the entire Wilcox application and GPS process in all cases was insufficient time. This challenge manifested in different ways. As Elise said,

"There's huge value in [the GPS work]…if we had the time, but we don't and we are barely surviving." Georgette said, *"I never had any time."* Chanley echoed this:

> *I guess you get caught up in your life and Wilcox allowed us to stop and we reflected all the time. And…I have reflected, but I have never really debriefed and talked to others and really took that time. And that's just so important.*

In the occasions where time itself was not the barrier, the theme of participants having a lack of mental energy, colloquially referred to as "having too much on their plate" or not wanting to "add to their plate" emerged. Georgette felt overcommitted and struggled to find available time to work on her project. Elise said, *"as far as implementing this sort of research into classrooms and stuff, in a perfect world, that would be great. We have too much on our plates."* Georgette echoed this sentiment when she shared not wanting to inconvenience other teachers: *"I'm not adding to their plates this year. [The administration] is asking so much of them already."* Izabella described a similar experience, *" I felt tired…I was always grading because I was always behind in grading…I was so overwhelmed."* In my researcher journal I wrote,

> No wonder they didn't look into it before. They didn't have the time or mental capacity. I wonder how they found the time with Wilcox. They probably just felt that because they were being paid to do it [by the stipend], it was like a part-time job. And with any part-time job, you do it because you accepted the responsibility and committed to accomplishing a task in exchange for money…but in the moment you'd probably rather sleep, spend time with your family, or any of the other reasons they didn't do it before. I know they did not receive their final stipend payout until after they finished their project. If Wilcox was free, I wonder how many would finish their projects.

At the time I wrote that, I had not noticed one of Elise's comments in our interview that supported this thought. Having reread her transcript, I pointed out a "Yes!" when she said:

> *I'm saying, okay, you're going to pay me money and I'm going to give you a certain amount of my time, which is very precious, and I'm going to do a certain job for you. I'm going to give you my time and my labor.*

This correlates to the barrier of funding that also emerged. Multiple participants expressed that a lack of funding prevented them from engaging in the GPS work in the traditional sense of funding. However, it is worthwhile to consider that by receiving funding, there may be a conscious opening of time and mental energy that would otherwise be consumed with something else. The sheer act of receiving a stipend for participating in the GPS work may have been a pivotal factor in the professional learning actually taking place.

Regarding the identification of barriers representing the traditional sense of funding, all the participants mentioned a prior desire for professional learning that they were unable to do due a lack of funding. Referencing her original GPS idea, Georgette said, *"I've always wanted to build a greenhouse, but I never had any cash, or I never had any time."* Chanley and Elise also commented on not having money available to further their professional learning. As mentioned in Chapter 4, Elise said, *"I've really always wanted to go to a conference, but I literally can't afford it."* Chanley echoed this, *"I really wanted to go to a conference…but I wasn't going to have the funding available to go."*

Another identified barrier was a lack of administrative support. Administrative support may be seen when school administrators provide or "buy" time for teachers, allowing them to work on an independent project at the "expense" of excusing them from other responsibilities, but none of the participants reported this happening. As previously described in Chapter 4, Elise

elaborated on how she felt her administration was unsupportive of her GPS work:

>*They were not supportive in any way, shape, or form, nor was my district…I sent [my*
>
>*district supervisor] emails a couple of times…he didn't [reply] because it was something*
>
>*he didn't want to deal with…There was no support. I did this all on my own.*

It makes sense that if the participants felt this unsupported while they were actively implementing their GPS projects, they also felt this lack of support prior, which may contribute to not attempting to address the goals their GPS focused on prior to the Wilcox SEF program. While Georgette described her immediate administrator as very supportive of her GPS work, she mentioned that she did not want to involve other teachers in her work because, as mentioned in Chapter 4, *"honestly, it would also give my admin more to grade them on. And I just didn't want to do that."* This suggests that while she personally felt supported by one member of her administrative team, there is an underlying concern with administrative evaluations. It is possible that by investigating an area you would like to improve on, you are also drawing attention to an area of current weakness. In the event that the administration has not previously identified that area as a weakness of theirs, it may bring attention to an area of their practice that will be evaluated critically.

A final barrier that emerged was a lack of awareness. This specifically arose when Izabella mentioned that, prior to a seminar given by Leslie in one of the Wilcox monthly meetings, she had never considered having a professional development on addressing bias and equity in the science classroom: *"I hadn't really thought about it before,"* and through her GPS work she developed one and offered it to teachers. Elise's GPS involved incorporating tenets of reality pedagogy into her curriculum, but prior to a presentation given by Dr. James in one of the monthly meetings, she had never heard of it: *"One speaker introduced me to one book, to one*

person, and that's what all that is based off of."

While Elise and Izabella both experienced the barrier of a lack of awareness in a direct way, there is another way to interpret the lack of awareness barrier that was a factor in all the cases. As discussed above, all the GPS goals were identified as a result of an iterative process working with their mentors. None of the participants knew what they were going to work on for their GPS goals at the beginning of Year 2 because they were not self-aware of their articulated GPS goals before the iterative brainstorming process began. Since they did not know about their goals yet, they could not have investigated them prior.

The main barriers preventing prior GPS investigation were (a) insufficient time; (b) lack of mental energy; (c) a lack of funding; (d) lack of administrative support; and (e) a lack of awareness. These barriers, which are discussed as assertion six, often intersected and reinforced each other, making it challenging for the participants to pursue their professional interests and growth outside of the Wilcox SEF umbrella. Self-awareness of their GPS goal did not exist until after the iterative GPS goal selection process, which is assertion seven in this study.

Conceptualizing GPS Work Through a Practitioner Inquiry Lens (Research Question 1c)

The purpose of the final research sub-question, "Did the fellows' processes designing and implementing their GPS work contribute to an understanding of their work as practitioner inquiry, and, if so, how?" was to explore the participants' understandings of practitioner inquiry, its tenets, and how their GPS work may be represented through a practitioner inquiry lens. To answer this question, I first assessed their familiarity and understanding of the terminology. After investigating this, I provided the participants with the definition of practitioner inquiry from Chapter 2. As the term 'action research' arose organically in our conversation, I also shared the definition provided in Chapter 2 with the participants, however I did not delve further

into if the participants understood the nuances between the definitions as that is outside the scope of this particular study. After discussing the definition of practitioner inquiry, I asked the participants if they considered their GPS work to be practitioner inquiry based on the definition we discussed. At this point, I sought to determine if they considered their GPS work to be representative of practitioner inquiry, and, if so, why? Finally, I assessed what impact, if any, their GPS professional learning experience had on their future intent to engage in practitioner inquiry work.

Prior Knowledge of Practitioner Inquiry

None of the participants had explicit knowledge of practitioner inquiry before prior to engaging in their GPS work. Izabella felt confident in her knowledge of the term 'action research' from a prior professional learning experience, but she was not familiar with the term 'practitioner inquiry.' This is interesting since, despite the two terms being closely related, it suggests that the professional learning experience she attended only shared the one term and did not expose its participants to related terminology. Shari shared a somewhat similar sentiment in that she had "*heard of action research,*" though she could not offer a definition for it, and she had *"never heard of practitioner inquiry."* Georgette, Chanley, and Elise were not familiar with either terminology.

After assessing the participants' prior knowledge of practitioner inquiry in our interviews, I provided them with the definition for practitioner inquiry as described in Chapter 2. At this point, some of the participants declared that they had engaged in practitioner inquiry, or action research, earlier in their career due to engaging in reflective teaching practices. Shari felt she had not engaged in formal practitioner inquiry prior to her GPS work, but she did have exposure to reflective teaching practices and had informally made changes to her practice over time.

Chanley felt she had engaged in informal action research, using a pad of paper to record her reflections and make changes to her teaching practice, but she commented that it was not a systematic and intentional study of her practice, which is a tenet of practitioner inquiry. In my researcher journal I posed a contradiction of her statement writing, "I know it's just a pad of paper, but I still think that that could be considered intentional, after all she intentionally got that pad of paper ready to go." Georgette had a similar experience saying, she had *"worked [on] a couple of different things [that may be considered informal practitioner inquiry] with just inquiry-based learning…again, it wasn't as intense because there weren't reflections I had to write."* Her use of the word 'intense' conveyed the meaning of formal practitioner inquiry, and I questioned in my researcher journal, "there is clearly something about writing down the reflections that makes it feel more formal to them." Elise's previous experience involved surveying her students: *"you want to know how well something works, [a] great way to do it is to look at the data. And especially my first two or three years teaching, I would survey my kids fairly often."* Izabella's prior experience was limited to when she attended an action research workshop at a local university.

In short, all participants had previously engaged in some sort of informal reflective practice with their teaching, however none of the participants knew the term "practitioner inquiry" and referred to their reflective practice in this way. This highlights the need for professional learning programs to introduce and explicitly teach the concept of practitioner inquiry to educators, so they can accurately describe their reflective practice and determine if they would like to adapt their informal practices to have a more systemic and intentional methodology.

Identification of GPS as Practitioner Inquiry

   After discussing the definition of practitioner inquiry found in Chapter 2, all the

participants identified their GPS work as engaging in practitioner inquiry to varied degrees. The

majority were extremely confident their work was practitioner inquiry, using resounding,

affirmative statements such as *"Absolutely!" and "Definitely!"* However, Elise felt as if her

GPS project could be considered practitioner inquiry *"to a small extent."* In my researcher

journal, I wondered if she was an outlier to the emphatic agreements others made since her GPS

work primarily revolved around her self-care; I wrote:

> I can see how if your main work is going to the gym and redecorating your living room
>
> there would be less of a connection to practitioner inquiry. Surely the reason she
>
> considered her GPS to still reflect practitioner inquiry tenets was a result of her reality
>
> pedagogy work.

   The participants all identified specific tenets of practitioner inquiry, without being

directly asked, when providing rationale for considering their GPS work to be practitioner

inquiry. Georgette cited the fact that she systematically took notes throughout her project,

reflecting on what worked and what didn't, and made changes based on her observations while

Elise mentioned surveys she intentionally gave her students. Shari asserted her GPS reflected

the intentional, systematic, and longitudinal process found in the tenets of practitioner inquiry,

and Izabella asserted her GPS work was intentional, saying, *"this is me going out, learning from*

me, and learning how to change my practice." Chanley credited the structure of the GPS work

designed by the Wilcox SEF program for making her project systematic and intentional.

Assertion eight in this study is that engaging in GPS work is a form of interactive practitioner

inquiry. Most participants cited the systematic and intentional nature of the GPS process as a

key factor in viewing their GPS projects as a form of practitioner inquiry.

Attitude towards Practitioner Inquiry

All the participants felt that practitioner inquiry was a useful, effective, and ideal way to

engage in professional learning, often through citing the success of their GPS projects. As

described in Chapter 4, Shari had a strong stance in favor of practitioner inquiry, saying, *"Yes, I*

mean, I think everybody should do it if they had [the opportunity]." Elise said, *"Definitely. I*

mean, to me, that's good practice. You should always be doing that to an extent, if not

completely…there's huge value in it." Izabella echoed this saying, *"I do informal action*

research [and practitioner inquiry] all the time. I don't call it that, but I do it all the time."

A theme emerged in that the positive experiences the participants had with practitioner

inquiry were a result of the collaboration, reflection, intentional debriefing that occurred. The

debriefing was specifically mentioned multiple times and credited for enabling a self-awareness

to develop. As explained in Chapter 4, Chanley explained this sentiment articulately, saying: *"I*

have reflected, but I have never really debriefed and talked to others and really took that time.

And that's just so important to kind of fine tune and to finish up what work you are trying to do."

Shari mirrored this thought in saying why she felt practitioner inquiry was effective:

> *because I saw the rewards of Wilcox…the fellowship itself and just in general, practicing*
>
> *teaching using various pedagogical practices that are rich in the research…doing this*
>
> *project where you are just invested in yourself…you've learned a lot of things the first*
>
> *year. Then you go to pivot and then just really focus on yourself.*

Later in the interview, Shari also commented on a specific tenant of practitioner inquiry that

made it a particularly meaningful way to engage in professional learning:

Other things aren't over a two-year period of time. I think that key growth doesn't

happen overnight. You could sit into a wonderful professional development for three

hours, but it's not going to have as much effect as this is going to have on you.

However, the theme of insufficient time emerged once again when Elise questioned the

feasibility and practicality of incorporating practitioner inquiry into the professional lives of

teachers who are already overwhelmed. She mentioned it may be counterproductive for

teachers, especially those without prior experience or knowledge of practitioner inquiry as they

would have to *"waste their time going to PD to learn how to do it,"* She elaborating saying if

teachers engaged in practitioner inquiry without proper education in the method, she felt they

would *"waste a ton of time looking at yet more data that they don't understand and don't know*

how to apply." In this situation, rather than engaging in practitioner inquiry, Elise felt we should

"leave the damn teachers alone." I wrote in my researcher journal, "she said it was good

practice and everyone should be doing it and there's huge value in it… that opinion must have

only pertained to teachers who have been trained in practitioner inquiry."

Ultimately, the tenets of effective professional learning are represented in the

conceptualized, common GPS experience. However, concerns about the practicality and

feasibility of incorporating it into teachers' already busy lives suggest that more support,

training, and resources might be necessary to make practitioner inquiry a viable option for

professional learning, and there may be insufficient time for that to occur.

Future Engagement with Practitioner Inquiry

After completing their GPS projects, all the participants declared their intent to engage in

future practitioner inquiry projects, though how they intend to implement their practitioner

varied in terms of scale, formality, and collaboration. Georgette intends to *"work on data the*

same way that I worked with questioning this year" and essentially repeat her GPS work.

Chanley also expects to *"continue [her] GPS work."* Izabella plans on *"definitely look[ing] into*
equitable grading and using standard space grading." Elise anticipates continuing to use my
reality pedagogy and work with other teachers to incorporate it into their curriculums as well. *In*
her new position as a science coach, Shari hopes to "encourage other teachers to engage in
practitioner inquiry" and study that process in a formal program sponsored by Wilcox.

As seen when Georgette mentioned she intended to engage in future practitioner inquiry
projects because her GPS work *"made a big difference in my own confidence,"* the desire to
engage in future practitioner inquiry was shaped by the participants' personal experiences,
professional goals, and perceived benefits of engaging in practitioner inquiry through their GPS
work including improved teaching practices and focused self-reflection. The fellows intending
to engage in future practitioner inquiry is the ninth assertion in this study. While the scope of
this study concluded with the fellow's intent to engage in practitioner inquiry, it would be
beneficial for a future study to follow up and determine if their aspirations became reality.

In summary, GPS participants are highly inclined to engage in future practitioner inquiry
work. While their intent was a result of the benefits of their GPS work, it remains to be seen if
those benefits outweigh the demands of their teaching career and if the participants are able to
make time to intentionally and systematically study their practice.

Chapter Summary

In this chapter, I began by introducing a cross-case analysis of the participants'
backgrounds. From there, I explained the findings based on fourteen aspects that were
considered in the cross-case analysis to make meaning of the participant's GPS experience and
answer research question 1 and research sub-question 1a. From there, I introduced a model that

was developed to visually represent the consistent, conceptualized GPS experience. I then explained the model through a cross-case analysis of each section of the model: before the Wilcox SEF program, during the GPS project phase, and after the GPS phase concluded. From there, I discussed the findings of the cross-case analysis of research sub-question 1b and research sub-question 1c.

Chapter 6: Discussion and Implications

I begin this chapter by summarizing the assertions made in the individual and cross-case analysis presented in chapters four and five. At this point, I discuss the assertions in relation to the existing literature, evidence, and the theoretical framework. Then, I suggest possible implications and recommendations for professional learning based on the assertions, limitations, and delimitations of the study. Finally, I make suggestions for future research and provide concluding remarks.

Summary of Assertions

I summarized the nine main assertions made in Chapters 4 and 5 into Table 12 below. In doing this, I provide a way to connect the discussion back to the assertions made in this study in a clear and concise manner. This table also allows each assertion to reflect the research question it answers. The research questions in this study, as seen in Chapter 1, are:

1. How do Wilcox SEF fellows understand their experience designing and implementing an autonomous professional learning plan?

   a) How did the fellows come to identify and articulate their growth plan system (GPS) goals?

   b) What barriers, if any, prevented the fellows from investigating their GPS goals prior?

   c) Did the fellows' processes designing and implementing their GPS work contribute to an understanding of their work as practitioner inquiry, and, if so, how?

Table 12

Assertions Made from Cross-Case Analysis

Assertion Number	Research Question	Assertion
1	1	The participants experienced a consistent conceptualized experience as represented by the model in Figure 2.
2	1	The participants overall GPS experience was beneficial regardless of varied backgrounds when starting the program.
3	1	The participants' conceptualized common GPS experience included tenets of effective professional learning.
4	1a	The participants found their prior professional learning experiences did not meet their content and pedagogical needs, specifically lacking in the areas of equity and the practice of questioning and argumentation.
5	1	The participants expressed that formal and informal support systems were essential to the success of their GPS.
6	1b	The participants encountered five barriers that prohibited them from prior practitioner inquiry engagement: insufficient time, mental energy, awareness, support, and funding.
7	1b	One barrier specifically prevented participants front investigating their GPS goals prior to the Wilcox SEF program: a lack of awareness.
8	1c	All participants identified their GPS experience as a form of interactive practitioner inquiry once they were informed of the definition.
9	1c	All participants experienced a desire to engage in future practitioner inquiry work.

Assertions and Self-Efficacy Theory

The theory of self-efficacy, as proposed by Bandura (1997), has been a focal point in this study. Self-efficacy is an individual's belief in their capacity to execute behaviors necessary to produce specific performance attainments (Bandura, 1977). It is influenced by five primary sources: (1) performance outcomes; (2) vicarious experiences; (3) verbal persuasion;

(4) physiological and emotional states; and (5) setting challenging goals (Bandura, 1997). In this study, the GPS project served as an empowering tool that encouraged educators to navigate their professional learning proactively and led to an enhanced sense of self-efficacy. Each of the nine assertions in this study reflects elements of Bandura's (1997) self-efficacy theory to varying extents.   While each assertion's connection to Bandura's (1997) self-efficacy theory will be detailed in their respective Evidence and Literature Connections section, Table 13, on the next page, provides a comprehensive summary of these connections, aligning each assertion with the five facets of self-efficacy and offering a comprehensive understanding of how these principles intertwine within the framework of autonomous practitioner inquiry in professional learning.

Assertion 1: A Consistent, Conceptualized Experience

As described in Chapters five, the cross-case analysis revealed that the participants encountered a consistent conceptualized experience. As seen in Table 9, its expanded version Table 11, and Figure 2 in Chapter 5, there were nine consistent phases that all the participants experienced when designing and implementing their GPS project. As detailed in Chapter 5, the sequence of the Experience Phases was as follows: (A) Awareness; (B) Application; (C) Wait; (D) Acceptance; (E) Realization; (F) Development; (G) Overwhelm; (H) Homeostasis; (I) Ramp; (J) Launch; (K) End Point; (L) Impact Point 1; and (M) Impact Point 2.

Evidence and Literature Connections

When Knowles (1984) defined the term andragogy as the ability to meet teachers where they are to foster their learning, he acknowledged that adults' distinct needs, challenges, and preconceived beliefs all impact how they engage in learning (Galbraith, 2004; Jacobs et al., 2015). The starting point of each fellow as they begin to embark on their Wilcox SEF journey was different as they each brought an individual metaphorical backpack filled with their own

Table 13

Connections Between Assertions and Bandura's (1997) Self-Efficacy Theory

Assertion	Performance Outcomes	Vicarious Experiences	Verbal Persuasion	Physiological and Emotional States	Setting Challenging Goals
1	Consistent experiences suggest comparable performance outcomes	Shared experiences suggest vicarious learning	Support systems provided positive feedback and encouragement	Shifts in participant mindsets reflect changes in emotional states	Structured phases of GPS program could implicitly involve goal setting
2	Participants' benefits represent positive performance outcomes	n/a	Improved confidence could be bolstered by positive verbal feedback	Improved well-being and career satisfaction reflect positive emotional states	n/a
3	Participants achieved their goals, reflecting positive performance outcomes	Monthly cohort meetings and affinity groups provide opportunities for shared experiences	Support systems could provide constructive feedback and encouragement	n/a	Participants identify and implement challenging goals
4	Autonomy suggests potential for positive performance outcomes	n/a	n/a	Ability to choose learning goals likely fosters positive emotional states	Autonomy in setting individual goals aligns with Bandura's component of goal setting
5	Support systems facilitate successful performance outcomes	Collaborative ethos allows for vicarious learning experiences	Both formal and informal support systems involve verbal persuasion	Safe environment for exploration suggests a positive emotional state	n/a
6	Barriers can hinder successful performance outcomes	n/a	n/a	Struggles with time and mental load can cause negative emotional states	n/a
7	Setting and achieving improvement goals suggest positive performance outcomes	n/a	GPS goal selection process involves feedback, serving as verbal persuasion	Addressing the need for improvement in practice can impact emotional states	GPS goal selection process involves setting challenging goals
8	Realization of their practitioner inquiry represents a positive performance outcome	Collaborative design process allows for vicarious experiences	Working collaboratively involves verbal persuasion	Realization of engagement in practitioner inquiry likely leads to positive emotional states	Recognition of engagement in practitioner inquiry could lead to setting challenging goals
9	Successful completion of GPS projects suggests positive performance outcomes	Collaborative nature of GPS projects suggests opportunities for vicarious experiences	Feedback during GPS project work and positive self-talk represent verbal persuasion	Successful completion of GPS projects and intent to continue suggests positive emotional states	Determination to continue practitioner inquiry represents setting challenging goals

histories; this has also been referred to as funds of knowledge (Gonzalez, 2020; Moll et al., 1992). Their metaphorical backpacks were filled with their various skillsets, degrees and certifications, teaching experiences, personal beliefs, personal and community histories, personal responsibilities, and more.

One participant, Izabella, entered the program having previously participated in a formal action research workshop through a state university. Two participants, Izabella and Elise, had experience facilitating professional learning workshops for the district. One participant, Shari, had experience serving as the science department chair for her school. Another participant, Chanley, experienced a traditional certification path through undergraduate and master's degree programs in science education while Georgette, Izabella, Shari, and Elise all obtained certification through an alternative certification program and did not have undergraduate degrees in education.

In addition to their individual backgrounds, their current responsibilities differed as well. Georgette had additional responsibilities outside of her classroom coaching her school's competitive cheerleading team. At home, Georgette and Shari are both parents to young children. Chanley, a parent to three children all over the age of twenty, specifically acknowledged that she felt she had more time to invest in the program because her children were grown. Izabella and Elise do not have the additional responsibilities of children, though Elise does care for her father, who lives with her, and Izabella acts as a caregiver to multiple local relatives, assisting them with doctor appointments and medical procedures.

With all the individualities discussed in Chapters 4 and 5, I expected the participants to experience and make meaning of the Wilcox SEF program, and specifically their GPS projects, in different ways. Remarkably, this is not what the study uncovered.

As the model discussed in Chapter 5 shows, all participants, regardless of their individual starting points of their Wilcox SEF journey or their differing extracurricular responsibilities during the program, they all experienced similar phases (moments of ease, moments of challenge) at similar program stages. I interpreted the participant's positive and negative mindsets through analyzing their word choice, and when possible, their tone, speaking style, and body language. Their mindsets and the changes between them from positive to negative were also consistent as represented by the slope of the line throughout the model in Figure 2.

In Experience Phase A, the Awareness Phase, the participants were excited about the potential of the program, and the associated stipend, however all were concerned with the time requirements reached out to discuss the program with colleagues before applying. While all the participants showed a predisposition to bettering their practice, there was a substantial stipend associated with this fellowship. In my researcher Journal I wrote: "In my decade plus of teaching, I never encountered a way to earn an extra $8,000 - and to get that while bettering myself instead of it being a job for others, such as running an after-school program - Wow." It is possible that this sizable stipend may have made the fellowship be perceived as a truly elite and professional way to better their practice and gain science leadership skills and lead to the excitement.

During Experience Phase E, the Realization Phase, the participants similarly expressed feeling anxious over the amount of work involved in completing a GPS project and having insufficient time to complete their GPS work as well as how they were going to select the goals for their GPS projects. At Experience Phase F, the Development Phase, all the participants experienced an iterative process in designing their GPS goals and relied on formal support systems, primarily their assigned Wilcox mentor. This implies structure of the GPS program is

effective for any teacher regardless of their individualities. Experience Phase G, the Overwhelm

Phase, was also consistent; here participants recalled major goal changes, sobbing episodes,

inability to recruit necessary participants for their GPS work, and having insufficient time to get

their GPS work done, whether that was lacking time to make necessary documents and lessons in

advance of implementing a new strategy or finding time to implement their strategy or

workshop. For all, there was a heavy reliance on informal and formal support systems here.

From this, we can see that not only did the participants rely most heavily on their support

systems at similar program stages, but the types of support systems they relied upon at different

stages of the program were also similar; this will be discussed in the Assertion 5 below.

Ultimately, the success of their GPS work and the presence of personal benefits and student

benefits were also consistent; this will be discussed in Assertion 2 below.

In summary, Assertion 1 highlights that despite each participant's individual background

and circumstances, they all underwent similar experiences throughout the program's phases.

This uniformity was observed across diverse starting points, differences in education and

professional histories, and varying personal responsibilities. The conceptual model, illustrated in

Figure 2, outlined the experience phases of the GPS program and pinpointed the consistent shifts

in participant mindsets from positive to negative throughout the process. Notably, irrespective of

the individual differences, the participants faced similar challenges and moments of ease at

comparable program stages. This reveals a consistent experience across participants in terms of

program engagement, reliance on support systems, and eventual benefits derived from their

participation. The study's findings contradicted my initial expectations of differing experiences

and interpretations of the program due to participant individuality. Instead, it highlights the

broad applicability of the GPS program structure.

In light of Bandura's (1977) self-efficacy theory, Assertion 1 illustrates the potential influences of the structured GPS program on participants' self-efficacy. All participants, regardless of their individual backgrounds, underwent similar experiences and faced the same challenges at various stages of the program. These uniform performance outcomes could have significantly impacted their belief in their ability to successfully complete the program and apply their learning in their professional contexts. Moreover, the shared vicarious learning experience of navigating the same challenges could have bolstered their belief in their own abilities to succeed. Additionally, the support systems that participants relied upon likely provided verbal persuasion, through positive feedback and encouragement, thereby enhancing their self-efficacy. Changes in participants' mindsets from positive to negative during the program may reflect shifts in their physiological and emotional states, with negative states potentially dampening and positive states likely boosting self-efficacy. While not directly addressed, the structured phases of the GPS program likely involved implicit goal-setting and achievement, further strengthening self-efficacy. Therefore, Bandura's (1997) theory offers valuable insights into how the structured GPS program might have shaped the self-efficacy of participants across varied backgrounds and circumstances.

Implications

Despite the disparate backgrounds and unique personal circumstances of each participant in the Wilcox SEF program, they all experienced the program in a similar way. This shared pattern of experience suggests that the structure of the GPS program has a universally effective framework that caters to teachers' needs, irrespective of their diverse professional backgrounds and personal responsibilities. This might be due to the program's ability to adapt to different learning styles, or the support systems in place that foster individual growth and development.

This consistency may also imply that the program's design, including its instructional methodologies, strategic structure, support frameworks, and project requirements, aligns well with adult learning principles. The fact that the GPS work was able to transcend personal and professional disparities among the participants reinforces the importance of program structure in educational journeys and suggests that a well-crafted curriculum and pedagogical approach can accommodate and engage a wide range of individuals. This may lead to more inclusive and equitable learning experiences. This is significant for the broader field of education, particularly for those involved in teacher training and professional development programs, as it could provide valuable insights into creating more effective learning experiences for a diverse population of educators.

Despite these participants' varied backgrounds and unique personal circumstances, my research found that all participants experienced similar stages and phases of the program. This phenomenon implies that the structure of the GPS program is universally effective for secondary science teachers, irrespective of their personal and professional differences, and may be implemented to create a more inclusive and equitable professional learning experience.

Assertion 2: A Beneficial Experience

While the Impact Points represented in the model range vary and may be found anywhere on a continuum from Experience Phase L to Experience Phase M, the lowest Impact Point was intentionally represented above the starting point in the model to draw attention to the fact that the GPS experience, no matter the participant, was beneficial for the participants. The evidence supporting the notion that the GPS work was beneficial for all participants ranged from data on promotions to personal health declarations to anecdotal statements on confidence, teaching practices, student improvement, and more. The benefits created by the program to the

participants will be described in more detail below, but it is clear all participants regardless of what was in their metaphorical backpack (Moll et al., 1992) as they began their GPS journey had a beneficial experience.

Evidence and Literature Connections

Engaging in GPS work resulted in incredible benefits for the participants as well as the students in their charge. As represented in their GPS posters, nearly all the participants showcased student outcome benefits. For example, Shari showcased her student's increased questioning skills and scores on the end of course (EOC) exam. Elise discussed her increase in student engagement after implementing reality pedagogy into her curriculum. Chanley shared that 80% of her students scored in the high range for their team AP seminar presentations on the long-term effects of damaging levels of sound in adults while Georgette showcased her students 25% growth in their ability to recognize and ask complex scientific questions. The presence of the student outcomes reinforces the fact that engaging in GPS work is an effective tool for engaging in professional learning (Zepeda, 2015). This also provided a great example of positive student outcomes outside of the all too common, and inaccurate, form of standardized test scores (Badiali, 2018). There is no denying that by engaging in GPS work, the participants gained impact power (Tricarico et al., 2015), using their newly gained knowledge to better serve the students in their charge.

Engaging in GPS work resulted in fantastic benefits for students, but I suggest the most remarkable benefits were gained by the participants themselves. Bangs & Frost (2012) declared that the more a teacher believes in his or her own abilities, the more confident, resilient, able to solve problems, and learn from past experiences that person will be. Every participant described gaining great confidence from engaging in their GPS work. Shari stated that presenting her work

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increased her confidence and made her more likely to present in the future. Elise declared that she felt more confident in her everyday life after reaching her personal GPS goal. Izabella gained confidence presenting to other teachers in the district; prior to her GPS work she had only served as a co-facilitator, but right before her poster symposium presentation, she was the sole facilitator for the largest equity workshop she had ever offered. Chanley gained confidence implementing argumentative discourse in her curriculum, but she was specifically proud of herself for facilitating a workshop on argument driven inquiry to her colleagues at school. Georgette increased her confidence both with her scientific questioning instructional practices as well as presenting her work. Additionally, all the participants said engaging in the GPS work within the context of the Wilcox SEF made them more likely to be outspoken as they feel confident in their ability to reference their newfound knowledge of academic research to advocate for themselves and their students.

Coldwell (2017) declared that effective professional learning allows teachers to feel confident in their abilities as educators, but through their GPS work the participants became confident not only in their abilities to better their instructional practice but also to present their work, share research, be outspoken, and facilitate workshops for others. When teacher confidence increases, students benefit, yet I suggest that the greater educational community benefits even more when teachers become confident enough to share their talents through informal or formal peer coaching, advocating for educational reform, and facilitating workshops, widening the umbrella of students who will ultimately benefit.

Teaching is emotional work (Day & Gu, 2007). We know that teacher attrition remains an issue facing education (Carver-Thomas & Darling-Hammond, 2019; Ingersoll, 2001). Teachers are more likely to remain committed to their careers if they receive high quality

professional development (Coldwell, 2017). In this study this study found that engaging in the GPS work directly had direct career cycle benefits for all the participants. Georgette shared that through completing her GPS work and using collaborative feedback protocols provided by the Wilcox SEF program she became less critical and was no longer *"yelling at myself."* Elise's GPS work made her feel happier and more content with her career and education. While she plans to ultimately leave teaching one day, she will likely remain in education longer than she would have without engaging in her GPS work. Izabella hopes to one day have her own company that offers professional learning to schools and districts. Through her GPS work she now has experienced designing and facilitating professional learning workshops, has facilitated those workshops in-person, virtually, and in hybrid formats. She has acted as a co-facilitator as well as a sole facilitator. While engaging in the GPS work has undoubtedly set Izabella up for a greater likelihood of achieving her long-term career goals, in the short term, she has also become more effective at teaching IB (International Baccalaureate) Biology.

Chanley intends to remain in education until her retirement. However, after her GPS experience, she facilitated her first workshop to her colleagues on argument driven inquiry. She has also accepted a position as science department head. She credited her Wilcox SEF and GPS experience for increasing her confidence and empowering her to be a change agent.

Since our final interview, Shari has left her teaching position. She applied for a position as a district science coach and brought her GPS portfolio in a large binder to her interview. Unsurprisingly, she was offered the job and she is now excited to *"widen her umbrella"* and serve even more students by helping their teachers. She will likely be effective in goal to serve more students, as positive impacts on teacher behavior has been correlated with increased student achievement (Lakshmanan et al., 2011; Zepeda, 2015). One of the most extraordinary benefits

of engaging in GPS work is the greater sense of career satisfaction it has offered the participants (Day & Gu, 2007). When combined with the positive student outcomes, the overall GPS experience has elevated the career and impact of each participant from their respective starting points and validating it as a beneficial experience.

As described above, Assertion 2 states that the GPS program was a beneficial experience for all participants, irrespective of their individual backgrounds and histories. The GPS program led to significant benefits both for the participants and the students under their charge. These benefits spanned across multiple facets of professional development, including promotions, improved teaching practices, enhanced student outcomes, increased confidence, and improved personal well-being. Participants also expressed enhanced career satisfaction, evident in the way the program positively impacted their career trajectories and boosted their confidence in their abilities as educators.

Assertion 2, considered through the lens of Bandura's (1997) self-efficacy theory, sheds light on how the participants' self-efficacy may have been enhanced by their GPS program experiences. Tangible successes such as promotions, improved teaching practices, and enhanced student outcomes are examples of positive performance outcomes, which would likely have increased the participants' belief in their abilities to improve their professional practice. Although vicarious experiences aren't directly addressed in Assertion 2, observing their peers' professional growth could potentially enhance each participant's self-efficacy. The improved confidence reported by participants might have been reinforced by positive verbal feedback, a component of verbal persuasion in Bandura's (1977) theory, which could foster their belief in their capacity to succeed as educators. Further, participants' increased career satisfaction and improved personal well-being, indicative of positive physiological and emotional states, would

likely amplify their self-efficacy. While Assertion 2 doesn't explicitly mention goal-setting, the range of benefits experienced by participants suggests that they may have set and achieved challenging goals throughout the program, reinforcing their self-efficacy. Thus, Bandura's (1997) theory illuminates how the GPS program could bolster participants' self-efficacy, resulting in various professional and personal benefits.

Implications

The implications of the GPS program being a universally positive experience are profound. First, the program's effectiveness in fostering professional learning and development suggests its potential for wide-scale implementation across diverse teaching disciplines and even beyond the educational sector. Combined with the autonomy provided by program structure, engaging in GPS work is an excellent form of professional learning for science teachers, regardless of the diversity of a person's educational background, teaching journey, leadership history, and professional learning history. The broad applicability of the GPS program offers promising avenues for professional learning, irrespective of an individual's educational background, teaching journey, leadership history, or professional learning history.

Second, the impact of the GPS program on teachers' emotional well-being and career commitment addresses a critical challenge in education: teacher attrition (Craig et al., 2023). Given the relationship between high-quality professional development and improved teacher retention (Allen & Sims, 2017; Ovenden-Hope et al., 2018), the GPS program could serve as a strategic tool for mitigating teacher turnover rates. If so, the program's benefits extend beyond the realm of personal growth and improved student outcomes, offering potential solutions to pervasive systemic issues within the education sector.

Third, the universality of the positive experience afforded by the GPS program implies its inherent equitable nature. The fact that benefits were shared regardless of the participants' individualized backgrounds suggests the GPS project's potential for promoting educational equity. The implications of Assertion 2 reinforce the implications associated with Assertion 1. The universally beneficial experience of the GPS program underscores the GPS project's value as an effective tool for professional learning. This also reveals its potential as a mechanism for addressing larger systemic issues in education, such as teacher attrition and the need for equitable learning experiences. The universality and breadth of the benefits discovered through this study offer promising prospects for the future of professional learning and development, and it may also be scalable outside of the education sector. Once again, the equitable nature of the GPS program, which delivers benefits regardless of individual backgrounds, also showcases its potential for promoting educational equity in future professional learning opportunities.

Assertion 3: GPS as Effective Professional Learning

As discussed in Chapter 2, Darling-Hammond et al., (2017) states that effective professional learning: "is content focused, incorporates active learning utilizes adult learning theory; supports collaboration in job-embedded contexts; models effective practice; provides coaching and expert support; offers opportunities for feedback and reflection; and is of sustained duration" (p.1). The participants' conceptualized, common GPS experience in the Wilcox SEF program included all these effective professional learning tenants and more.

Evidence and Literature Connections

Thomas (2016) declared professional learning to be effective when it focuses on active learning and specific teaching practices. The GPS projects involved active learning and addressed adult learning theories making sure that each participant had a clear and effective path

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for successful learning to occur regardless of the funds of knowledge they brought with them in their previously mentioned metaphorical backpack. Zepeda (2015) noted that job-embedded professional learning can occur in a variety of modalities throughout the context of a normal workday. The implementation of the participants GPS work was job-embedded. Participants autonomously identified goals directly related to their current teaching practices, and they implemented work to achieve those goals in real-time with their students in their classrooms. As previously discussed, the built-in coaching and expert support was directly responsible for the success the participants experienced achieving their GPS goals. The GPS project offered opportunities for feedback and reflection organically through monthly cohort meetings, affinity group meetings, as well through the formal submission of reflection documents and written feedback from mentors which occurred throughout the process. As previously mentioned, this GPS work was of sustained duration; it was conducted over an entire year and as part of a larger professional learning program which had a 2-year duration. This sustained duration is a valuable component of the GPS work as "one-shot" (Knight, 2009, p. 18) workshops are "notoriously unproductive" (Nieto, 2009, p. 10); Lakshmanan et al. (2011) echoed this sentiment declaring professional learning to be more likely to increase student learning when it occurs through an ongoing and systematic process.

As previously discussed, when Izabella and Elise were empowered to autonomously design their professional learning, they selected to address issues of equity and bias in their science classrooms. Chapter 2 highlighted that effective professional learning has content that is inclusive and discusses equity, not only for student learners but also with respect to the teachers engaging in the learning (Carter Andrews & Richmond, 2019; Jacobs & Burns, 2021). Izabella's GPS work exemplified this criterion, providing teachers with an education workshop on

addressing bias and equity in their curriculum, teaching, and classrooms. It has also been determined that effective professional learning needs to meet the academic and social needs of a culturally diverse student population and enable teachers to refine their pedagogies and practices appropriately (Carter Andrews & Richmond, 2019; Prenger et al., 2017). Elise's work with incorporating reality pedagogy into her classroom accomplished this. By the end of her GPS work, her students were aware of Black, Indigenous and People of Color scientists from her bulletin board and seemingly began to 'see' themselves in different science careers. The GPS work empowered participants to address issues of equity and bias in their teaching environment. Examples from Izabella's and Elise's work illustrate the program's capacity to foster inclusive content and teaching practices that meet the academic and social needs of a culturally diverse student population. A future study to see if implementing reality pedagogy impacted the way the students self-identified as scientists would be beneficial; anecdotally, Elise believes this to be the case.

Effective professional learning creates more productive and equitable student learning outcomes and establishes social skills that are vital to conflict resolution, democracy, and fostering a sense of community (Badiali, 2018; Burns et al., 2013). While the equity work addresses this statement, the GPS work that addressed questioning and argumentative discourse also fulfills this criterion. In her GPS portfolio, Chanley mentioned that teachers did not want to build argumentative discourse because "students think arguments are fights." Chanley and Georgette helped their students understand the practice of questioning, but Chanley assisted her students in debate as well as held a professional learning workshop for her colleagues to become more confident in argumentative discourse. The GPS work enhanced vital social skills, conflict resolution skills, and promoted a sense of community, as seen in Chanley's work on

argumentative discourse. Furthermore, in looking at Chanley's dedication to helping her peers become comfortable implementing argumentative discourse in their classrooms, it is possible to witness her transition from becoming someone being coached in the Wilcox SEF program to acting as a peer coach among her colleagues (Swafford, 2000).

To briefly summarize, I defined self-efficacy as a person's belief regarding their ability to organize, execute, and complete a course of action to achieve a goal in Chapter 2. All the participants demonstrated self-efficacy with the successful completion of their GPS work. As seen in the interview data in Chapter 4, each of the participants increased their confidence in a variety of areas. Coldwell (2017) declared effective professional learning as that which allows teachers to feel confident in their abilities as educators. This study clearly unveiled several characteristics in the GPS phase of the Wilcox SEF program that fulfills not only Darling-Hammond et al. (2017) criteria for effective professional learning but also the additional criteria declared by multiple scholars.

Assertion 3 provides insights into the role of the GPS program in enhancing participants' self-efficacy, closely aligning with Bandura's (1997) self-efficacy theory. The successful translation of participants' learning into practical applications, and the subsequent achievement of their goals, embody positive performance outcomes. Such success likely bolsters their self-efficacy by providing tangible evidence that their efforts can indeed foster professional advancements. The shared experiences in the monthly cohort meetings and affinity groups present opportunities for vicarious learning. Observing the successes and strategies of their peers could have fortified their belief in their own capabilities. Furthermore, the comprehensive support systems of the GPS program, involving coaching and expert support, could offer verbal persuasion through encouragement and constructive feedback, potentially bolstering participants'

self-efficacy. While physiological and emotional states aren't directly discussed in Assertion 3, achieving their goals and having opportunities for reflection might foster positive emotional states, further enhancing self-efficacy. Finally, the participants' autonomy in setting and implementing challenging goals aligns directly with Bandura's (1997) emphasis on goal-setting, contributing significantly to self-efficacy enhancement. Therefore, the components of the GPS program detailed in Assertion 3 are well-tuned to fostering self-efficacy.

Assertion 3 declares that GPS work, as a part of the Wilcox SEF program, is a potent embodiment of effective professional learning, meeting and exceeding the established criteria articulated by Darling-Hammond et al. (2017). The GPS projects promote active learning and apply adult learning theories, ensuring each participant has a clear path to successful learning irrespective of their background. GPS work is job-embedded, with participants autonomously identifying goals linked to their current teaching practices and implementing these goals in real-time in their classrooms. The GPS structure also provides comprehensive support systems, including coaching and expert support, contributing significantly to the success participants experienced in achieving their GPS goals. Opportunities for feedback and reflection are organically integrated into the program through monthly cohort meetings, affinity groups, and formal submission of reflection documents. The GPS initiative is also characterized by sustained duration, extending over an entire year as part of a larger two-year professional learning program. This aspect contrasts with "one-shot" workshops, which have been criticized for their lack of productivity and effectiveness (Knight, 2009, p. 19).

Implications

Assertion 3 carries substantial implications for both the science educational community and beyond. Grounded in the principles of effective professional learning, stated by Darling-

Hammond et al. (2017), the GPS program seamlessly incorporates (a) content-focused learning; (b) active learning; (c) collaboration in job-embedded contexts; (d) modeling of effective practices; (e) coaching and expert support; (f) opportunities for feedback and reflection; and (g) sustained learning. These dimensions, fundamental to successful professional learning, position the Wilcox SEF program's GPS component as a robust model on how professional learning may be conceptualized and implemented. This is particularly consequential considering the program's evident effectiveness across a diverse range of personal and district goals, reinforcing the potential of the GPS approach for wider adoption.

The GPS work's capacity to address vital social skills, conflict resolution, and fostering a sense of community bolsters the notion of professional learning beyond traditional academic confines. The opportunity GPS work provides to engage in equity, reality pedagogy, and the promotion of culturally responsive teaching underscore its potential to foster a more inclusive, equitable, and socially conscious educational environment for science teachers.

Importantly, the GPS program appears to boost the self-efficacy of its participants, instilling a sense of confidence in their abilities as educators. This increased self-efficacy could lead to more effective teaching practices, enhanced job satisfaction, and reduced teacher attrition rates, addressing some of the more significant challenges in the education sector today. Assertion 3 proposes that the GPS program not only meets but exceeds the established criteria for effective professional learning, offering a compelling model that holds promising implications for the future of professional learning, science teaching practices, and the broader education sector.

Assertion 4: A Need for Equity, Questioning and Argumentation Professional Learning

The structure of the GPS work within the Wilcox SEF program provided the participants with autonomy. In addition to this independence, the participants were also empowered by teacher agency as they took action to address a personal learning need and further their professional growth (Atkinson et al., 1996). The cross-case analysis also determined the personal factors that contributed to the participants' GPS goal selection; ultimately the participants had insufficient education in the areas of equity as well as questioning and argumentation, and they sought to fill this gap through their GPS work.

Evidence and Literature Connections

As previously described in Chapter 2, having autonomy over their professional learning allows teachers to seek out opportunities which address the specific needs of either their students or their teaching (Darling-Hammond et al., 2017). The presence of these needs suggests that prior professional learning opportunities were lacking in this area and did not meet the needs of the participants. The structure of the GPS work included an iterative brainstorming process, occurring in the Development Phase, where participants developed a personal goal and a district-aligned goal to address an issue they were currently experiencing in their practice. While all five participants were in the same Wilcox SEF program engaging in practitioner inquiry, the individuality of each GPS goal supports that engaging in GPS work is a form of autonomous practitioner inquiry.

Zepeda (2019) defined teacher agency as the ability for teachers to have a voice in their own professional learning and defined teacher agency as the "capacity of teachers to act purposefully and constructively to direct their professional growth and contribute to the growth of their colleagues'' (p.51). The teacher agency provided by the GPS work empowered each

participant to actively fulfill a need in their practice. However, instead of finding six distinct needs, this study uncovered two trends among the specific professional learning needs addressed by the participants: (1) equity and (2) the practice of questioning and argumentation.

As described in Chapter 5, Izabella and Elise identified that issues of bias and equity are still largely present in their schools and even their classrooms, and they needed distinct strategies to create a more equitable learning environment. There is a high likelihood that the experiences with equity facing Elise and Izabella are also present in other classrooms. Therefore, one of the implications of this study is a call to action for programs to consider if they adequately address issues of equity and bias in their structure and curricula.

As seen with Georgette's, Shari's, and Chanley's respective goal selection processes, students being increasingly grade-focused and having a fear of failure has caused a reduction in natural curiosity. The lack of this natural curiosity has decreased student questioning skills and argumentative discourse skills, and the participants needed strategies to address this change in learner mindset. Prior to this GPS work, they lacked exposure to professional learning which met their needs in the pedagogical areas of questioning and argumentative discourse.

This study also showed that when teachers lacked autonomy in their professional learning, they had a less enjoyable experience. Elise specifically commented that one of the main reasons she chose to facilitate workshops at her district's mandatory professional learning day was so that she would not have to attend other workshops. This sentiment was echoed in the literature when Guskey (2000) stated that, without autonomy, professional learning is "something [teachers] must endure and get out of the way" (p. 15).

Assertion 4 emphasizes the significance of teacher agency and autonomy in setting and working towards individual goals in the GPS program, which aligns closely with Bandura's

(1997) self-efficacy theory. The successful achievement of these personalized goals signifies

positive performance outcomes, which according to Bandura (1977), play a crucial role in

enhancing self-efficacy. While Assertion 4 does not explicitly address vicarious experiences or

verbal persuasion, the structure of the GPS program may provide opportunities for educators to

learn from their peers' successes and receive valuable feedback, thereby strengthening their

belief in their own abilities. Furthermore, the empowerment derived from having agency in their

learning paths would likely foster positive emotional states, which can further boost self-

efficacy. The structure of the GPS work, which revolves around setting and achieving

challenging goals to address their professional learning needs, directly resonates with Bandura's

(1997) emphasis on goal setting as a critical source of self-efficacy. Therefore, Assertion 4

showcases how the GPS program's structure, by fostering educator agency and autonomy,

effectively aligns with the key components of Bandura's (1997) self-efficacy theory, enhancing

participants' self-efficacy.

In short, Assertion 4 highlights the significance of teacher agency in shaping professional

learning experiences, with the structure of the GPS work within the Wilcox SEF program

granting the educators the autonomy to meet their learning needs. The study identified that their

prior professional learning did not meet their needs, particularly in the domains of equity as well

as questioning and argumentation. The individuality of the selected goals underscored the

diverse needs of the educators and calls for professional learning programs to provide more

personalized and needs-oriented offerings.

Implications

Assertion 4 is valuable as it underscores the necessity of autonomy in professional learning experiences for science teachers and reveals gaps in current professional learning programs, particularly in the areas of equity and questioning and argumentation. First, the assertion strongly emphasizes the significance of teacher agency in professional learning. The findings that teachers, when given autonomy, were able to pinpoint specific areas where they needed further knowledge and created unique goals to address those areas is crucial. It proposes a shift in professional learning strategies towards granting teachers more control over their professional growth. This approach can stimulate more meaningful engagement and investment from teachers in their learning experiences, which in turn, can lead to more effective application of new skills and knowledge in their classrooms.

Second, the assertion uncovers two key areas that teachers find lacking in current professional development programs: equity and the practice of questioning and argumentation. This finding is important, implying that teacher preparation and professional learning programs need to reassess their content to include more explicit, focused education on these topics. There is a clear demand for professional learning that provides distinct strategies to create more equitable learning environments and to address the shifting learner mindset around questioning and argumentation.

This study recommends that professional learning programs should strive to foster teacher agency as well as diversify their content to directly address the equity and questioning and argumentation gaps identified in this study. Such a transformation could result in more effective and relevant professional development experiences, leading to improved science teaching practices and, ultimately, better student learning outcomes.

Assertion 5: Support is Essential for Success

Effective professional learning provides coaching and expert support (Darling-Hammond et al., 2017). When I originally considered this statement, I imagined it suggesting that a school mentorship program would be effective professional learning. However, this study showcased coaching and expert support being used as an integrated piece of a larger professional learning experience as opposed to the main source of learning. This study has shown that sustained professional learning is naturally going to ebb and flow with moments of ease and moments of challenge. To push through the moments of challenge, and ultimately achieve success, support systems are essential.

Evidence and Literature Connections

Mentors, GPS affinity groups, and other Cohort 3 colleagues acted as formal and informal support systems in the Wilcox SEF GPS process. Based on the model in Figure 2, the formal support systems were critical during the Development Phase and the Overwhelm Phase. In the aptly named Development Phase, the iterations of dialogue with mentors were responsible for the development and articulation of the GPS goals. Likewise, the formal support systems were responsible for the end of the participant's steep mindset decline and allowed for the transition out of Overwhelm Phase and into the Homeostasis Phase to occur.

In my experience, when biology teachers instruct on the concept of homeostasis, they reference body temperature regulation. When the body overheats, homeostasis causes your body to sweat and cook down; conversely, if your body temperature is too cold, your body will shiver to warm itself back up. In scientific terms, it negates the unfavorable stimulus. The support systems were responsible for stopping the negative experiences and transitioning the participants out of the Overwhelm Phase, maintaining the Homeostasis Phase where they could regain

perspective and feel supported until their data offered reassurances. The reassurances offered by the mentors and other affinity group members, as well as informal support by Cohort 3 members, were critical. If the design of the Wilcox SEF program was different and did not have built-in support systems, I question how many of the participants would have been unable to be pulled out from the negative path of the Overwhelm Phase to complete their GPS work.

While the support systems were essential for the successful completion of the GPS projects, they should be credited for allowing the GPS to begin. Hsieh et al. (2021) described that peer coaching powerfully develops teaching practice and improves student learning through cooperation, sharing, reflection, and feedback. All the participants reflected, shared, and worked cooperatively with their peers to get feedback during their GPS process. As Georgette said, *"Floundering through it together makes you more comfortable."* The literature supports this sentiment; teachers need to feel that they are in a safe place to be vulnerable, whether to admit insecurities in their own teaching or to try something new (Tooley & Connally, 2016).

Assertion 5 emphasizes the crucial role of extensive support systems in the GPS program, both formal and informal, which aligns closely with Bandura's (1977) self-efficacy theory. The robust support structures described likely enhanced participants' successful outcomes, contributing to increased self-efficacy. The collaborative ethos of the program, fostering an environment of shared experiences, reflection, and feedback, provides opportunities for vicarious learning, reinforcing participants' belief in their own capabilities. Additionally, elements of verbal persuasion are present within these interactions, further boosting self-efficacy. The safe environment for participants to explore new approaches implies the presence of positive emotional states, which Bandura (1977) identifies as a significant contributor to self-efficacy. While the assertion does not directly address goal-setting, the availability of a supportive

environment likely facilitated the setting and pursuit of challenging goals, thus reinforcing self-efficacy. Assertion 5 suggests that the robust support mechanisms embedded in the GPS program structure effectively enhances participants' self-efficacy, closely aligning with Bandura's (1977) theoretical framework.

In summary, robust support systems are indispensable to successful professional learning. The study revealed that formal support systems, such as assigned mentors and GPS affinity groups, as well as informal support systems, interactions with colleagues and other Cohort 3 members, functioned as vital support mechanisms throughout the Wilcox SEF GPS process. Moreover, participants worked cooperatively, reflecting, sharing experiences, and giving feedback to one another throughout the GPS process. This collaborative ethos fostered a safe environment where the participants were able comfortably and securely explore new approaches and admit uncertainties in their teaching, underlining the central importance of support structures in the effectiveness of professional learning initiatives.

Implications

Assertion 5 provides essential insight into the value of support structures in amplifying the efficacy and impact of professional learning initiatives for science teachers. This understanding can guide the design and implementation of future programs, ensuring they offer the necessary scaffolding to support science educators in their journey of continuous growth and evolution. This study showed that stabilizing, supportive structures serve as a lifeline, equipping educators with the resilience to navigate the fluctuating experiences inherent in sustained, transformative professional growth. The absence of such comprehensive support systems could potentially deter educators from engaging in or persisting through challenging stages of professional learning, thereby inhibiting their developmental journey.

This study also illuminates the substantial benefits of collaborative practices, such as peer coaching and informal, collegial dialogue, in creating a nurturing and supportive learning culture. The synergistic interaction of cooperative work, reflective dialogue, and mutual feedback, creates spaces for vulnerability within professional learning so that educators can acknowledge their teaching insecurities and embrace innovative strategies without apprehension. Comprehensive support systems are necessary to enhance the effectiveness of professional learning programs.

Assertion 5 emphasizes the necessity of robust support structures in professional learning programs to ensure educators' success in their educational journey. The insights suggest that programs should assess their existing framework and integrate such support mechanisms if missing or consider them crucial while designing new professional learning initiatives.

Assertion 6: Barriers Prevented Prior Practitioner Inquiry Engagement

Assertion 6 reflects critical insights into the barriers that stood between the participants and their engagement in practitioner inquiry before their involvement with the Wilcox SEF program. These identified barriers were insufficient time, mental energy, awareness, support, and funding. While I uncovered these barriers in answering research question 1b, which focused on barriers preventing prior GPS investigations, my analysis found that four of the barriers, insufficient time, mental energy, support, and funding, were not limited to preventing GPS work; they also prohibited generalized practitioner inquiry from taking place.

Evidence and Literature Connections

As teachers face inadequate resources, ranging from personnel and expertise shortages to financial issues and lacking curriculum materials, they are less likely to engage in professional learning (Tooley & Connally, 2016) because their jobs are intrinsically harder. This means that

they have less mental energy and time available to engage in professional learning. For example, Elise mentioned having to cover classes for students during her 'free period.' We also saw this theme emerge when Georgette described relying on spring break and winter break to construct many of the lesson plans needed for her GPS work. As discussed in Chapter 5, the barriers of having insufficient time and limited mental energy were present in nearly every stage of the model. The concept of limited mental energy is becoming more commonly discussed in society through a feminist lens with respect to the "mental load" of motherhood (Dean et al., 2022). A Taiwanese study in 2015 declared itself to be the first study addressing the mental load of elementary school teachers (Liu et al., 2015). Indeed, this does seem to be a gap in the literature as other literature exists under the guise of the "cognitive load" impacting educators, but that traditionally referred to teachers being overstimulated by sensory components in their classroom (Feldon, 2007). While the participants in this study were secondary science teachers, I interpreted their use of the colloquial phrases of having "too much on their plate" or not wanting "to add to their plate" as a reference to not only insufficient time, but also a high mental load. Ultimately, the two are related as time constraints increased the stress-level of the mental load (Liu et al., 2015).

In the traditional sense, the insufficient funding barrier may be perceived in the restricting professional learning due to an inability to purchase the required materials or attend desired conferences. While that traditional interpretation was showcased when Elise elaborated on her inability to even partially fund traveling to a conference, I suggest that the barriers of a lack of funding as well as insufficient support can also be viewed through the lens of insufficient time. As suggested in Chapter 5, receiving a stipend may create a conscious opening of time and mental energy that would otherwise be consumed with a competing priority. The sheer act of

receiving a stipend for participating in the GPS work may have been a pivotal factor in the professional learning taking place. Similarly, a lack of administrative support could be interpreted as a lack of the administration agreeing to remove a duty or fund a substitute for a colleague instead of requesting class coverage during "free period" to allow for ample time to engage in practitioner inquiry work. If the administration truly supports professional learning in through practitioner inquiry, they should make it a priority to assist teachers in having dedicated time available to design and implement their inquiry as well as for data assessment, reflections, and adjustments. Through this discussion, I suggest that ultimately the barriers of insufficient support, funding, and mental energy are all experienced through their own lens as well as represented through emphasizing the insufficient time barrier.

The barrier of insufficient time (Guskey, 2002) was also mentioned during discussions of the Wilcox SEF application process. The application process was consistently perceived as negative due to the length and intensity of the application itself. Izabella's interview illuminated that, not only was she unable to complete her application by the first two deadlines, but the application window reopened multiple times. If the reopening was due to a shortage of applications rather than their quality, it aligns with Izabella's and Chanley's experiences and suggests that time constraints served as a significant recruitment barrier. Professional learning programs could potentially address this by reevaluating their application processes, aiming to attract the same caliber of applicants more efficiently and less dauntingly.

Assertion 6 underscores the potential negative impacts of external barriers on self-efficacy within the context of professional learning, consistent with Bandura's (1977) self-efficacy theory. Encountering barriers such as insufficient time, energy, funding, and support can result in struggles with achieving successful performance outcomes, thereby decreasing

educators' self-efficacy. Although vicarious experiences and verbal persuasion are not explicitly

discussed in Assertion 6, observing colleagues successfully navigate these barriers, coupled with

receiving constructive feedback and encouragement, could enhance science teachers' beliefs in

their abilities. The assertion suggests that these barriers may cause stress and anxiety, leading to

negative emotional states that could decrease self-efficacy, underscoring the need for resources

to manage these barriers and foster positive emotional states. While goal-setting is not directly

mentioned, these barriers could impede science teachers' ability to set and achieve challenging

goals which is a key aspect of self-efficacy development. Therefore, Assertion 6 indicates that

addressing these barriers and offering appropriate support could be pivotal in bolstering teachers'

self-efficacy, aligning with Bandura's (1977) theoretical framework.

As described above, Assertion 6 describes barriers teachers face that prevent them from

engaging with professional learning, specifically underlining the interrelated factors of

insufficient time, mental energy, funding, and support. Elise and Georgette's case studies

illustrated their struggle with time constraints and high mental load, a concept becoming

increasingly discussed in educational literature and societal discourse. The impact of these

barriers extends to seeking out professional learning opportunities, as evidenced by the

application experiences of Izabella and Chanley.

Implications

Identifying barriers may prevent practitioner inquiry engagement, as referenced in

Assertion 6, offers substantial value for the evolution of professional learning practices in

science teacher education. By identifying insufficient time, mental energy, awareness, support,

and funding as impediments, we can better address these barriers when structuring future

professional learning programs. The crucial finding that four of these barriers - insufficient time,

mental energy, support, and funding - not only prevented GPS inquiry but also inhibited generalized practitioner inquiry, underscores their systemic nature in the education profession. A major implication of this finding is the need for a comprehensive approach to overcoming these barriers. Addressing these challenges may not just improve GPS-specific learning but could revolutionize the greater professional learning landscape. However, the feasibility of addressing these challenges, an ideal subject for future research, is yet to be determined.

This assertion's emphasis on mental load and time constraints, illuminated by the narratives of Elise and Georgette, compels us to acknowledge these factors in the design of professional learning experiences. These insights could inform more empathetic policies and practices in the scheduling and structure of professional learning programs. The advent of mental load discourse in education calls for further research and practical strategies to alleviate this stressor for teachers. The intersection of funding, support, and time suggests that a lack of financial resources and institutional support often manifests as time constraints for teachers. This understanding could encourage funding bodies and administrations to adopt measures that free up time for educators by adequately funding their endeavors and promoting supportive policies.

Financial support, as demonstrated by the Wilcox SEF program's stipend, is another area that future professional learning programs could incorporate into their design. The excitement generated by the substantial stipend underscores the potential impact of robust financial backing. This could lead to increased participation and retention of educators in these programs, ultimately enhancing the learning outcomes and efficacy of the programs themselves.

In terms of immediate implications, the Wilcox SEF application process could be modified to be less time-consuming and intense, while still maintaining a high standard for applicant selection. This approach could address the issues highlighted by Izabella and Chanley

during their recruitment process, making it less daunting for potential participants and potentially attracting a larger pool of high-quality applicants.

In short, Assertion 6 offers valuable insights into the complexities of professional learning engagement related to practitioner inquiry. Its findings argue for the adoption of participant-centric, comprehensive, and context-aware strategies in the design and implementation of professional learning programs. Addressing these identified barriers creates an opportunity to foster a more conducive environment for educators' professional growth.

Assertion 7: Awareness Barrier Prevented Prior GPS Engagement

As mentioned in Assertion 6, barriers including insufficient time, mental energy, funding, and support could prevent any practitioner inquiry, and thus any GPS project, from happening. However, one barrier specifically prevented participants front investigating their actual GPS goals prior to the Wilcox SEF program: a lack of awareness.

Evidence and Literature Connections

The iterative GPS goal selection process that the participants went through in the program resulted in a greater self-awareness of their professional learning needs. In my researcher journal, I recalled my high school U.S. History classroom. In giant cutout letters spanning the entire wall, just above the whiteboard, was my teacher's version of a famous Confucius quote. It said, "to know what one knows and to know what one does not know is the mark of one who knows." I connected this to the iterative process that took place for the participants to identify their GPS goals. To determine their GPS goals, the participants engaged in personal reflection, and then completed their GPS Brainstorming Document. After multiple feedback cycles between themselves and their assigned Wilcox mentor, the participants each submitted a GPS Proposal Document. However, in some cases, the goals were still modified

after this point. In my researcher journal, I wrote: "This iterative process allowed the participants to find out what they didn't know they didn't know. If they knew they needed to learn it right away, their final goals would match their brainstorming documents. They don't."

Assertion 7 highlights the role of self-awareness in professional development and its potential to strengthen self-efficacy, in alignment with Bandura's (1997) self-efficacy theory. The process of identifying areas of improvement and setting challenging goals in the GPS program likely results in positive performance outcomes, subsequently bolstering participants' self-efficacy. Though vicarious experiences are not explicitly mentioned in Assertion 7, observing peers successfully navigating the GPS process and addressing their own practice needs could enhance science teachers' beliefs in their abilities. Similarly, the likely presence of feedback in the iterative GPS process represents verbal persuasion, which could further boost participants' self-efficacy. The journey of identifying and resolving practice needs, while challenging, could elicit positive emotions and thereby enhance self-efficacy. Notably, the essence of Assertion 7 is anchored in setting challenging goals—a fundamental aspect of Bandura's (1997) theory. Consequently, the GPS process's emphasis on self-awareness and challenging goal-setting contributes to the reinforcement of science teachers' self-efficacy, paving the way for more effective learning and teaching practices. In short, it is not possible to address a need in your practice that has not been identified. It was the iterative GPS goal selection protocol that provided the crucial platform for the identification and subsequent successful resolution of these needs. This process, in turn, amplified the participants' self-efficacy.

Implications

Assertion 7 discussed an essential barrier that prohibiting participants from investigating their GPS goals before joining the Wilcox SEF program: a lack of awareness. This finding bears substantial relevance for understanding the role of self-awareness in enabling effective practitioner inquiry and shaping effective professional learning. This showcases the importance of introspection and iterative goal-setting processes in identifying gaps in science teachers' professional knowledge and skills. The Wilcox SEF program's approach, involving self-reflection, brainstorming, and multiple rounds of feedback with mentors, served to illuminate these colloquial "blind spots" in participants' practices.

This assertion also provides valuable implications for the design of professional learning programs. To enhance their effectiveness, programs should incorporate an iterative protocol for practitioners to identify and articulate their specific learning needs. Encouraging educators to discover what they "didn't know they didn't know" can lead to more targeted and beneficial learning experiences and allow for needs to be not just identified but also adequately addressed.

Assertion 7 affirms the value of introspective and iterative goal-setting processes in professional learning programs and calls for an emphasis on nurturing self-awareness within professional learning frameworks to enhance teachers' professional growth and competence.

Assertion 8: GPS as Interactive Practitioner Inquiry

The collaborative relationship between teachers and external experts, in the co-designing of a research focus, data collection, and evaluation, underpins the essence of interactive practitioner inquiry (Feldman, 2022). This aligns closely with the participant's experiences as they crafted and actualized their GPS project, effectively suggesting that engagement in GPS work is indeed a practice of interactive practitioner inquiry.

Evidence and Literature Connections

While the structure of the GPS work, as depicted by the model, clearly aligns with Feldman's (2022) definition of interactive practitioner inquiry, there are additional aspects of practitioner inquiry that also resonate within the framework of GPS program. As discussed in Chapter 2, practitioner inquiry is sustained, reflective, and autonomous in nature (Cochran-Smith & Lytle, 2009; Jacobs et al., 2015). The Wilcox SEF program is sustained in nature as it takes place over two years. The GPS portion of the Wilcox SEF program is one year in duration. Within this year, participants spend months developing and implementing their GPS project. Throughout that time, they work closely with their support systems to reflect on their data and its implications. Upon the conclusion of implementing their GPS and achieving their GPS goals, the participants spend well over a month sharing their knowledge through academic posters, portfolios, and presenting at poster symposiums. Considering that many professional learning opportunities are "superficial, episodic sessions" (Feiman-Nemser, 2012, p. 135) or "one-shot" (Knight, 2009, p. 18) workshops, the GPS project is sustained in nature.

As described in Assertion 7, the participants, who are teachers, engaged in an iterative process with external experts, assigned Wilcox SEF mentors, to identify their GPS goals and develop a proposal for implementation. However, the participants were directly responsible for the classroom action that took place to achieve their GPS goals. Elise's experience with her mentors, Keith and Dr. James, exemplifies this collaborative process, as they helped her to craft her goal of incorporating reality pedagogy into her curriculum. However, it was Elise alone who orchestrated the musical dance parties and BIPOC Scientist of the Month bulletin board in her classroom. Similarly, Chanley worked closely with Miranda and Rosie to articulate her plan of sharing argumentative discourse with other teachers, yet it was Chanley who independently

facilitated the workshop. Post-classroom implementation, the participants re-engaged with their affinity groups and mentors to process and evaluate the data and deliberate implications for future action. This ongoing engagement with the support systems emphasizes the iterative and interactive aspect of the practitioner inquiry process.

When considering the GPS model, as seen in Figure 2, in the Realization Phase, the participant consulted other teachers, and in the Development Phase, the participants worked alongside their Wilcox mentors. Participants typically entered the Overwhelm Phase when they are working solo, before collaborating with their assigned affinity groups and mentors again as they moved throughout the Homeostasis, Ramp, and Launch Phases. The importance of this re-engagement with support systems was addressed in Assertion 5.

As defined in Chapter 2, practitioner inquiry refers to the "systematic and intentional study of an educator's own professional practice" (Jacobs et al., 2015, p. 375). All participants joined the Wilcox SEF program with a clear intention to enhance their teaching practice and science leadership skills. The systematic approach was maintained as they navigated the structured framework of the GPS project, with designated milestones and opportunities for reflection interspersed throughout.

This study also revealed that participants could not define practitioner inquiry until it was explicitly outlined, as presented in Chapter 2, during their second interview. Once they were familiarized with the concept, they immediately associated their GPS work with practitioner inquiry. Following this realization, many participants also recognized informal practitioner inquiry instances throughout their teaching careers. This finding illuminates a potential gap in the participants' educational foundation. Whether through their formal degree work, alternative certification programs, or professional learning experiences, their educational background did

not sufficiently incorporate or emphasize the terminology of practitioner inquiry.

Assertion 8 underscores the role of practitioner inquiry in professional learning, and its recognition can enhance science teachers' self-efficacy, drawing from Bandura's (1997) self-efficacy theory. The participants' ability to identify their work as practitioner inquiry upon learning the terminology likely led to a sense of achievement, a positive performance outcome that could support their self-efficacy. While not explicitly stated, the GPS program's collaborative design could offer opportunities for vicarious experiences, as the science teachers observed their peers and external experts, further solidifying their belief in their capabilities. The collaborative process likely includes verbal persuasion in the form of feedback and encouragement, which would also contribute to heightened self-efficacy. This assertion implies that educators may experience positive emotions upon realizing their engagement in practitioner inquiry, thereby reinforcing their self-efficacy. This newfound understanding could motivate the participants to set more challenging goals, the achievement of which could further enhance their self-efficacy. Assertion 8 aligns well with Bandura's (1997) theory, suggesting that recognizing and understanding one's engagement in practitioner inquiry, particularly within a collaborative context, can significantly foster self-efficacy among science teachers.

To briefly summarize, the GPS collaborative design process, involving teachers and external experts, embodies interactive practitioner inquiry. Upon learning the terminology of practitioner inquiry, all participants quickly recognized their GPS work as such. Additionally, they retrospectively identified instances of practitioner inquiry in their previous teaching experiences. This realization exposed a gap in their formal educational experiences, where the terminology of practitioner inquiry was not sufficiently emphasized.

Implications

Assertion 8 offers notable implications for the field of science teacher education, particularly in shaping teacher preparation programs and professional learning experiences. It demonstrates a necessity to integrate the concepts and practices of practitioner inquiry more explicitly into educational curricula. Given that practitioners could identify their GPS work as practitioner inquiry after understanding its definition, it suggests that they may already possess the intrinsic skills and instincts for such work but lack the terminology and theoretical framework to recognize it. An implication of recognizing and naming practitioner inquiry is the potential it holds for legitimizing and advocating for this form of work within educational institutions.

Understanding practitioner inquiry not just as an incidental activity, but as a deliberate, academically recognized practice, provides educators with a powerful tool for negotiation and advocacy. Teachers, once aware of the academic grounding and potential benefits of practitioner inquiry, can draw upon relevant literature and research to build a compelling case for support from their administration. They can illustrate how practitioner inquiry ties into established frameworks for effective teaching and learning, and how it aligns with broader educational goals such as continuous improvement, reflective practice, and learner-centered pedagogy. By making this case, science teachers may be more successful in securing necessary resources such as dedicated time, funding, or logistical support for to engage in formal inquiry work. Furthermore, the recognition of practitioner inquiry can contribute to a culture shift within educational institutions, placing greater value on teacher-led research and innovation. This shift could have far-reaching impacts, helping to bridge the gap between research and practice, encouraging a

culture of lifelong learning among teachers, and ultimately leading to enriched learning experiences for students.

Assertion 8 also highlights the potential for greater self-awareness among educators about their professional practices. By having a clear understanding and recognition of practitioner inquiry, teachers may be better positioned to deliberately engage in such inquiry and to articulate and share their findings more effectively with their peers and the wider educational community. Recognizing these activities as legitimate and valuable forms of inquiry can validate and encourage such practices, thereby promoting an ongoing culture of professional learning and reflective practice.

Overall, Assertion 8 underscores the need for explicit integration of practitioner inquiry concepts and practices in teacher preparation and professional learning experiences. Upon recognizing their GPS work as practitioner inquiry, practitioners gain the ability to advocate for support and resources by referencing academic literature on the subject. Moreover, this understanding promotes self-awareness among educators regarding their professional practices, enabling them to engage more deliberately in inquiry, share their findings, and foster a culture of continuous professional learning and reflective practice.

Assertion 9: Future Engagement with Practitioner Inquiry

This study revealed all participants intended to engage in future practitioner inquiry projects. Their expressions were indicative of their positive experience with their GPS projects and of their recognition of the benefits of practitioner inquiry with respect to their professional growth and student outcomes.

Evidence and Literature Connections

All participants expressed clear intentions to continue their practitioner inquiry journey in one form or another. Georgette, Izabella, Chanley, and Elise all expressed an intent to work on a continuation of their GPS projects. Shari hoped to engage in new areas of interest, supporting others in their practitioner inquiry endeavors. Their intentions highlight the transformative nature of their GPS experiences. Georgette credited her engagement in practitioner inquiry for a significant increase in her confidence. Their determination to continue this work underlines their belief in the value of practitioner inquiry, not just as an approach to problem-solving but also as a way of professional learning.

Assertion 9 underscores the participants' successful completion of their GPS projects and intent to continue with their practitioner inquiry work, both of which reflect positive performance outcomes. According to Bandura's (1977) self-efficacy theory, these successful experiences should significantly enhance the participants' self-efficacy, as they have demonstrated competency through their successful inquiry work. The collaborative nature of the GPS projects suggests the potential for vicarious experiences, where observing peers' successes and challenges could strengthen participants' resolve to continue their practitioner inquiry. Verbal persuasion, in the form of feedback and encouragement received during the projects, coupled with positive self-reflection, would also boost participants' self-efficacy. Assertion 9 also implies positive emotional states associated with project completion and future commitment, which supports self-efficacy. The participants' decision to persist with their practitioner inquiry work embodies the setting of challenging goals, an aspect Bandura (1997) identifies as characteristic of individuals with high self-efficacy. The questions raised in Assertion 9, such as the long-term effects of programs on teachers' self-efficacy and the impact of practical factor is also supported by

Bandura's (1997) view of the reciprocal interaction between individuals and their environment. Ultimately, science teachers' self-efficacy beliefs are influenced by and influence their broader professional context.

The participants' intent to engage in future practitioner inquiry underscores the impact of their GPS work on their perspectives towards their teaching practices, their self-efficacy, and their commitment to their students' learning. Nevertheless, the question remains: will their teaching commitments allow them to continue this work, and will they be able to find the necessary support for their future practitioner inquiry endeavors? These questions could provide rich directions for future research.

Implications

Assertion 9 brings to the forefront an important implication: that effective engagement in practitioner inquiry, such as through GPS projects, can significantly influence science educators' professional orientations and their commitment to continual learning and improvement.

The unanimous intention of participants to engage in future practitioner inquiry projects is a strong endorsement of the GPS experience and the benefits it offers to both teachers and their students. This finding strongly suggests that educational entities, from science teacher preparation programs and professional learning providers to districts and schools, should seriously consider integrating a cohort-style practitioner inquiry model into their educational processes.

The GPS model developed in this study could serve as a helpful blueprint for those interested in implementing practitioner inquiry projects. It would enable them to anticipate the challenges and easier moments of the practitioner inquiry journey and to provide the necessary support for their teachers during these times. Additionally, they could also make use of the

findings from this study to design and implement effective recruitment strategies and to alleviate potential concerns about the ability to succeed in practitioner inquiry work.

It is crucial to note that while the GPS work aligns with the principles of practitioner inquiry, it was undertaken within a two-year cohort-style fellowship program, suggesting that the program structure, support mechanisms, and community of practice were integral to its success. Therefore, for those who are considering or who have tried to implement practitioner inquiry projects, it would be beneficial to reflect upon these elements and ensure their presence in their practitioner inquiry initiatives.

Assertion 9 highlights the positive influence of effective engagement in practitioner inquiry on teachers' professional learning and their commitment to continual learning. The participants' unanimous intent to engage in future inquiry projects strongly endorses the GPS model, advocating its adoption in educational entities. This assertion underscores the value of structured support and cohort-style fellowships in facilitating successful practitioner inquiry projects.

Future Studies

In response to the insights gleaned from this study, there are several avenues for future research that could extend and deepen our understanding of the various themes emerging from this study.

Continued Engagement in Practitioner Inquiry

Future studies could investigate whether participants engaged in subsequent practitioner inquiry projects, as per their stated intentions. If so, it may be useful to explore the areas of practice they chose to improve and see if those areas aligned with their former practitioner inquiry work. If the participants did not fulfill their intent, it would be beneficial to study the

barriers that hindered their engagement. Such studies could extend longitudinally to assess

whether removing identified barriers subsequently influenced participants' involvement in

practitioner inquiry.

Equity, Bias, and Inquiry Practices

Research into the impact of changes made to lesson plans, following workshops on bias

and equity facilitated by Izabella as part of her GPS work could provide valuable insights.

Similarly, a study examining the likelihood of teachers implementing argument-driven inquiry

into their curriculum, following workshops led by Chanley, could shed light on any influence

this new pedagogical approach had on student outcomes. Another possible direction for future

research could involve developing and implementing professional learning programs that

addressed the professional learning needs identified in this study. This could entail workshops or

courses designed to address bias and promote equity in classroom settings as well as sessions

focused on enhancing teachers' questioning techniques and argumentation skills. Once these

programs are in place, a subsequent study could evaluate their effectiveness and impact,

exploring how these targeted learning experiences influence teachers' practices and, in turn,

student outcomes.

Comparative Analysis of Practitioner Inquiry and Action Research

Future research might delve into a comparative analysis between action research and

practitioner inquiry professional learning programs. An associated study could also investigate

whether raising awareness about practitioner inquiry and its benefits influences teachers'

likelihood to engage in this practice. As mentioned in Chapter 5, there was a difference in some

participant's awareness of the terminology practitioner inquiry and the terminology action

research. It would be worthwhile to exploring the nuances between these two forms of

professional learning programs. Additionally, it would be beneficial for a future study to address if increasing awareness of practitioner inquiry, and its benefits, positively influences the likelihood of teachers to engage in practitioner inquiry.

Terminology Evolution

Related to the terminology nuances between practitioner inquiry and action research, a potential tangential study could explore any shifts in professional learning terminology, particularly the distinctions and usage between 'professional development' and 'professional learning.' Throughout the dissertation, I have deliberately employed the term 'professional learning' to describe the active engagement of participants in their learning process. Notably, much of the literature cited in this dissertation pertaining to professional learning used the term 'professional development.' Prior to Scherff's (2018) proposal to use 'professional development' as a noun and 'professional learning' as a verb, the widely accepted, all-encompassing terminology was 'professional development.' A future study could explore whether subsequent literature adopts Scherff's (2018) distinction between the active sense of 'professional learning' and the more passive notion of 'professional development,' or if the terms continue to be used interchangeably with 'professional development' remaining the dominant term.

Scalability of the GPS Model

Given the positive experience and benefits of the GPS work, future studies could explore the scalability of the GPS projects and the Wilcox SEF program across different disciplines or even sectors beyond education. Such a study on the inclusive tenets of practitioner inquiry and effective professional learning in other sectors may offer value for professionals in a wide array of fields, including medicine, law, technology, business, and more.

Corporate Citizenship and Professional Learning

In recent times, there has been a growing demand for large corporations and universities to engage in corporate citizenship (Nagy & Robb, 2008; Windsor, 2001). The successes of the Wilcox SEF program, sponsored by a multinational information technology company, provides compelling evidence for the potential impact of this kind of corporate involvement in professional learning. This should encourage other companies, regardless of their industry, to support similar initiatives. Future studies could further explore how corporations can effectively support professional learning for educators, particularly through the practitioner inquiry model. Moreover, enhancing awareness of the value of autonomous professional learning through practitioner inquiry within the educational sector, as well as its potential scalability, would also be a valuable avenue for future research.

Awareness and Formal Education of Practitioner Inquiry

Given the emphasis Assertion 8 placed on the need for explicit integration of practitioner inquiry concepts in teacher preparation and professional learning experiences, future research should investigate the effectiveness of such integration. A possible study could examine how a structured introduction to practitioner inquiry concepts in professional learning programs affects educators' understanding and implementation of these practices. The investigation could also assess whether this explicit education improves teachers' abilities to advocate for support and resources, enhances their self-awareness regarding their professional practices, or encourages a culture of ongoing learning and reflective practice.

Summary of Future Studies

A variety of potential future research studies are proposed based on the findings and implications of this study. One proposed area of focus is continued engagement in practitioner

inquiry. I suggest that studies should examine whether the participants of this study engaged in subsequent practitioner inquiry projects. If they did not, studies should investigate what barriers hindered their engagement, and whether these barriers can be overcome. Another proposal calls for further exploration into the effects of workshops focused on bias, equity, and argument-driven inquiry. Such studies could measure the impact of these workshops on teacher practices and student outcomes, and potentially lead to the development of targeted professional learning programs.

The possibility of conducting a comparative analysis between action research and practitioner inquiry is also proposed, investigating the nuances between these professional learning programs and whether increased awareness of practitioner inquiry influences teacher engagement. Another potential avenue of research is the evolution of professional learning terminology, specifically, the usage and distinction between 'professional development' and 'professional learning.' The study also calls for an exploration into the scalability of the GPS program, examining if it can be expanded beyond the educational sector and into different professional fields. Given the growing demand for corporate citizenship, future studies could explore how corporations can effectively support professional learning for educators and promote the practitioner inquiry model.

Finally, future research could examine the effectiveness of explicit integration of practitioner inquiry concepts in teacher preparation and professional learning experiences and assess whether such an approach fosters a culture of continuous learning and reflective practice among educators. These proposed future studies emphasize the ongoing need for thoughtful, intentional research in these areas to continue advancing our understanding and implementation of effective professional learning in diverse contexts.

Conclusion

The focus of this study was to conceptualize the experiences of fellows within the Wilcox SEF program, seeking a deeper understanding of how they perceived and navigated their professional learning journey while designing and implementing an autonomous growth plan system. It became evident that their journey through the fellowship program was a dynamic and multifaceted process, characterized by challenges, iterative learning, and significant personal and professional growth. The fellows overcame barriers such as insufficient time, lack of mental capacity, inadequate administrative support and funding, and a lack of awareness through leveraging both formal and informal support systems. Despite these barriers, their experience was beneficial and revealed a promising inclination among the fellows to continue engaging in practitioner inquiry work.

Understanding these fellows' experiences empowers us to devise more effective and responsive professional learning programs. The fellowship has shed light on the power of practitioner inquiry as a catalyst for professional growth, and the potential of such a model to be adopted more widely in teacher preparation and professional learning experiences. Encouraging partnerships that provide dedicated time, advocacy, and resources for such professional learning experiences could amplify educators' self-awareness and efficacy, nurture an ethos of continuous learning and reflective practice, and promote equitable access to high-quality science education for all students. This study highlights the potential of this transformative approach to professional learning, thereby laying a solid foundation for future research and practice in this field.

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Appendix A: Email Requesting Participants

Research Participants Needed!

Must be a secondary science teacher in the Mountain, Plains, or Pier County School System and be in the second year of the USF Wilcox Science Education Fellowship Program

Curriculum and Instruction Study
University of South Florida

This research (IRB STUDY #004151) aims to investigate Wilcox Science Education Fellowship growth plan system projects performed by Pier County secondary science teachers. Your experiences, perceptions, and beliefs regarding teaching, science, and teaching science are important to this research.

Your expected voluntary contribution will be participating in two interviews, spread out with one occurring early May and one occurring in early June. Each interview will take approximately one hour and will be conducted remotely via Zoom software at a time mutually agreed upon by you and the researcher. Continued participation in the study is at your discretion. Please e-mail dnkelly@usf.edu for additional information.

Thank you!

Appendix B: IRB Approval letter

UNIVERSITY of SOUTH FLORIDA

APPROVAL

May 4, 2022

Daina Kelly
4202 E Fowler Ave
Tampa, FL 33620

Dear Ms. Daina Kelly:

On 5/3/2022, the IRB reviewed and approved the following protocol:

Application Type:	Initial Study
IRB ID:	STUDY004151
Review Type:	Expedited 5, 6, 7
Title:	Autonomous Professional Learning through Practitioner Inquiry in the Science Classroom: A Study of Growth Plan System Experiences
Approved Protocol and Consent(s):	• IRB Protocol - Version 1 - 05.02.22.docx; • Interview Consent - Version 1 - 04.25.22.pdf; Approved study documents can be found under the 'Documents' tab in the main study workspace. Use the stamped consent found under the 'Last Finalized' column under the 'Documents' tab.

Your study qualifies for a waiver of the requirements for the documentation of informed consent for interviews as outlined in the federal regulations at 45 CFR 46.117(c).

Within 30 days of the anniversary date of study approval, confirm your research is ongoing by clicking Confirm Ongoing Research in BullsIRB, or if your research is complete, submit a study closure request in BullsIRB by clicking Create Modification/CR.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

Jennifer Walker
IRB Research Compliance Administrator

Institutional Review Boards / Research Integrity & Compliance
FWA No. 00001669
University of South Florida / 3702 Spectrum Blvd., Suite 165 / Tampa, FL 33612 / 813-974-5638
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Appendix C: Semi-Structured Interview Protocol 1

General Information:
Interviewer (Researcher): Daina Kelly   Interviewee (Participant):_____

Date:_____ Start Time:_____   End Time:_____

Introduction:

First, I would like to thank you for participating in this study. I am looking forward to discussing your professional learning history, experience in the Wilcox SEF program, and specifically your growth plan study. Through these interviews, I hope to learn about your personal journey in the field of education, including workplace experiences, professional learning experiences, and the Wilcox SEF program experience specifically.

We will follow a semi-structured protocol for the interviews. This means that although I have some questions pre-generated, I may ask you further follow-up questions based on your responses. You are also welcome to ask me questions or make additional comments at any time during the interviews.

I want to assure that anything you say in these interviews will be kept completely confidential. I will not share any information that could be used to identify you in my findings or anything else I write. I will not include anything in my write up that you are not comfortable with me including. I would like to record our interviews so that I have an accurate account of our conversations. Is this okay?

For this first interview, I am going to ask you about your background, teaching experiences, and history with professional learning. Do you have any questions before we begin?

Question Prompts:

The first set of questions is about your education, and why and how you became a teacher.

1. Tell me about schools you attended from preschool or elementary school throughout your highest degree.
2. How did you get certified?
3. Why did you decide to become a teacher? Was that your initial career goal? If not, why did you change?
4. Can you walk me through your teaching career from where you were to where you are now?

5. Have you held any leadership positions, formal or informal, along your teaching career?

I'm now going to ask you some questions about previous professional development opportunities that you've had.

6. Excluding the Wilcox SEF program, because we will get to that in a minute, I would like for you to tell me a bit about the professional learning opportunities your schools have provided for you. Clarify locations, costs, topics, engagement style.
7. Tell me about the professional learning opportunities you sought out for yourself. Clarify locations, costs, topics, engagement style.
8. What would effective, helpful professional learning/professional development look like for you?
9. How did you find out about the Wilcox SEF program, and what made you want to apply? Did the stipend influence your decision to apply at all?
10. Once you were accepted to the WSF program, but before you started in it, did you have any preconceived notions or expectations about what your experience would be like in the program? Any concerns, fears, hopes?
11. Would you have gone through the Wilcox SEF program if it cost money instead of offering a stipend?
12. If so, how much would you be willing to pay?
13. Do you think you would have gone through the program if it was free, but you did not receive a stipend?

I'm now going to ask you some questions about deciding on your GPS topic.

14. Before you entered Year 2 and began to design your growth plan system, did you have any preconceived notions about it?
1. Any concerns, fears, hopes?
15. I'd like to talk specifically about how you arrived at your GPS project. First, what is the topic or title of your current GPS?
1. Can you tell me about your project?
16. Did you have any ideas for GPS projects before deciding on this one?
1. What made you decide on this topic?
17. Did you have a desire or try out your GPS topic prior to this experience?
1. If so, what are the reasons that you did not engage in this before now?
18. Describe how content knowledge impacts your job.
19. Are you familiar with the terms "action research" or "practitioner inquiry?" If so, how would you describe those terms?

Closing:

I have learned a lot from our conversation today. Thank you again for taking the time to participate in this interview and for your willingness to share. Do you have any questions for me before we end this interview and schedule our second interview?

Appendix D: Semi-Structured Interview Protocol 2

General Information:
Interviewer (Researcher): Daina Kelly   Interviewee (Participant):_____

Date:_____ Start Time:_____ End Time:_____

Introduction:

Thank you for meeting with me again. For this second interview I would like to ask you more about your experience in Year 2 of the Wilcox SEF program and completing your GPS project, your overall Wilcox SEF program experience, and some final thoughts on professional learning. As a reminder, we will follow a semi-structured protocol for this interview. Feel free to stop me anytime to ask questions or make comments. I also want to remind you that anything you say will be kept confidential. Are you okay with me recording again? Do you have any questions before we begin?

Question Prompts:

The first set of questions I am going to ask you is about completing your GPS project.

1. How did finishing your project go?
   a. What were your GPS project results / What did you find out?
2. Tell me about your experience creating the poster to present your GPS project.
   a. How did you decide what to include?
   b. Any moments of difficulty or ease?
3. How comfortable were/are you presenting your work?
4. Has this made you more or less likely to present your work to others in the future?
5. What worked well for you in the GPS program? Can you describe it?
6. Have you faced any difficulties (challenges or concerns) in carrying out your GPS project?
   a. If yes, can you elaborate?
      i. How did you work through this situation?
      ii. Who did you talk to about the situation?
      iii. Do you seek help from or talk about this with another colleague in the WSF program (if yes, did this occur during a scheduled WSF meeting or outside of that time), someone at your school that is not in the WSF program (if yes, did this occur during the school day or outside of that time), someone in the teaching field but not at your school or in the WSF program, or someone who is not associated with either the WSF program, school, or teaching field?
      iv. If yes, what is the advice they give you? How do you find their advice?
      v. Did you use any other resources?

b. If no, what are some of the challenges that you foresee?
7. How has the GPS program compared to other types of professional learning experiences you have had?
   a. What was better or worse about it?

The next set of questions I am going to ask you is about practitioner inquiry.

8. In the last interview, I asked you if you were familiar with the terms "action research" or "practitioner inquiry." From our transcript, you explained them as "....." Do you still agree with that comment or is there anything you would like to add or change about your explanation?
9. In the past two interviews I asked you about the terms "action research" and "practitioner inquiry?" Do you feel that you have engaged in action research or practitioner inquiry through completing this GPS project?
   a. Had you engaged in any formal or informal practitioner inquiry prior to this?
      i. If yes, can you describe those inquiries?
   b. Has this experience made you more or less likely to engage in formal or informal practitioner inquiry in the future?
      i. If yes, why?
      ii. If yes, do you think this experience has made you more likely or less likely to present future work to others in the future? Why?
      iii. If no, why?
      iv. If no, is there anything else that may make you more likely to engage in formal or informal practitioner inquiry in the future?
10. Do you consider action research or practitioner inquiry to be an effective outlet for professional learning?
    a. Are there any other examples of professional learning opportunities you think may be more valuable or less valuable to your practice than practitioner inquiry?

I am now going to ask you about how the Wilcox SEF program may have affected your practice as a science teacher or science teacher leader.

11. After completing the WSF program, do you feel you are more or less likely to be outspoken with issues facing your classroom, school, or the education system in general? Why?
12. After completing the WSF program, do you feel you are more or less likely to seek out leadership opportunities within your department, school, or the education system in general?
    a. If yes, formal or informal opportunities? Why?
    b. If no, why?
13. Has participation in the Wilcox SEF affected how you see teaching science as a long-term career? Explain.
14. Has your participation in the Wilcox SEF program influenced your science instructional practices or content knowledge?
    a. If yes, how? Was that more a result of the CCLS, GPS, or both?
    b. If no, is there anything you can think of that would influence your instructional practices or content knowledge?

Closing:

Is there anything we have not discussed that would help me to better understand your journey in the Wilcox SEF program, especially as it relates to the GPS project, or your beliefs on professional learning opportunities or practitioner inquiry?

Thank you again for spending your time letting me talk to you about your experiences in the Wilcox SEF program. I have learned so much from you. When I have finished analyzing my data, I will share my interpretations with you and make any necessary adjustments. Please remember you can always reach out to me as well if you think of anything you would like me to know. Do you have any final questions for me before we end the interview?