THE PREDICTIVE RELATIONSHIP BETWEEN ELEMENTARY PRE-SERVICE TEACHER PRAXIS SUBJECT ASSESSMENT SCORES AND PEDAGOGICAL KNOWLEDGE

by

Miranda L. Arnold

Liberty University

A Dissertation Presented in Partial Fulfillment
Of the Requirements for the Degree

Doctor of Philosophy

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APPROVED BY:

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ABSTRACT

The purpose of this study was to examine the relationship of elementary pre-service teachers’ pedagogical knowledge with the predictor variable of content knowledge. This quantitative, correlational study measured content knowledge through the Praxis Subject Assessment – Elementary Education: Multiple Subjects scores, including the four subtests: Reading and Language Arts, Mathematics, Social Studies, and Science. The criterion variable of pedagogical knowledge was obtained through the scores from the Candidate Preservice Assessment of Student Teaching Form. Scores from the two assessment instruments for 167 elementary education pre-service teachers were collected through archived data from one educator preparation program. A multiple regression analysis demonstrates a lack of sufficient evidence to support a significant predictive relationship of the linear combination of the four subtests on elementary pre-service teachers’ pedagogical knowledge or performance.

Keywords: educator preparation program, Praxis Subject Assessment, content knowledge, pedagogical knowledge, dispositions, Candidate Preservice Assessment of Student Teaching Form, accreditation
Dedication

The work behind this dissertation is dedicated to my niece and nephews and all the littles that call me Aunt Randa. May you always know the value of being a life-long learner and know you have my eternal support as you work toward your dreams and goals. Enjoy what is ahead for you!! “The Lord bless you and keep you; the Lord make his face shine on you and be gracious to you; the Lord turn his face toward you and give you peace” (Numbers 6:24-26).
Acknowledgements

I have often admitted that it takes a village to raise Miranda. That is just as true for the accomplishment of this dissertation and doctoral study. Thank you often feels insufficient; if there were more eloquent and deeper words to express my gratitude and thanksgiving, now would be an appropriate moment for those words.

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List of Abbreviations

Analysis of Variance (ANOVA)

Candidate Preservice Assessment of Student Teaching (CPAST)

Council for the Accreditation of Educator Preparation Program (CAEP)

Educational Testing Service (ETS)

Georgia Assessments for the Certification of Educators (GACE)

Interstate Teacher Assessment and Support Consortium (InTASC)

National Center of Education Statistics (NCES)

National Teacher Examination (NTE)

Performance Assessment for California Teachers (PACT)

Statistical Package for Social Sciences (SPSS)

Teacher Performance Assessment (edTPA)

Variation Inflation Factors (VIF)
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CHAPTER ONE: INTRODUCTION

Overview

Chapter One will provide a background of the historical and theoretical nature of teacher licensure assessments, as well as a description of the problem, purpose, and significance of the study. A set of definitions related to the study will conclude Chapter One.

Background

Every year colleges and universities produce hundreds of thousands of pre-service teachers. The U.S. Department of Education (2016) calculated an approximate 460,000 pre-service teachers were registered in a teacher certification program during the 2013-2014 academic year, which is a detrimental loss for the field of education from 2009 having about 691,000 pre-service teachers enrolled in teacher education (Berry & Shields, 2017). This equates to a 35% decrease (Berry & Shields, 2017). Of those hundreds of thousands of pre-service teachers currently registered, approximately 100,000 begin their careers as new teachers in public education each year (Goldhaber, Cowan, & Theobald, 2017). Pre-service teachers are students enrolled in an educator preparation program, pursuing a state teaching licensure. Teacher licensure, as defined by Jones, McDonald, Maddox, and McDonald (2011) is “a certificate which allows the recipient to teach others in a classroom setting” (p. 907). To obtain a teaching license, a pre-service teacher must fulfill a number of qualifying tasks, including high-stakes licensure assessments, which ultimately are intended to measure what teachers should know in their subject content field (Gitomer & Zisk, 2015; Jones et al., 2011; Maddox & Reglin, 2019; Wahl, 2017). Assessments evaluate both content knowledge and pedagogical knowledge. High-stakes assessments are considered consequential for licensure, meaning a pre-service teacher must meet all licensure test regulations to be eligible for licensure. Lankford, Loeb,
McEachin, Miller, and Wyckoff (2014) found that since 1999, increased subject matter competency has been demonstrated by those entering into the teaching workforce, as compared to previous generations of new teachers, particularly those holding a teaching license.

**Historical**

Shulman (1986) summarized the historical progression of teacher examinations, stemming from 1875 where the California Teachers Examination had a large, prominent focus on content knowledge and a minuscule reflection of pedagogy. Teacher assessments at that early stage in teacher preparation were constructed and managed at regional and state levels. The National Teacher Examination (NTE) was crafted in the 1930s, and Gitomer and Zisk (2015) suggested that the NTE was the inaugural assessment used nationally for teachers, particularly one that was supported with scholarly research. In the 1980s, teacher assessment transitioned to prioritize pedagogy over content (Shulman, 1986), though some education researchers advise not to lose complete sight of the value of content knowledge for teachers (Barker & Conley, 2014). Maddox and Reglin (2019) reported that in 2000, the NTE was reconstructed as the Praxis Series. With the continued waver of balance between the two assessment foci, the two primary categories of pre-service teacher assessment are content knowledge assessment and pedagogical knowledge assessment. Various measures, ultimately designed to add rigor and accountability, are available to describe and rank the pre-service teacher’s content knowledge and pedagogical knowledge and performance, which are qualifiers for a teaching license.

The job market for teachers can often be viewed as having momentum reflective of a pendulum swing. Currently, that pendulum leans toward teacher shortage for much of the United States (Sutcher, Darling-Hammond, & Carver-Thomas, 2016). In fact, at least 48 states reported some type of teacher shortage (Berry & Shields, 2017; U.S. Department of Education Office of
Postsecondary Education, 2017). While endorsement area shortages may vary by region (Aragon, 2016; Berry & Shields, 2017), teacher shortage across the nation has strained the school community and drawn concern for student achievement (Martin & Mulvihill, 2016). Though many states have resolved to fill classrooms with individuals not yet licensed, usually still working through their educator preparation program, in order to confront the teacher shortage dilemma, those same states recognize this to be an ineffective resolution when considering teacher longevity and student achievement (Berry & Shields, 2017; Walker, 2013). Berry and Shields (2017) called this “rushing new recruits into the classroom” (para. 4). As just one state’s example, California documented at least 10,000 teachers across the states in the 2015-2016 school year were in the classroom without proper preparation and licensure (Berry & Shields, 2017). Research presents several reasons for the root and growth of teacher shortage: increased score requirements on licensure assessments (Berry & Shields, 2017; Shuls, 2018), low salary (Martin & Mulvihill, 2016), and low teacher retention (Herman, Hickmon-Rosa, & Reinke, 2018; Wronowski, 2017).

With a pattern of increased accountability in PreK-12 education, teacher preparation programs have also been affected by the regulations of numerous licensure assessments for future teachers, often regulated to some degree by the U.S. Department of Education (Mahoney, 2015; Wahl, 2017) and trickled down through national, state, regional, and even program-specific guidelines. Though there are alternative means to becoming a licensed teacher, such as the Career Switcher Alternative Route to Licensure Program offered through the state of Virginia (Virginia Department of Education, 2019), the most common route is through a traditional education program, which would follow the regulations of licensure assessment. Goldhaber et al. (2017) estimated approximately 75% new teachers each year were trained through traditional
education preparation programs as compared to those completing some other alternative route. Tilley (2014) defined a traditional, undergraduate student as falling into the age category of 18-24. By contrast, then, a non-traditional student are 25 years old or older, though Tilley (2014) provided a disclaimer that this age categorization may vary from study to study and may also be impacted by a number of other factors.

Increases in assessment expectations of pre-service teachers create additional obstacles for obtaining a teacher license and also add further pressure and responsibility on educator preparation programs to ensure their pre-service teachers are not only prepared for classroom instruction but also are fully equipped with the competencies to pass the necessary assessments (Wahl, 2017). As a culminating descriptor of licensure and certification expectations, Irby and O’Sullivan (2018) addressed these components as professional standards for teachers.

There are a number of factors that influence achievement on standardized assessments that measure both content knowledge and pedagogical knowledge. Some of those areas include pre-service teacher demographics (Anis, Krause, & Blum, 2016; Elpus, 2015; Kula & Tasdemir, 2014; Lankford et al., 2014; Petchauer, 2015; Russell & Davidson Devall, 2016; Stewart, Coombs, & Burston, 2016), self-efficacy (Kula & Tasdemir, 2014; Liou et al, 2017), faith-based integration and worldview (Critchfield, 2018; Logan, 2014), and the pre-service teacher’s educator preparation program (Petchauer, Baker-Doyle, Mawhinney, & Ciarkowski, 2015). Similar to PreK-12 education, there are concerns that demographics, most notably gender and race/ethnicity, may impact pre-service teacher assessment results and therefore impact teacher licensure eligibility (Petchauer, 2016). Teacher licensure eligibility would then highly define the teacher population pool.
Elpus (2015) found that White pre-service teachers outperformed their Black peers on the Praxis administration for music, one licensure assessment series, and in the same study discovered that male pre-service teachers scored well above their female counterparts.

In conjunction with a course focused on social justice, Critchfield (2018) examined the effect a biblical worldview had on a pre-service teacher’s perception of social justice and how that adapted the pre-service teacher’s pedagogical knowledge through better understanding the needs of the classroom learners as a whole and the needs of the learners on an individual level.

Understanding how these factors impact the pool of quality pre-service teachers and longevity of pre-service teachers, educator preparation programs have been tasked with digging deeper to analyze the available data, including licensure assessments, to generate sustainability of future teaching generations.

The number of required assessments, though varied by state and endorsement area, has seen drastic changes over the years, including increased score requirements (Shuls, 2018), and has certainly added a new level of complexity to the pursuit of teacher licensure. Wahl (2017), on behalf of those opposed to the increase of accountability for upcoming teachers, expressed concern about the financial implications of such assessment. The concern originates in the fact that private organizations are making a profit for a public-based teaching license, such as pre-service teachers having to pay large costs for high-stakes licensure assessments (Wahl, 2017). Greenblatt’s (2019) study participants, including both pre-service teachers and teacher educators, also shared frustration related to the cost investment of the high-stakes assessments. Despite a number of oppositions and continued debates regarding standardized testing for pre-service teachers (Wahl, 2017), the role of licensure assessments continues.
One of the measurements to determine the potential of a pre-service teacher to be successful is the Praxis Series of assessments provided through the Educational Testing Services (ETS, 2019), which consists of three main testing administrations: Praxis Core Academic Skills for Educators (Core), Praxis I Pre-Professional Skills Tests (PPST), and the Praxis II Subject Assessments (Mahoney, 2015). The first two assess more foundational knowledge in reading, mathematics, and writing that is considered relevant and applicable to all teaching fields. The latter, previously known as the Praxis II and now known as the Praxis Subject Assessment, is a measure used across the nation with more than 40 states and U.S. territories participating in the testing requirements to analyze an individual’s content knowledge in a more rigid and defined content area (ETS, 2019; Mahoney, 2015). Specific assessment versions and passing scores vary from one state to the next (ETS, 2019). The ETS (2019) claimed the Praxis Subject Assessment is a collaborative instrument developed by experts in the education field who provide input for test content based on what they deem as being most appropriate for beginning teachers. The validity and reliability of the various Praxis Subject Assessments are documented through the *ETS Standards for Quality and Fairness* (ETS, 2015).

To better prepare for the Praxis Subject Assessment and prepare for classroom instruction, pre-service teachers take pedagogy classes, or methods classes, in their education preparation program where they explore how to teach the content knowledge through effective instructional strategies in addition to or as a supplement to content-based courses. Most recently, a new form of assessment has been developed, called the Candidate Preservice Assessment of Student Teaching (CPAST) Form to measure a pre-service teacher’s classroom performance (The Ohio State University, 2019). Though the specific framework and implementation varies from one educator preparation program to the next, student teaching is the “extensive and
substantive clinical practice in P-12 schools for candidates preparing to teach” (CAEP, 2020, p. #). The CPAST Form was specifically developed to be used during the student teaching experience to assess two subscales: pedagogy and dispositions (The Ohio State University, 2019). Dispositions, defined by InTASC (Council of Chief State School Officers, 2013), are the “habits of professional action and moral commitments that underlie…how teachers do, in fact, act in practice” (p. 6).

Likely due to the relative newness of the CPAST Form development (Kaplan et al., 2017), little research has been conducted regarding its implementation, use, and practice for educator preparation programs. Building a connection to another component of licensure eligibility, such as the Praxis series, to the new CPAST Form will add depth to the field of research surrounding teacher education and the readiness of the pre-service teachers.

With a continual change of tide in teacher assessment priorities (Gitomer & Zisk, 2015; Shulman, 1986; Shuls, 2018), educator preparation programs and school systems have to understand how they can more strategically use the data of the required licensure assessments as an opportunity to drive undergraduate pre-service teacher training supports and screen for the most effective pre-service teachers. The connection between the two measures of knowledge mastery, content (the Praxis Series; ETS, 2019) and pedagogy (the Candidate Preservice Assessment of Student Teaching (CPAST) Form; Kaplan et al., 2017; The Ohio State University, 2019), can be used strategically by educator preparation programs in supporting pre-service teacher growth and achievement and by school systems to identify effective pre-service teachers as potential candidates for future hiring. Due to the limited research on the CPAST Form, an opportunity exists to explore the predictive nature of the Praxis Subject Assessment for elementary pre-service teachers on the performance measures reflected on the CPAST Form.
Gitomer and Zisk (2015) described this notion as comparing a pre-service teacher’s “knowing that” to their “knowing how” (p. 6). Furthermore, initial research into the relationship of the two knowledge forms should begin to expose how education stakeholders use the assessment outcomes to promote more strategic teacher selection for longevity in the field. To do so, data has to be made more meaningful and purposeful, rather than simply viewed as a checklist item on a pre-service teacher’s to do list.

Theoretical

Lee Shulman’s (1987) theory of knowledge encompasses several categories of teacher knowledge: curriculum knowledge, general pedagogical knowledge, content knowledge, pedagogical content knowledge, knowledge of learners and their characteristics, knowledge of education contexts, and knowledge of education ends, purposes, and values (Callingham, Carmichael, & Watson, 2016). Shulman’s (1986) theory’s focus of pedagogical content knowledge will serve as the primary theory in exploring the impact of teacher licensure assessment for pre-service teachers, educator preparation programs, and the PreK-12 school systems eventually seeking to hire the future educators coming out of the educator preparation programs. Shulman (1984) addressed the work of both John Dewey (1938) and Joseph Schwab (1983). Shulman’s theory expands on the fundamental representation of Dewey’s (1938) bridge between practice and theory (Shulman, 1984), which lends itself to a discussion of the role and purpose of evaluating a pre-service teacher’s content knowledge and pedagogical knowledge because the theory of pedagogical content knowledge does in fact merge elements. Schwab (1983) advocated for one to learn through activity and interaction, which seems to be the combination of Shulman’s (1984) focus on pedagogical knowledge in conjunction with content knowledge. Shulman (1984) recognized that pre-service teachers have more to learn in the
physical classroom with practicing teachers, actual PreK-12 students, and realistic demands of the classroom environment than can be learned strictly in isolation from content knowledge and pedagogical knowledge presented in a textbook or through a professor’s lecture.

Shulman (1984) described a teacher’s predisposition for making critical decisions in the classroom related to content and instructional practices, as well as general management, based on professional discretion rooted in knowledge and understanding classroom complexities. Shulman (1984) regarded this as professional autonomy. Loo (2007) outlined six attributes of Shulman’s pedagogical content knowledge theory for pre-service teachers as they transition from stages of knowledge acquisition to performance in teacher preparation: comprehension, transformation, instruction, evaluation, reflection, and new comprehensions. A brief look at these attributes in transition suggests a different structure or format for assessing mastery at each stage or progression would be necessary.

A teacher’s confidence or competence in their ability to make decisions based on professional discretion is also influenced by their self-efficacy (Bandura, 1989). Self-efficacy, an individual’s “self-appraisal of capabilities” (Bandura, 1993, p. 118), plays a role in the development of pre-service teachers (Liou et al., 2017) as Petchauer (2016) explained that an individual’s previous experiences, those of success and failure, with standardized assessments has the ability to determine how that same individual views their potential on a teacher licensure assessment. Both external experiences and internal thoughts and reflections are contributing factors to an individual’s perceived levels of self-efficacy (Bandura, 1989).

**Problem Statement**

Accountability has a strong presence in the field of education, both at the PreK-12 level and in higher education. For educators, accountability and evaluation includes standardized
assessment of their students’ performance, as well as in-person observations, informal and formal evaluations, self-reflections, and even mentoring relationships that are reflective of their own performance and management of the classroom (Sayavedra, 2014). A similar accountability system is true for pre-service teachers and their responsibility to fulfill high-stakes licensure exams that affect their eligibility for a state teaching licensure, and the stakes only continue to rise with increased passing cut scores (Shuls, 2018). Licensure assessments address both content knowledge (Gitomer & Zisk, 2015) and pedagogical knowledge or performance (Brown, Suh, Parson, Parker, & Ramirez, 2015). Gitomer and Zisk (2015) entitled teachers as content knowledge professionals needing to fully understand their content area in order to transfer their knowledge to their students. Pedagogical knowledge is often demonstrated through performance in the classroom of actual instruction (Callingham et al., 2016; Voss, Kunter, & Baumert, 2011). While mastering content may lead to higher performance in the classroom, the concern is that not all content masters equate to effective educators. In other words, one perspective implies that knowing the content does not guarantee the individual will be able to teach the material to a class of students while also managing the complexities of a classroom environment. That is where the inclusion of performance evaluations and pedagogical knowledge for undergraduate elementary pre-service teachers takes a role in screening for effective educators. The problem is that there is a lack of research for using content knowledge exams as a screening tool for in-class performance quality of pre-service teachers (Shuls, 2018).

**Purpose Statement**

The purpose of this quantitative, predictive correlational study will be to explore the relationship between the predictor variable, content knowledge, and the criterion variable, pedagogical knowledge of elementary education pre-service teachers.
The predictor variable, content knowledge mastery, is defined as how well a pre-service teacher knows the subject matter reflective of their teaching endorsement area (Mahoney, 2015). In this particular study with a focus on traditional, undergraduate elementary education pre-service teachers in Virginia, the teaching endorsement assessment measure includes Reading and Language Arts, Mathematics, Social Studies, and Science as subtests organized through the Praxis Subject Assessment - Elementary Education: Multiple Subjects (ETS, 2019).

The criterion variable, pedagogical knowledge, is defined as an individual’s ability, in this case a pre-service teacher, to use effective research-based strategies to transfer or teach that information to the class of students (Callingham et al., 2016; Voss et al., 2011). The criterion variable will be measured by the Candidate Preservice Assessment of Student Teaching (CPAST) Form (Kaplan et al., 2017; The Ohio State University, 2019).

**Significance of the Study**

High-stakes, standardized testing has become a commonplace discussion in the PreK-12 school systems. A similar impact of standardized assessment is present at the university level for pre-service teachers, though less attention tends to be addressed in that direction. Accountability is the root instigator of high-stakes assessment. Among other requirements, licensure assessments dictate a pre-service teacher’s ability to obtain a state teaching license, which then influences the available teacher workforce. Some credit a shortage in the teacher workforce to the high expectations of numerous licensure assessments (Martin & Mulvhill, 2016; Shuls, 2018). Previous studies have explored the connection of such licensure assessments to teacher quality and student achievement (Callingham et al., 2016; Chan & Yung, 2018; Fritsch et al., 2015). While the licensure assessments are intended to serve as a screening tool for new teachers (Shuls & Trivitt, 2015), or a gatekeeping tool as labeled by Ledwell and Oyler (2016), there is
also a concern that those same screening instruments may be keeping otherwise qualified and effective teachers out of the classroom. Therefore, it is important to understand the relationship between the licensure assessment scores or outcomes in connection to a teacher’s effectiveness in the classroom.

Part of defining this relationship is building the connection between a pre-service teacher’s content knowledge (content test score) and their performance or pedagogical knowledge (effectiveness). The assessments to be used for this study are the Praxis Subject Assessment, which measures a pre-service teacher’s content knowledge, and the CPAST Form, which measures a pre-service teacher’s performance during student teaching (Kaplan et al., 2017). Understanding this relationship will better equip school systems to identify key attributes that distinguish and predict the most effective teachers through such assessments, or offer an argument for higher education institutions, states, and accrediting agencies to review the continued use of such licensure assessments. While Shuls (2018) highlighted several studies that have reviewed the relationship of content exam performance and teacher performance, little comparison has been measured against the CPAST Form.

**Research Question**

The research question to be explored in this study is as follows:

**RQ:** How accurately can undergraduate elementary pre-service teacher pedagogical knowledge as measured by the Candidate Preservice Assessment of Student Teaching (CPAST) Form scores be predicted from a linear combination of content knowledge as measured by the Reading and Language Arts, Mathematics, Social Studies, and Science subtests scores from the Praxis Subject Assessment – Elementary Education: Multiple Subjects?
Definitions

1. **Candidate Preservice Assessment of Student Teaching (CPAST) Form** – The CPAST Form is an assessment tool used to evaluate pedagogy and dispositions of a pre-service teacher during the student teaching experience (The Ohio State University, 2019).

2. **Content Knowledge** – Content knowledge is the information needed by a pre-service teacher “based on the content area specific to perspective teachers’ chosen area of specialty” (Mahoney, 2015, p. 78).

3. **Dispositions** – Dispositions are “habits of professional action and moral commitments that underlie…how teachers do, in fact, act in practice” (Council of Chief State School Officers, 2013, p. 6).

4. **Educator Preparation Program** – The Council for the Accreditation of Educator Preparation (2018) identifies an educator preparation program, or educator preparation provider, as an institution that “offer(s) bachelor’s, master’s, and/or doctoral degrees, post-baccalaureate or other programs leading to certification, licensure, or endorsement in the United States and/or internationally” (para. 1).

5. **Elementary Education: Science Subtest** - The Science subtest includes categories of earth science, life science, and physical science (ETS, 2019).

6. **Elementary Education: Social Studies Subtest** - The Social Studies subtest includes categories of United States history, government, and citizenship; geography, anthropology, and sociology; and, world history and economics (ETS, 2019).

7. **Elementary Education: Mathematics Subtest** - The Mathematics subtest includes categories of numbers and operations, algebraic thinking, geometry and measurement, data, statistics, and probability (ETS, 2019).
8. *Elementary Education: Reading and Language Arts Subtest* – The Reading and Language Arts subtest includes categories of reading, writing, speaking, and listening (ETS, 2019).

9. *Pedagogical Knowledge* – Pedagogical knowledge is often referred to as pedagogical content knowledge, rooted in Shulman’s (1986) pedagogical content knowledge theory, blends the pre-service teacher’s ability to use research-based practices, specific to the content area, to effectively teach the subject material (Callingham et al., 2016; Voss et al., 2011).

10. *Praxis Subject Assessment* – Created as an assessment instrument to primarily measure content knowledge and some notes of pedagogical knowledge, the Praxis Subject Assessment series is geared toward testing whether or not a pre-service teacher has mastery of the content expected to be taught in their respective K-12 classroom based on the specific teaching endorsement area (ETS, 2019).

11. *Praxis Subject Assessment – Elementary Education: Multiple Subjects* – The version of the Praxis Subject Assessment specific to pre-service teachers seeking an elementary endorsement in Virginia (ETS, 2019) has four subject subtests: Reading and Language Arts, Mathematics, Social Studies, and Science. Test requirements and the established passing scores vary per state.

12. *Pre-service Teacher* – Pre-service teachers are college students in an educator preparation program seeking a teaching license, or “individuals preparing for professional education positions” (CAEP, 2015, para. 8).

13. *Self-efficacy* – Self-efficacy is the “conviction that one can successfully execute the behavior required to produce the [expected/intended] outcomes” (Bandura, 1977a, p.
193), or how well an individual feels they are capable of reaching given expectations (Bandura, 1979).

14. **Student Teaching** – Student teaching describes the “extensive and substantive clinical practice in P-12 schools for candidates preparing to teach” (CAEP, 2020, para. 19). For the purpose of this study, P-12 schools will be referred to as PreK-12 schools.

15. **Teacher Licensure** – Teacher licensure refers to “a certificate which allows the recipient to teach others in a classroom setting” (Jones et al., 2011, p. 901).

16. **Traditional Student** - A traditional college student falls into the age category of 18-24 (Tilley, 2014).
CHAPTER TWO: LITERATURE REVIEW

Overview

A review of literature was completed to evaluate the relationship of content knowledge assessments and pedagogical assessments for pre-service teachers enrolled in educator preparation programs. An overview of the current research will be provided. The theoretical framework section addresses the pedagogical content knowledge theory as developed by Shulman (1981), as well as the self-efficacy component of Bandura’s social learning theory (1977a). Both theories connect to teacher preparation and the factors of content mastery and pedagogical knowledge skills in how pre-service teachers are assessed, including how pre-service teachers perceive their abilities within the assessments.

Beyond the theoretical framework, the next section focuses on drawing a synthesis of the research related to content knowledge and pedagogical knowledge for assessment and teacher licensure eligibility for pre-service teachers. Within the literature review, attention is given to show association of licensure assessment results to pre-service teacher demographics (content/subject area, gender, and race/ethnicity) as well as PreK-12 student achievement. In building the synthesis of literature on the side of pedagogical knowledge and performance, several observational instruments will be briefly introduced. These tools include the Performance Assessment for California Teachers (PACT) and Teacher Performance Assessment (edTPA), as these instruments are two of the more commonly discussed and available tools in the field of education today. The Candidate Preservice Assessment of Student Teaching (CPAST) Form, as one primary attribute, or variable, of the proposed study, will also be reviewed in terms of relevant literature. Further synthesis will determine the link of pre-service teacher readiness to assessment results. This review of literature surrounding content and pedagogical knowledge will
show evidence of the need for study in the preparation of pre-service teachers, and their applicable readiness and licensure assessments.

**Theoretical Framework**

Identifying a theoretical framework in education research “generate[s] knowledge that describes, predicts, improves, and explains processes and practices related to education” with the intent to “understand the connection between research and practice” (Gall, Gall, & Borg, 2007, p. 10). The purpose is to demonstrate the relationship of the theory to the available research. In this current study, a predictive relationship will be evaluated between content knowledge and pedagogical knowledge for pre-service teachers in an educator preparation program based on Shulman’s theory of pedagogical content knowledge and Bandura’s social cognitive theory of self-efficacy.

**Pedagogical Content Knowledge**

Shulman (1981, 1986) recognized a concern in how educator preparation programs and teacher certification exams measured and weighed importance of pre-service teacher mastery. In the late 1800s, certification exams focused on content knowledge. In the 1980s, certification exams focused on pedagogical knowledge and skills. This perspective offered that there should be a blend of the two, so Shulman sought to identify the knowledge domains and how they are measured. His theory of pedagogical content knowledge suggests that teaching is more than just content knowledge (Shulman, 1984). It requires the ability of the teacher to use effective skills, appropriate to the content, to transmit the knowledge to students (Shulman, 1984). Irby and O’Sullivan (2018) gave reference to Shulman’s pedagogical content knowledge in stating, “effective teaching requires the ability to transform one’s content knowledge into something that is accessible and understandable to learners at their levels of development” (p. 59). Loo (2007)
described the six attributes of Shulman’s pedagogical theory as pre-service teachers progress from knowledge to performance in their teaching preparations: comprehension, transformation, instruction, evaluation, reflection, and new comprehensions.

Shulman’s (1986) explanation of knowledge leads to his pedagogical content knowledge theory, the blend of content knowledge mastery with pedagogical skills. Shulman’s theory blends components of both content knowledge (subject matter) with pedagogical skills. He researched the connection of the two and how pedagogical skills can be applied to particular content areas, or “the ways of representing and formulating the subject that make it comprehensible to others” (Shulman, 1986, p. 9). Effective instructional skills may have different applications across subject area disciplines, and teachers need to understand how to appropriately use those skills in context (Shah et al., 2018). Three areas of knowledge represented were propositional knowledge (research-based strategies), case knowledge (confirmation of strategies based on observation and evaluation), and strategic knowledge (professional discretion based on understanding of classroom and context). The focus of his theory is pedagogical content knowledge, the blend of content mastery and pedagogical skills.

Shulman evaluated the connection between Dewey and Schwab in relation to teacher training and education (Gitomer & Zisk, 2015; Shulman, 1984). Further, Shulman examined the profession of teaching and teaching training to that of both medicine and law (Shulman, 1984). In medicine, he suggested there are more formulated and structured steps and protocols to achieve desired outcomes. In law, Shulman recognized there is not always a one-size-fits-all approach. Lawyers have to use what they know to navigate each new case and apply appropriate and acceptable strategies to each situation based on the context of the case and previous knowledge or experience. Similarly, for pre-service teachers to successfully practice, implement,
and apply effective instructional strategies, they need “substantial instruction in the sources of such premises combined with the experiences needed to learn how to apply them well to particular cases” (Shulman, 1984, p. 193).

Shulman’s (1984) conceptual framework of knowledge, particularly that of pedagogical content knowledge, builds a bridge in the proposed study between the content assessment of Praxis Subject Assessment and the pedagogical performance assessment of the CPAST Form. This connection will better serve in understanding the relationship between the two measures of mastery, content and pedagogy. Further, this may have implications for how educator preparation programs and state-level certification regulations view the use of both measures.

**Social Learning Theory: Self-Efficacy**

Bandura’s (1979) social cognitive theory, or social learning theory, is the idea that an individual uses prior knowledge and experiences to adapt to new situations. The social cognitive theory is reflective of discussions in education pertaining to self-efficacy (Bandura, 1977a, 1977b). Self-efficacy is the “conviction that one can successfully execute the behavior required to produce the [expected/intended] outcomes” (Bandura, 1977a, p. 193), or how well an individual feels they are capable of reaching given expectations (Bandura, 1979). Bandura sought to disconnect his social learning theory from Sullivan’s (1953) theory of human behavior. Sullivan’s (1953) theory of human behavior largely represented an individual making adjustments to their behaviors in order to “avoid and to minimize anxiety” (Bandura, 1979, p. 441). Bandura, on the other hand, aimed to offer reasoning for individuals bringing awareness and regulation to all of their behaviors, not just for the purpose of avoiding anxiety (Bandura, 1993).
Self-efficacy relates to many fields of study with a variety of applications (Bandura, 1997, 2018), but self-efficacy is closely linked to several aspects in education and teacher training (Colson et al., 2017), often measured using the Teacher Sense of Efficacy Scale (Tschannen-Moran & Woolfolk Hoy, 2007). The Teacher Sense of Efficacy Scale, also known as the Ohio State Teacher Efficacy Scale, or OSTES, addresses three areas of efficacy (efficacy for instructional strategies, efficacy for classroom management, and efficacy for student engagement) and offers use by both pre-service teachers and practicing teachers (Tschannen-Moran & Woolfolk Hoy, 2001). The scale has been rooted, in part, in Bandura’s own teacher self-efficacy scale and recognizes the significance of both content knowledge efficacy and pedagogical knowledge of teachers (Tschannen-Moran & Woolfolk Hoy, 2001). Though research in self-efficacy clearly exists for both pre-service teachers and practicing teachers, Liou et al. (2017) expressed that more attention needs given to the relationship of self-efficacy and the development of pre-service teachers as much of the research focuses on the in-service or practicing teacher. Bandura (1989) also relayed this notion of professional discretion or the ability to make professional decisions on one’s experiences through the construction of their self-efficacy.

Bandura (1979) outlined four means of efficacy development: performance accomplishments, vicarious experience, verbal persuasion, and physiological states. The depth of an individual’s self-efficacy suggests how likely the individual will endure and press forward in difficult circumstances related to the area of self-efficacy. Both effort and expectation formulate development of self-efficacy, identifying that the individual plays an active role in their own learning (Bandura, 1979). Personal reflection is a critical factor in social cognitive theory, which intends to push individuals to adjust and grow in their experiences based on what they have
previously experienced. Bandura related self-awareness and self-regulation to social cognitive theory as it demands an individual to actively make adjustments to their actions toward the designated goal or outcome. Bandura dismissed, then, the notion that individuals are passive agents only acting from learned habit. He discussed the use of standards and goal setting to aid in the self-regulation process toward growth and improvement.

In addition to an elementary teacher’s self-efficacy of classroom management and other similar instructional strategies being connected to student achievement, Herman et al. (2018) and Liou et al. (2017) demonstrated concern that a teacher’s self-efficacy toward their subject knowledge, or content knowledge, also impacts student achievement. A healthy balance of self-efficacy leads to effective educators (Liou et al., 2017). Too low in the self-efficacy department may result in an overly stressed, anxious, and unproductive educator; too high in the self-efficacy department, and the educator becomes complacent (Bandura, 1993; Liou et al., 2017).

There is a connection of the social learning theory to pedagogical skills in that pre-service teachers have to use what they know and have learned to navigate classroom instruction and situations that may not directly align with a carefully prescribed textbook scenario. These concepts of pedagogical knowledge are addressed and evaluated through the CPAST Form for pre-service teachers during their student teaching semester.

In considering a pre-service teacher’s own self-efficacy, or their ability to perform well in the classroom, “self-efficacy proved to be an accurate predictor of performance…subjects were simply judging their future performance from their past behavior” (Bandura, 1977a, p. 211). Self-efficacy, therefore, can easily be argued to influence a pre-service teacher’s performance on both content and performance assessments, or the academic demands of their program (Bandura, 1993; Petchauer, 2016; Liou et al., 2017; van Dinther, Dochy, & Segers, 2015). Of particular
interest and connection is the process of pre-service teachers completing their own review of the CPAST Form, in addition to their university supervisor and their cooperating teacher. Self-efficacy likely affects how a pre-service teacher responds and evaluates their own performance. As the correlations are reviewed between the Praxis Subject Assessment and the CPAST Form, an extra insight may be if there is a significant difference between the correlation of the Praxis Subject Assessment score to the pre-service teacher CPAST score versus that of Praxis Subject Assessment score to the CPAST score assigned by the university supervisor and cooperating teacher.

**Related Literature**

To review the related literature surrounding the proposed study, a few core areas were examined. Those areas include content knowledge and pedagogical knowledge and the associated assessments related to pre-service teacher readiness, as well as the alignment of educator preparation programs to licensure and accreditation regulations in supporting pre-service teachers in their teacher readiness.

**Pre-service Teacher Content Knowledge and Assessment**

Each pre-service teacher opts for a licensure endorsement area to pursue, which ultimately reflects a specific area of content knowledge. Content knowledge assessment, therefore, has to be adapted to align with the pre-service teacher’s licensure pursuit to be meaningful and purposeful. The CAEP (2020) defines content knowledge, or subject matter knowledge, as

the acquisition and understanding of facts, truths, or principles associated with the academic disciplines that are taught at the elementary, middle, and/or secondary levels, or
a professional field of study such as special education, early childhood education, school psychology, reading, or school administration. (para. 25)

In their review of a teacher’s achievement on a national assessment in relation to PreK-12 student achievement, Belson and Husted (2015) focused on the notion that “certification improves student achievement” (p. 2) suggesting that successful passing of teacher content assessments predicts more qualified and effective teachers. Gitomer and Zisk (2015) recognized that being a content knowledge professional is just one role of the classroom teacher. Similarly, Corso, Bundick, Quaglia, and Haywood (2013) also identified teachers as being experts in their content area. Understanding the role of content knowledge assessment in teacher licensure is complicated due to the variance of requirements from one state to the next or even from one endorsement to another endorsement (Shuls, 2018; Shuls & Trivitt, 2015). To further complicate the discussion, Shuls (2018) reported a positive relationship between high test scores and teacher quality; unfortunately, raising the test score expectation with the intent of increasing teacher effectiveness significantly influences the available population pools of teachers.

**Content Knowledge Measured by Licensure Assessments**

Teacher licensure assessments, such as the Praxis I for general knowledge and Praxis II for content mastery in the teaching field, are used to measure a pre-service teacher’s content knowledge (Gitomer & Zisk, 2015) and even teacher effectiveness (Shuls, 2018; Shuls & Trivitt, 2015). The Praxis Series serves as the primary means of teacher testing in the United States (Petchauer, 2013), while England uses the Qualified Teacher Status Skills Test. For most states, the content licensure assessments are used as screening tools for admittance to educator preparation programs and teacher licensure eligibility (Baker-Doyle & Petchauer, 2015; Maddox
Petchauer (2015) described licensure exams as a means of gatekeeping for qualified candidates in the field of education.

**Relationship of Content Assessment Outcomes to Pre-service Teacher Demographics**

A concern of any standardized assessment, including those used for teacher licensure eligibility, is whether the assessment outcomes show limitations related to test taker demographics, particularly the demographics of race (Floden, Richmond, Drake, & Petchauer, 2017). Several studies have examined this link of demographics to teacher licensure eligibility and whether there exists biased limitations of race (Elpus, 2015; Kula & Tasdemir, 2014; Petchauer, 2016, 2018; Petchauer et al., 2015; Shah et al., 2018). Elpus (2015) found the predictive correlation between 20,521 music pre-service teachers’ Praxis II scores and their demographic profiles. Of the test takers, 85.8% of White pre-service teachers showed a passing score, while only 41.7% of Black pre-service teachers showed a passing score (Elpus, 2015). Demonstrating a predictive correlation between Praxis II and race, this confirmed the concern of bias in the assessment. Nettles, Scatton, Steinberg, and Tyler (2011) reinforced this notion by finding a similar discrepancy in test scores between White and Black test takers of the Praxis Pre-Professional Skills Test, consisting of reading, writing, and mathematics sections (Owens-Oliver, 2014; Petchauer, 2016; Petchauer et al, 2015). In all three sections of the assessment, White test takers passed about twice as much as Black test takers. Floden et al. (2017) described this outcome as an unintended consequence of good intentions, meaning licensure screening tools were enacted to ensure highly-qualified teachers were being placed in the PreK-12 classrooms to promote student success but resulted in minimizing the diversity of the teaching population.
Interestingly, Gitomer et al. (2011) reported that even though this wide gap in passing rates existed between White and Black test takers for what is called the professional readiness exam, or PPST, pre-service teachers passing the professional readiness exam were equally more likely to pass their content assessment, Praxis II or Praxis Subject Assessment. In other words, if a student, whether White or Black, passed their early professional readiness exam, they were likely to pass their content exam. The key explanation for this result is that it focuses on those that successfully passed the assessment on the first attempt. Those that took multiple attempts to achieve a passing score on their Praxis I assessment and also passed their Praxis II elementary assessment were referred to as borderline passers (Petchauer, 2018).

On the Praxis Subject Assessment – Chemistry exam, 67% of White test takers passed the exam with only 30.8% of Black test takers having passed (Shah et al., 2018). With that said, the passing rate of Hispanic test takers was more in line with the White test takers at 57% (Shah et al., 2018). Owens-Oliver (2014) found similar results of the Praxis Elementary assessment in that White test takers and Hispanic test takers had closely aligned passing rates, 88.7% and 83.4% respectively, which were both drastically higher than the 52.7% passing rate of Black test takers. The two subject-based assessment studies demonstrate a significant difference in pass rate of White and Hispanic pre-service teacher populations as compared to Black pre-service teacher populations (Owens-Oliver, 2014; Shah et al., 2018). Though edTPA evaluates the pedagogical knowledge and performance as compared to the content knowledge measured by the various Praxis assessments, a similar outcome resulted from edTPA implementation in 2014 (Russell & Davidson Devall, 2016) where world language pre-service teachers in the Asian, Hispanic, and White populations scored relatively higher than their Black pre-service teacher peers. Unlike the Russell and Davidson Devall (2016) study, Goldhaber, Cowan, and Theobald (2017) found that
13.7% of Hispanic pre-service teachers tended to fail the edTPA by the state of Washington’s standards as measured against the 3.7% of failed edTPA attempts by their non-White Hispanic peers.

Though many studies view results in terms of pre-service teachers’ race, others compare results based on gender (Kula & Tasdemir, 2014; Shah et al., 2018). Kula and Tasdemir (2014) observed, through an independent samples t-test, that female pre-service teachers tended to have increased levels of self-efficacy in areas of academic learning associated with cognitive application than their male counterparts. On actual passing rates of a Praxis Subject Assessment – Chemistry exam, male test takers more commonly passed the assessment at a 73.2% rate compared to 58.4% of female test takers, even though there were more female test takers overall in the 15,500 testing population from 2006 to 2016 (Shah et al., 2018). For the edTPA, a pedagogical performance assessment, Russell & Davidson (2016) reported “no significant differences [were] found for gender” (p. 482). The proposed study will present an opportunity to analyze results of the Praxis Subject Assessment: Elementary Education – Multiple Subjects as part of the participant demographics in determining whether a similar passing rate is achieved by gender as in earlier studies.

Similar to the analysis of test scores in relation to gender, participant demographics in the current study will allow for analysis of results by race. Petchauer (2015) has drawn attention to the discussion of predictive nature of teacher licensure assessment and research associated with a pre-service teacher’s race. In one study, Petchauer (2015) extended that attention beyond the test itself and highlighted the need to examine the entire testing event, to which she described as including the arrival of pre-service teachers to the testing site, interactions between site employees, and other factors influencing the individual’s comfortableness with the testing
environment (ease of check in, ease of testing set up, etc.). She revisited this concept of test event in her 2018 study, recognizing that the full testing experience at the test site can make test takers self-conscious of their test-taking abilities or the expectations others may have of their test performance on the day of the test, including their peer test takers and those administering or proctoring the exam. Feelings of anxiousness toward the testing experience may be rooted in general test anxiety, or feelings by the pre-service teacher for how they sense they are perceived through racial biasness by the testing site personnel. All of these factors have the potential to impact how a pre-service teacher approaches the test itself. An implication of this research is that if an individual senses they are viewed differently upon arrival based on their race, they may not approach the exam with full confidence and self-efficacy.

Another predictive element reviewed by education researchers in relationship to teacher licensure assessments related to content is grade point average (GPA) (Jones et al. 2011; Maddox & Reglin, 2019). Jones and her research colleagues (2011) found that of 196 elementary and special education pre-service teachers, those earning a high GPA were more likely to successfully pass and gross a higher score on two Virginia-based assessments: Virginia Reading Assessment and Virginia Communication Literacy Assessment. Using the data, Jones et al. (2011) encouraged educator preparation programs to use these predictive models to better structure their programs and screen their pre-service teachers, while also empowering the pre-service teachers themselves to work diligently toward excellence, even from their early days in the program.

Maddox and Reglin (2019) analyzed the relationship of Praxis II: Elementary Education – Multiple Subjects to a number of professional measurements: College Basic Academic Subject Area Examination, Praxis Core, overall GPA, Reading for Virginia Educators, and Virginia
Communication and Literacy Assessment. By contrast to the study of Jones et al. (2011) and other studies (MacMath and Salingre, 2015; Walter, 2015) rounded up by Maddox and Reglin (2019), they were surprised when their results showed no predictive relationship of GPA to test results of the Praxis II: Elementary Education – Multiple Subjects. One of their recommendations was to study the predictive correlation of other licensure exams and assessments to the Praxis II: Elementary Education – Multiple Subjects. The current study will do just that through evaluating the relationship of the Praxis assessment to the Candidate Preservice Assessment of Student Teaching (CPAST) Form.

**Relationship of Assessment Outcomes to PreK-12 Student Achievement**

Shah et al. (2018) made a dramatic claim that “teacher[s] have been identified as the single most impactful factor on student achievement in the United States,” and they furthered that claim having indicated that “the effect of individual teacher qualifications on students’ science, technology, engineering, and mathematics (STEM) achievement in particular has been found to be especially critical” (p. 700). Belson and Husted (2015) and Goldhaber, Gratz, and Theobald (2017) also ascertained student achievement is linked to pre-service teacher licensure assessment outcomes. One concern with measuring this success outcome based on PreK-12 student achievement is the delay of data. Bastian, Henry, Pan, and Lys (2016) recorded that such data is often generated years after the pre-service teacher has worked in the field for years as a full-time classroom teacher; therefore, the practices and instructional strategies that the pre-service teacher experienced and acquired in their educator preparation program are no longer reflected in the program or relevant to the current trends, needs, and complexities of the ever-changing classroom. Nonetheless, Liou et al. (2017) recognized that student learning or student
achievement is one of the increased areas of accountability in measuring the success of pre-service teachers and practicing teachers.

**Pre-service Teacher Pedagogical Knowledge and Performance Assessment**

Contrary to high-stakes standardized assessments that measure content knowledge, educator preparation programs also utilize pedagogical performance assessments to evaluate how well a pre-service teacher performs in the classroom with real PreK-12 students, or a pre-service teacher’s pedagogical knowledge (Brown, Suh, Parson, Parker, & Ramirez, 2015). Bastian et al. (2016) defined three primary reasons for the trend of performance assessments in educator preparation provider programs:

1. the National Research Council’s call to develop broader and more authentic assessments of teacher candidates—beyond [content] licensure exams—and their performance in the classroom…;
2. the National Board for Professional Teaching Standards and its performance-based framework for assessing and credentialing veteran teachers…; and
3. the widespread push to improve [EPPs] and the performance of beginning teachers.” (p. 3)

While most forms of pedagogical performance assessment take shape through observational instruments, other complex tools have been developed to ensure a more comprehensive analysis of the pre-service teacher’s readiness to include the full spectrum of instruction, beginning with planning and leading to reflection (Gargani & Strong, 2014; Spooren, Brockx, & Mortelmans, 2013). Many of the new instruments bring a consensus of sorts between multiple reviewers, such as the pre-service teacher, mentor or host teacher, and the university supervisor, rather than a singular evaluation completed by just the mentor teacher or supervisor as the primary observer (Chandler-Olcott & Fleming, 2017).
Pedagogical Content Knowledge

Pedagogical content knowledge evaluates pre-service teachers’ ability to effectively teach their content with research-based strategies (Callingham et al., 2016; Corso et al., 2013; Voss et al., 2011). Callingham et al. (2016) showed a positive relationship of a teacher’s pedagogical content knowledge and student growth and achievement in statistics over a two-year longitudinal study. Because pedagogical content knowledge has not always been a priority in teacher licensure, Chan and Yung (2018) explored how practicing teachers navigated previous experiences in subject-focused training to transition to a more pedagogical content focus, which proved that continual professional development in pedagogical content knowledge needs to be priority for both pre-service teachers and veteran teachers.

Pedagogical Knowledge Measured by Performance Assessment

In striving to develop valid and reliable performance measures to meet the demands of accreditation standards, educator preparation programs are working to develop appropriate evaluation instruments. This accreditation standard has driven several educator preparation programs to collaborate and share efforts in designing such valid and reliable tools (Caughlan & Jiang, 2014; Henry et al., 2013; Huijgen et al., 2017; Voss et al., 2011). In driving this accountability standard, one state even supplemented the outcome measures with a monetary incentive (Berry & Shields, 2017; Polly & Byker, 2019). North Carolina increases a teacher’s pay by “a few thousand dollars more than their peers during the first three years of their career” when meeting a designated cut score in conjunction with a high-earned grade point average as a pre-service teacher (Polly & Byker, 2019, p. 147). Other incentives included financial support for additional education, increase in pay for earning a master’s degree, and further compensation for obtaining national board certification (Berry & Shields, 2017). Three of the primary valid and
reliable performance evaluations are Performance for California Teachers (Stewart, Scalzo, Merino, and Nilsen, 2015), Teacher Performance Assessment or edTPA (Goldhaber, Cowan, & Theobald, 2017), and the Candidate Preservice Assessment of Student Teaching Form (Kaplan et al., 2017).

**Performance Assessment for California Teachers.** Stewart et al. (2015) analyzed “what distinguished a strong performance assessment from a weaker one” (p. 35) based on submissions of the Performance Assessment for California Teachers (PACT), which requires pre-service teachers to create a portfolio of their teaching artifacts, along with commentaries to discuss their instructional decisions (Castellano, Duckor, Wihardini, Tellez, & Wilson, 2016; Duckor, Castellano, Tellez, Wihardini, & Wilson, 2014). Though this approach focuses on performance-based items rather than content, Sandholtz and Shea (2015) organized a predictive correlational study that compared a pre-service teacher’s academic standing to a pre-service teacher’s PACT score. The two-year longitudinal study of 337 pre-service teachers showed a moderate correlation of undergraduate grade point average (GPA) and course grades to the PACT score, though a significant correlation was not identified between student teaching course grades and the PACT score.

Stewart et al.’s (2015) qualitative analysis used scores of 12 secondary pre-service teachers that were found at the upper and lower extremes to identify distinguishing characteristics of pre-service teachers who scored in the upper category. Those five attributes were use of formative assessment, content and language objectives, scaffolding to grow academic language, differentiated supports for building content understanding, and ability to reflect and adapt upcoming lessons based on past performance (Stewart et al., 2015). Similarly, Sandholtz and Shea (2012) evaluated whether trained supervisors were able to predict
performance scores based on their knowledge of the pre-service teacher’s distinguishing attributes.

**Teacher Performance Assessment.** The edTPA, known as the Teacher Performance Assessment in its earlier stages of implementation (Russell & Davidson Devall, 2016) and one of the newer evaluation tools being used across the United States to determine licensure eligibility of pre-service teachers, is the focus of relevant research on assessing pre-service teachers (Chandler-Olcott & Fleming, 2017; Clayton, 2018; Goldhaber, Cowan, & Theobald, 2017; Kessler, 2017; Okraski & Kissau, 2018; Stanford University, n.d.). In 2016, just three years after its start in 2013, edTPA was the popular choice of pedagogical performance assessment with 626 programs across 41 states, including Washington, DC, opting to use edTPA, even if the evaluation tool was not a required component of licensure eligibility (Bastian et al., 2016; Russell & Davidson Devall, 2016). Similar to Praxis assessments, individual states have the ability to adopt the edTPA as a licensure requirement and define a passing score (Russell & Davidson Devall, 2016) as a means of enumerating teacher readiness and gatekeeping licensure eligibility (Ledwell & Oyler, 2016). Though defined within the performance assessment category, edTPA is subject-specific (Greenblatt, 2019), meaning each pre-service teacher completes edTPA from the lens of their licensure endorsement area.

The edTPA entails a collection of artifacts in the form of a portfolio for a trained reviewer to analyze a pre-service teacher’s pedagogical knowledge through a performance assessment, including commentaries that justify instructional decisions, detailed lesson plans, student samples, etc. Though edTPA provides distinct structure and tasks for each subject area, 27 content area variances to be exact, the primary purpose is pedagogical mastery rather than content mastery (Goldhaber, Cowan, & Theobald, 2017). The edTPA offers a unique approach
by focusing on the pre-service teacher’s ability to not only assess the students but also assess and reflect on their own ability to effectively teach (Bastian et al., 2016). Despite this unique approach serving as a learning experience in and of itself in preparing the edTPA portfolio (Ledwell & Oyler, 2016), at least one study expressed hesitation that the edTPA lacked authentication as a true representation of a pre-service teacher’s teaching ability (Russell & Davidson, 2016). Participants in the study, including pre-service teachers, their mentor teachers, and their university supervisors, shared that “the requirements to complete the edTPA did not constitute a holistic measure of pedagogical practices or a complete assessment of [pre-service teacher] readiness” (pp. 491-492). In other words, pre-service teachers felt they knew what to say and do simply because they knew what the official reviewers of their edTPA portfolios were looking for in the brief collection of artifacts. Participants in Greenblatt’s (2019) study observed a similar perspective in that they discovered ways to manipulate their lesson recordings to highlight only the stronger aspects of their instruction and avoid the inclusion of the moments that were less than ideal.

Goldhaber, Cowan, and Theobald (2017) conducted a longitudinal study of over 2,000 Washington pre-service teachers that completed the edTPA assessment during the 2013-2014 school year to show the predictive validity of edTPA in determining pre-service teachers that actually enter the workforce. Though the data did not have means of distinguishing whether the growth experienced through the edTPA process was the sole factor determining if a pre-service teacher chose to enter the teaching workforce after graduation, there are implications that can be extended to explore this relationship with other licensure assessments. Results showed that higher edTPA scores did predict a pre-service teacher would be more likely to be hired within
the public school system in the state of Washington (Goldhaber et al., 2017). Teacher longevity and retention would be further considerations of impact, beyond the initial hiring.

**Candidate Preservice Assessment of Student Teaching Form.** Derived from Surowiecki’s book, *The Wisdom of Crowds*, Brownstein and Kaplan (2017) applied the “wisdom of crowds” concept to the development of the Candidate Preservice Assessment of Student Teaching (CPAST) Form by highlighting “the power of decisions made by groups through collective sharing of information and resources” (para. 1). Ultimately, this approach lends itself to the need for multiple perspectives in the success of decisions; and in this particular case, the decision of evaluating how successful or effective a pre-service teacher performs in the PreK-12 classroom setting.

Through a qualitative case study design, Kaplan et al. (2017) evaluated the drive for participation in the development and revision of the CPAST Form. A purposive sampling was used to identify 16 study participants (defined as a representative from each higher education institution), of which 11 represented private institutions and 5 represented public institutions. Of the institutions, seven were located in the urban area, six in suburban areas, and three in rural areas. The case study consisted of a three-year progress: (a) Year 1: Development of the CPAST form was completed by eight educator programs; (b) Year 2: Two programs were added to review and revise the form; and, (c) Year 3: After revisions, 24 programs used the form to evaluate their student teachers. Methodological triangulation was used to draw conclusions from the collected data (a five-question qualitative survey, focus groups of three to five people, and approximately one-hour long semistructured interviews). Most notably, institutions participated due to the accreditation demand to use valid and reliable instruments for student teacher performance evaluation. Kaplan et al. (2017) identified the emic viewpoint of the research to be
a limitation, meaning they were closely related in collaborations with those from which they collected data.

Other relevant studies of the CPAST Form were not discovered in the thorough literature review. The CPAST Form, though not nearly as widespread in use as the edTPA (used across the country in 626 programs in 2016 (Bastian et al., 2016; Russell & Davidson Devall, 2016)), was used by only 40 programs across just 8 states for the 2017-2018 academic year (Brownstein & Kaplan, 2017), which likely reflects the limited literature found involving the use and study of the CPAST Form. The Ohio State University (2021) did report an increased use of CPAST in 2021 as nearly 100 institutions are now considered to be CPAST partners.

**Pre-service Teacher Readiness and Content and Pedagogical Knowledge**

By examining the various assessments of pre-service teacher content knowledge and pedagogical knowledge, the ultimate goal is in striving to obtain a measure that most effectively predicts and addresses key qualifiers for professional teachers. For pre-service teachers transitioning to the teaching workforce, this means calculating and identifying teacher readiness (Russell & Davidson Devall, 2016). In Shulman’s (1986) exploration of pedagogical content knowledge, he discussed the progress toward evaluating teachers as professionals, by stating that if such a conception of teacher knowledge were to serve as the basis for a subject matter content examination for teachers, that examination would measure deep knowledge of the content and structures of a subject matter, the subject and topic-specific pedagogical knowledge associated with the subject matter, and the curricular knowledge of the subject. We would have a form of examination that would be appropriate for assessing the capacities of a professional. (p. 10)
With several assessments and increased accountability of educator preparation programs to prepare pre-service teachers for the teaching workforce, understanding the connections of assessment to pre-service teacher readiness is critical. Conrad and Stone (2015) asked, “How do college instructors ensure the readiness of their pre-service teachers for the realities of today’s elementary classrooms?” (p. 41). In some areas, the pressure has risen so high that educator preparation programs find themselves teaching to the test, the same plague that most PreK-12 schools face with high-stakes standardized testing (Conrad & Stone, 2015).

**Linking Content Knowledge Assessment to Pre-service Teacher Readiness**

Pre-service teachers have content knowledge assessments to demonstrate their readiness, or content understanding, for teacher licensure. The Praxis series is a common series of assessment, most notably structured through two layers: Praxis Core (previously known as Praxis I) and Praxis Subject Assessment (previously known as Praxis II). Gitomer et al. (2011) and Owens-Oliver (2014) studied the predictive nature of a pre-service teacher’s performance on Praxis I to performance on Praxis II. Gitomer et al. (2011) demonstrated that test results of Praxis I, particularly in the writing and math sections, predicted successful completion of the Praxis II – Elementary Education exam. Owens-Oliver (2014), whose study was based on Gitomer et al.’s 2011 study, had a population size of 2,999 New Jersey test takers of Praxis I and Praxis II – Elementary Education and concluded that Praxis I results were a strong predictor of Praxis II score results. These studies confirm that Praxis I may serve as an effective screening tool for pre-service teachers progressing in educator preparation programs.

**Linking Pedagogical Knowledge Assessment to Pre-service Teacher Readiness**

Performance assessments serve a purpose in “determin[ing] candidates’ readiness to teach” (Bastian et al., 2016, p. 3), leaving space for licensing agencies to use the performance
assessment outcomes as a screening or eligibility tool for licensure. Based on a non-significant correlation between student teaching course grades and PACT scores, Sandholtz and Shea (2015) suggested a pre-service teacher may write and prepare well-developed plans more effectively than they implement the lesson in the presence of PreK-12 students, while others may teach and perform more effectively yet struggle to write and thoroughly plan well on paper. This causes a challenge for determining pre-service teacher readiness through performance assessment.

Assessments must be carefully designed to evaluate all components of instruction, stemming from lesson planning to teaching to reflection. To combat this challenge, Vagi, Pivovarova, and Barnard (2019) advocated for a closer partnership of assessment between educator preparation programs and PreK-12 school systems with the hope that pre-service teachers have more direct opportunity to be assessed through similar, if not the same, evaluation tools as practicing teachers. This collaboration would enable consistency of expectation for pre-service teachers transitioning from their educator preparation programs into full-time teaching roles (Gargani & Strong, 2014). Several stakeholders expressed hesitation in the value of the edTPA performance assessment tool due to vocabulary alone (Greenblatt, 2019), just one example of the lack of consistency between a pre-service teacher’s training and the actual workforce. Through the interviews navigated by Greenblatt (2019), it was concluded that pre-service teachers, teacher educators, and even cooperating teachers found much of the edTPA lingo to be impractical as it was not educational language generally used by practicing educators. Lewis and Morse described the use of edTPA vocabulary as edTPAese (as cited by Lachuk & Koellner, 2015). Knowing and understanding the lingo or education jargon, as practical or impractical as it may be perceived, builds a bridge for pre-service teachers in demonstrating their content knowledge mastery while also displaying their pedagogical abilities in the classroom.
For those responsible for evaluating a pre-service teacher’s readiness, this bridge between the two knowledge sectors offers a meaningful assessment.

**Linking Content Knowledge and Pedagogical Knowledge to Pre-service Teacher Readiness**

Irby and O’Sullivan (2018) described teacher readiness in the likeness of teaching excellence: “Content knowledge is essential but insufficient for excellent in teaching” (p. 59). With the idea that teacher readiness is more than just content knowledge, Jones’ (2018) recent quantitative correlation study examined this relationship between content and performance assessment. He compared the score results of 20 pre-service teachers on the Praxis II – Social Sciences Content Knowledge exam and their performance results on the Teacher Competency Assessment, one university’s homegrown student teaching observation instrument. Though pre-service teachers achieved well on both the Praxis II and the Teacher Competency Assessment, results did not offer a significant relationship between the two. The proposed study will reflect a similar design by comparing a different content Praxis Subject Assessment for elementary pre-service teachers and a university’s student teaching observation instrument.

Another similar comparison of a content knowledge assessment to a pedagogical performance assessment was executed by Russell and Davidson Devall (2016) where they compared scores between multiple measures, two of those including the Georgia Assessments for the Certification of Educators (GACE) Spanish Subject Exams, similar to the Praxis Subject Assessment, and the edTPA. The GACE exams are tests specific to the state of Georgia through the Georgia Professional Standards Commission and involved two tests for Spanish pre-service teachers: GACE Test 141 (reading/writing) and GACE Test 142 (listening/speaking) (Russell & Davidson Devall, 2016). Results displayed a “weak negative correlation between edTPA scores and GACE reading/writing scores” and a “moderate negative correlation between edTPA scores
and GACE listening/speaking scores” (p. 490). Goldhaber, Cowan, and Theobald (2017) also explored the connection of edTPA to a state-specific content knowledge exam. Their study found a correlation between edTPA and the Washington Educator Skills Test-Basic (WEST-B) basic-skills licensure assessment, which compromises of foundational knowledge in reading, writing, and mathematics.

**Linking Self-efficacy to Pre-service Teacher Readiness**

Petchauer (2016) recognized the influence of a pre-service teacher’s self-efficacy in their readiness for licensure assessments, and Liou et al. (2017) discovered self-efficacy impacts the overall development and preparation of a pre-service teacher, particularly in regard to classroom management. For 31 African American pre-service teachers, Petchauer (2016) designed workshops to prepare pre-service teachers for their Praxis examinations with the hope that pre-service teachers would feel better equipped to successfully complete the necessary licensure assessments. Through qualitative interview coding, Petchauer (2016) and van Dinther et al. (2015) determined that educator preparation programs had the ability to guide pre-service teachers in overcoming previous negative testing experiences to focus on more positive testing experiences. Similar to Petchauer’s (2016) approach to workshops focusing on Praxis preparation, Moser (2014) reported pre-service teachers felt more prepared for their licensure assessments if educator preparation programs were intentional about connecting specific courses and content to the assessment content. Pre-service teachers “reported having assumed that their test outcome would be reflective of their success in required course” (Moser, 2014, p. 139). Extending beyond that connection, those same pre-service teachers reflected that more authentic experiences related to their content would have added to their preparation. Moser’s (2014)
example of this immersion learning approach demonstrated this relation of study abroad and service learning experiences for pre-service teachers studying to be language teachers.

Because “people who doubt their self-efficacy…are usually stuck on failure scenarios” (Kula & Tasdemir, 2014, p. 687), educator preparation programs have an opportunity to redirect pre-service teachers’ experiences to promote more positive outlooks on their licensure assessments. Heightened levels of self-efficacy are attributed to experiences that were positive or resulted in some type of successful achievement, while the opposite is also true where negative experiences or results of failure lead to decreased levels of self-efficacy (Pfitzner-Eden, 2016).

Kula and Tasdemir (2014) offered a unique perspective that each pre-service teacher’s self-efficacy may vary by area. That sentiment was echoed by Liou et al.’s (2017) find that practicing teachers have varying levels of self-efficacy in subject areas at any one time. As an example, a high self-efficacy related to content knowledge does not guarantee the same level of self-efficacy pertaining to actual teacher performance. Another example explains that a high self-efficacy related to one content area does not guarantee the same level of self-efficacy across all content areas. Ultimately, pre-service teachers need to have an opportunity to distinguish their self-efficacy related to test performance from that of classroom performance. The reason being that their test performance does not have to define their classroom effectiveness.

Further arguing for the types of experiences and opportunities pre-service teachers have to grow their self-efficacy, Liou et al. (2017) studied 48 pre-service teachers from a prestigious California university with a well-respected educator preparation program. The unique approach for this study evaluated the social support pre-service teachers perceived to have within their program and how that increased or decreased their own self-efficacy, among other independent variables. The research group used the results of the Teacher Efficacy Scale and the mathematics
subtest of the PACT licensure assessment to build their comparison, while also looking at other factors such as GPA and demographics. Though not as highly as anticipated, the correlation did show a positive relationship to self-efficacy and performance on the PACT assessment (Liou et al., 2017). In other words, higher self-efficacy did relate to higher scores on the assessment.

**Linking the Role of Educator Preparation Programs in Pre-service Teacher Readiness**

It is critical for educator preparation programs to continually evaluate their role in preparing pre-service teachers for licensure readiness (Fritsch et al., 2015; Kleickmann et al., 2012; Loo, 2007; Schwab, 1983; Shuls & Trivitt, 2015; van Es, Sandholtz, & Shea, 2014). Wahl (2017) esteemed the role of educator preparation programs in pre-service teacher training: “If, as many have claimed, how a society educates children offers a window into what it values, then how teachers are trained is also particularly revealing” (p. 499). Russell and Davidson Devall (2016) described this as a “critical role of teacher educators in helping [pre-service teachers] to meet professional expectations across all domains” (p. 494). Owens-Oliver (2014) summarized that the “role of a teacher education program is not just to prepare candidates to meet the demands of required of teachers, but to screen out those who are not able to do so” (p. 22). Maddox and Reglin (2019) summarized this responsibility as “building a foundation of professional knowledge” for pre-service teachers (p. 230), which further highlights the need to evaluate pre-service teachers for pedagogical knowledge and performance that cannot entirely be marked as right or wrong on a standardized content assessment. Multiple studies, then, demonstrate agreement in the active role educator preparation programs must take in preparing their pre-service teachers for both licensure assessments and readiness to be in the PreK-12 classroom.
In order to prepare pre-service teachers for qualifying examinations, educator preparation programs must expose pre-service teachers to the content and provide interaction with the content being measured on such assessments as Praxis Subject Assessments (Moser, 2014) and edTPA (Russell & Davidson Devall, 2016). Interestingly, to ensure faculty were equipped to guide pre-service teachers in test preparations, one educator preparation program took a unique approach and had two faculty members in each language content area take the associated content Praxis assessment (Moser, 2014). The faculty’s interaction through their own personal attempt with the assessment allowed the educator preparation program to more adequately make program enhancements to support pre-service teacher learning. This same approach could be implemented by other educator preparation programs to familiarize faculty with test structure and academic language (Castellano et al., 2016).

Beyond preparation for a strictly content-specific assessment, Stewart et al. (2015) advocated for educator preparation programs to design programs in a way to further develop classroom performance components and ensure pre-service teachers are able to justify the effectiveness of each support and instructional decision. This approach moves beyond a basic assessment score and requires pre-service teachers to defend their professional decisions. One redesign recommendation, given by Polly and Byker (2019), to better prepare pre-service teachers for such assessments relies on a fully online, asynchronous course to introduce and guide pre-service teachers through the fundamental principles of the high-stakes licensure assessments. Their course focused on the language, terminology or vocabulary, and skills that would set up pre-service teachers for success on the edTPA (Polly & Byker, 2019). In some perspectives, such a preparation course (Polly & Byker, 2019) or related assignments in preparation of the edTPA tasks (Greenblatt, 2019; Lachuk & Koellner, 2015) are deemed critical
for success, though other perspectives suggest that is merely teaching to the test, a common
critique enforced on many PreK-12 teachers in response to standardized testing. Lachuk and
Koellner (2015) advocated that education preparation programs need to maintain program
integrity while also supporting their pre-service teachers in these assessment foundations—that
is, programs need to not lose their program missions, values, and objectives just to strengthen
edTPA results.

Sandholtz and Shea (2015) challenged educator preparation programs using only one
measure of credentialing qualification to consider restructuring their programs to incorporate
multiple measures of evaluation until the education field designs one all-encompassing tool. This
stance was echoed by Russell and Davidson Devall (2016) in their encouragement to educator
preparation programs to use a “range of local-, state-, and nationally endorsed assessments” (p.
494). Bastian et al. (2016) suggested that educator preparation programs “use evidence from
candidate performance assessments to identify programmatic strengths and areas for
improvement, enact evidence-based program reforms, and evaluate the success of those reforms”
(p. 3). Further, Barker and Conley (2014) described the need for “multiple lines of evidence” (p.
199). Though a different type of recommendation than a purely content or pedagogical
perspective, Liou et al. (2017) promoted the need for educator preparation programs to create
opportunities and an atmosphere where pre-service teachers learn to comfortably rely on their
peers for support, collaboration, and encouragement. Their study demonstrated that increased
peer trust, self-efficacy, and GPA resulted in higher achievements on standardized licensure
assessments and evaluations, such as PACT (Liou et al., 2017). Education researchers seem to
agree, then, that a variety of assessment tools and approaches need used to fully evaluate and
support a pre-service teacher in their preparation.
Accreditation. Moser (2014) briefly described the accreditation process that involves professional standards “to identify the knowledge, skills, and professional dispositions that are required of candidates seeking initial teacher licensure” (p. 135) through a national accrediting agency, such as the Council for the Accreditation of Educator Preparation (CAEP; Brown et al., 2015; Floden et al., 2017). As part of the process, educator preparation programs document program effectiveness through their pre-service teachers’ success on various items, including high-stakes licensure assessments. Jones et al. (2011) reiterated that educator preparation programs “must produce candidates that successfully pass these exams or be prepared to lose their state accreditation” (p. 909). For this reason, compliance with content knowledge assessments and performance assessments are critical for each educator preparation program (Brown et al., 2015).

To promote accountability and accreditation for educator preparation programs, CAEP (2019), one of the primary accrediting agencies for teacher education, maintains five standards that outline regulations and expectations to be met. The five standards are as follows: (1) Content and Pedagogical Knowledge; (2) Clinical Partnerships and Practice; (3) Candidate Quality, Recruitment, and Selectivity; (4), Program Impact; and, (5) Provider Quality, Continuous Improvement, and Capacity (CAEP, 2019). Within the standards, a strong emphasis is given to mastery of knowledge and performance, which must be well-documented through assessment scores and performance evaluations. Heafner, McIntyre, and Spooner (2014) evaluated the critical mutually beneficial relationship between all stakeholders as reflected in CAEP’s (2019) stance on co-construction and co-design of evaluative measures and the validity and reliability of such measures. Russell and Davidson Devall (2016) added strength to the commentary for establishing consistency across valid and reliable evaluations with the intent to “clarify
expectations [of teacher readiness and success] and allow for the comparison of results across different programs, states, and districts” (p. 480).

With the exception that male pre-service teachers in graduate programs with a GPA above 3.0 were more likely to rate higher on their final student teaching performance evaluation, Dee and Morton (2016) found that for the larger sample of 355 graduate pre-service teachers, there was not an overall predictive relationship between GPA and student teaching performance. In other words, a high GPA does not guarantee or predict a pre-service teacher would be more successful in their student teaching experience than their peers with lower GPAs. Using their results, Dee and Morton (2016) further advocated for accreditation agencies and educator preparation programs to evaluate how such measures as GPA and early testing are used as screening measures for admitting or denying pre-service teachers entrance into licensure programs.

Despite the call for accountability through CAEP’s standards, Dee and Morton (2016) argued that some of the program admission expectations are not entirely reflective of guaranteed success of pre-service teachers in the classroom. Dee and Morton (2016) particularly examined the admission requirements for pre-service teachers entering a Master of Arts in Teaching (MAT) program. Due to the largely non-traditional nature of graduate students in MAT programs, Dee and Morton (2016) were concerned that program entrance measures, such as GPA and SAT/ACT scores, were not truly reflective of the pre-service teacher’s ability and potential of present day. Instead, these measures often reflected their past ability during an undergraduate program. Again, as many students enrolled in MAT programs are non-traditional students as noted by age or career switchers, it is likely those measures were from years and years prior to their pursuit of a teacher licensure degree.
Summary

To be eligible for state teacher licensure, pre-service teachers must fulfill a list of qualifications, including licensure assessments for both content and pedagogical knowledge. Many teacher evaluation tools exist, from those used in pre-service teacher assessment to those used for practicing teacher assessments. Though content knowledge evaluations have generally long been administered through high-stakes assessment formats, such as the Praxis Series of assessments for teacher licensure eligibility, performance evaluations have traditionally been homegrown in that each educator preparation program has created and adapted their own observational tools and protocols based on their own program missions, objectives, and values. To respond to increased demand from regional and national accreditation organizations, educator preparation programs have to shift toward the integration of valid and reliable instruments, such as PACT, edTPA, and the CPAST Form. Of course, as this trend continues, more and more instruments will likely become options. This steers educator preparation programs to reflect on and make program decisions on research-based data, but it does create more work and effort to accomplish the process of instrument development, followed by the process of confirming validity and reliability.

In addition to the presence of validity and reliability and the increased use of multiple assessments for each pre-service teacher, educator preparation programs must evaluate the relationship between content knowledge assessment and performance assessment, or pedagogical knowledge, with the hopes of determining how to more strategically and effectively streamline assessment of pre-service teachers. By identifying correlations within assessment data, pre-service teacher demographics, and similar attributes, educator preparation programs can adapt initiatives to meet the growing demands of the teacher workforce. Recognizing the correlations
of such pre-service teacher factors, educator preparation programs may also identify areas needing improvement within curriculum frameworks and develop appropriate interventions and trainings to support the weaker areas from the assessment outcomes.

From the literature review, it is evident that a gap in literature exists with building connections between the CPAST Form and other elements of pre-service teachers and educator preparation programs. While this may be due to the relatively new nature of the CPAST Form being used, this study will be valuable in building the awareness of and extended use of the CPAST Form in evaluating pre-service teachers and their eligibility of teacher licensure as well as their teacher readiness. Due to the wide gap in literature pertaining to the CPAST Form, there exists opportunities to research how the CPAST Form best predicts or correlates to other areas of pre-service teacher preparation and even connections to be made for how the CPAST Form relates to future performance and longevity of pre-service as practicing teachers. The focus of this study will seek to minimize the gap in literature by demonstrating a correlational relationship between the evaluation of a pre-service teacher’s content knowledge, as measured by the Praxis Subject Assessment for Elementary Education, and a pre-service teacher’s pedagogical knowledge or performance, as measured by the CPAST Form, through the lens of educator preparation programs.
CHAPTER THREE: METHODS

Overview

To expand direct analysis of the Candidate Preservice Assessment of Student Teaching (CPAST) Form as a measure of a pre-service teacher’s pedagogical knowledge, particularly as a predictive element of the pre-service teacher’s content knowledge, this study assessed the connection between the Praxis Subject Assessment for elementary education pre-service teachers and the CPAST Form. Chapter Three addresses the core study elements, including the research design, research question and hypothesis, setting and participants in the sample population, instruments used, procedures followed, and the data analysis overview.

Design

A quantitative research method was utilized to explore the predictive correlation of an elementary pre-service teacher’s content knowledge, defined as information needed “based on the content area specific to perspective teachers’ chosen area of specialty” (Mahoney, 2015, p. 78), and a pre-service teacher’s pedagogical knowledge, or their ability to effectively teach their content with research-based instructional strategies (Callingham et al., 2016; Voss et al., 2011). A predictive correlational design was appropriate for this study as the purpose was to examine the relationship between one or more predictive variables and a criterion variable (Creswell & Creswell, 2018; Gall et al., 2007).

As measured by the Praxis Subject Assessment – Elementary Education: Multiple Subjects, the predictor variable was content knowledge. Content knowledge for elementary education pre-service teachers involves a broad competency measure of Reading and Language Arts, Mathematics, Social Studies, and Science as elementary teachers are responsible for teaching fundamentals in all four subject areas. Gitomer and Zisk (2015) entitled teachers as
content knowledge professionals needing to fully understand their content area in order to transfer their knowledge to their students.

As measured by the Candidate Preservice Assessment of Student Teaching (CPAST) Form, the criterion variable was pedagogical knowledge. Pedagogical knowledge is often demonstrated through performance in the PreK-12 classroom of actual instruction (Callingham et al., 2016; Voss et al., 2011).

**Research Question**

The research question explored in this study is as follows:

**RQ1:** How accurately can undergraduate elementary pre-service teacher pedagogical knowledge as measured by the Candidate Preservice Assessment of Student Teaching (CPAST) Form scores be predicted from a linear combination of content knowledge as measured by the Reading and Language Arts, Mathematics, Social Studies, and Science subtests scores from the Praxis Subject Assessment – Elementary Education: Multiple Subjects?

**Hypotheses**

The null hypotheses for this study were:

**H₀₁:** There will be no significant predictive relationship between the pedagogy subscale of the criterion variable (elementary pre-service teacher pedagogical knowledge as measured by the CPAST Form) and the linear combination of predictor variables (Praxis Subject Assessment – Elementary Education: Multiple Subjects: Reading and Language Arts, Mathematics, Social Studies, and Science).

**H₀₂:** There will be no significant predictive relationship between the dispositions subscale of the criterion variable (elementary pre-service teacher pedagogical knowledge as measured by the CPAST Form) and the linear combination of predictor variables (Praxis Subject Assessment – Elementary Education: Multiple Subjects: Reading and Language Arts, Mathematics, Social Studies, and Science).
Assessment – Elementary Education: Multiple Subjects: Reading and Language Arts, Mathematics, Social Studies, and Science).

**Participants and Setting**

To understand the predictive nature of Praxis Subject Assessment on pre-service teacher’s pedagogical knowledge in the classroom, the target population of participants for the study was collected from a sample of college students enrolled in a traditional residential, four-year educator preparation program at the undergraduate level who were seeking an elementary education endorsement at a large university in the Mid-Atlantic region of the United States. The university, a private non-profit institution, is one of nearly 30 higher education institutions approved by the university’s state to offer an educator preparation program in elementary education at the undergraduate level. Other institutions also have state approval for offering elementary programs but are limited to graduate program offerings.

Students enrolled in such education programs are often referred to as pre-service teachers and were identified as such in this study. Pre-service teachers at the study’s university complete an application for student teaching eligibility that includes the submission of their Praxis Subject Assessment official score reports and other state-mandated assessments or components, as well as program-specific requirements. The applications are reviewed, and scores are verified by the staff personnel at the university. Data was drawn from four cycles, or semesters, of archival data: Spring 2019, Fall 2019, Spring 2020, and Fall 2020. Collection of data through the university’s archived data system took place as a convenience sample from all undergraduate elementary education pre-service teachers who student taught during the four cycles. A convenience sample was appropriate for this study as it meets most of Gall et al.’s (2007) criteria for such a sample, including the researcher’s close relationship with the site and the data already being available in
the site’s data systems. Due to the nature of this correlational study of archived data, names of participants were not needed to be included in the data analysis. The university, as a generic reference to the study’s higher education institution, will be used for confidentiality.

The sample size consisted of 167 pre-service teachers seeking an elementary education endorsement between the Spring 2019 semester and the Fall 2020 semester. To produce a medium effect size at the .05 alpha level with statistical power of .7, a sample size of at least 66 participants had to be recruited (Gall et al., 2007). Because archival data was accessed through the university record systems, direct recruitment of participants was not necessary. The university has an average of 50 elementary education pre-service teachers in their student teaching population each semester, so meeting the minimum number of 66 participants set by Gall et al. (2007) was easily obtained across four semester cycles.

The participants consisted of 6 males and 161 females who were seeking an elementary education endorsement, a combined total of 167 participants. A majority of participants were anticipated to be female due to the relative nature of the teacher population, and this was confirmed in the data collection. The Organisation for Economic Co-operation and Development (2019) showed that in 2016, 87.1% of all primary teachers in the United States were female. Following the National Center of Education Statistics (NCES, 2020) model for age categories, a traditional university student is defined as a student aged 25 years old and below, and a non-traditional university student is defined as a student aged 26 years and above. Of the participants, 165 were traditional university students below the age of 25 at the start of their student teaching semester, and 2 were non-traditional students above the age of 25 at the start of their student teaching semester. Additional demographics, including the race/ethnicity of participants was also obtained. The participants included 1 African American/Black (0.6%), 128 Caucasians (76.65%),
1 American Indian (0.6%), 1 Hispanic (0.6%), 3 two or more races (1.8%), and 33 participants (19.76%) did not report their race/ethnicity. Participant demographics are displayed in Table 1.

Table 1

Participant Demographics

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Participants (N)</th>
<th>Participants (%)</th>
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<tbody>
<tr>
<td>Gender</td>
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<td></td>
</tr>
<tr>
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<td>96.41</td>
</tr>
<tr>
<td>Male</td>
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<td>Total</td>
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<td>100</td>
</tr>
<tr>
<td>Age</td>
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</tr>
<tr>
<td>Traditional (&lt; 25)</td>
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<td>99</td>
</tr>
<tr>
<td>Non-traditional (26+)</td>
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<td>1</td>
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<tr>
<td>Race/ethnicity</td>
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<tr>
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<tr>
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<td>1.8</td>
</tr>
<tr>
<td>Unreported</td>
<td>33</td>
<td>19.76</td>
</tr>
</tbody>
</table>

Instrumentation

Instrumentation for this research study consisted of two primary measures: Praxis Subject Assessment – Elementary Education: Multiple Subjects and the Candidate Preservice Assessment of Student Teaching (CPAST) Form. Jones (2018) constructed a study, similar to the
current study, which assessed the relationship between content and performance assessments strictly for pre-service teachers in the social sciences field. The content assessment used was a Praxis exam, though the performance evaluation was the study university’s home-grown instrument rather than a tool that had been proven valid and reliable (Jones, 2018). Though Jones (2018) did offer pre-service teachers scored relatively well on both content and pedagogical assessments, the data analysis did not confirm a significant relationship or correlation between the two measures.

Though the implementation of the licensure assessments, the Praxis Subject Assessment and the CPAST Form, may vary per educator preparation program, the study’s university educator preparation program required their pre-service teachers to successfully pass the Praxis Subject Assessment – Elementary Education: Multiple Subjects prior to their student teaching semester, where their pedagogical performance was evaluated using the CPAST Form. Therefore, this sequential order of valid and reliable instruments (ETS, 2019; Kaplan et al., 2017) allowed for the content knowledge score as reported from the Praxis Subject Assessment – Elementary Education: Multiple Subjects to be identified as the predictor variable. This sequence then defined the CPAST Form scores as the criterion variable.

Pre-service teachers’ scores from both assessments were pulled from archival data housed with the educator preparation program to determine the possibility of using the content score as a screening tool for predicting a pre-service teacher’s performance in the classroom during their student teaching semester. Thorough descriptions of both assessments are provided in the following sections.
Praxis Subject Assessment – Elementary Education: Multiple Subjects

Created as an assessment instrument to primarily measure content knowledge and some notes of pedagogical knowledge, the Praxis Subject Assessment series is geared toward testing whether a pre-service teacher has mastery of the content expected to be taught in their respective endorsement of the PreK-12 classroom (Educational Testing Service [ETS], 2019). It is a series of measure across the nation with more than 40 states and U.S. territories participating in the testing requirements, though specific assessment versions and passing scores vary from one state to the next (ETS, 2019). Reflective of the high volume use across the United States, the Praxis assessment series has been used in numerous studies (Jones, 2018; Mahoney, 2015; Moser, 2014; Owens-Oliver, 2014; Shah et al., 2018). Mahoney (2015) confirmed that the Praxis Subject Assessment series is the primary assessment for teacher licensure eligibility for most states.

The ETS (2019) claims the Praxis Subject Assessment series is “developed by educators for educators” through “advisory committees of distinguished teachers, teacher educators, key administrations and professional organizations” who provide input for test content based on what they deem as being most appropriate for beginning teachers (About the Test, para. 10). The validity and reliability of the various Praxis Subject Assessments are documented through the ETS Standards for Quality and Fairness (ETS, 2015), which is supported through standards and technical guidelines set forth by the American Educational Research Association’s Standards for Educational and Psychological Testing.

The Praxis Subject Assessment – Elementary Education: Multiple Subjects numerates a pre-service teacher’s content knowledge. Question format involves selected-response and numeric-entry (ETS, n.d.) through a computer-based setting at available proctored testing centers. Traditionally, the assessment has only been offered through in-person testing options. In
the spring of 2020, when much of the United States and the world at large shut down due to the coronavirus (COVID-19) pandemic, testing availability was immediately impacted and in most cases halted altogether due to test center closures (ETS, 2020). With pre-service teachers still in need of access to the licensure assessments to proceed in their educator preparation programs and to proceed with their routes toward teacher licensure, ETS partnered with ProctorU® to make select assessments available through an at-home testing experience (ETS, 2020).

More traditional accommodations, such as additional testing allowance, are available upon request when the pre-service teacher qualifies and completes the applicable testing accommodations request process outlined, managed, and approved by ETS (2019). Accommodations approved at a pre-service teacher’s university do not automatically qualify accommodations through ETS for the Praxis series. Due to the nature of the Praxis Subject Assessment – Elementary Education: Multiple Subjects being a high-stakes, standardized assessment, a specific copy of the assessment is not available to include; however, practice assessments may be obtained through ETS or other available practice resources. The assessment administration requires approximately 4.25 hours to complete the four subtests.

In Virginia, the Praxis Subject Assessment – Elementary Education: Multiple Subjects is the current required Praxis Series assessment for those seeking an elementary education teaching license, which credentials a pre-service teacher to teach general elementary content areas from PreK through Grade 6. At the university, pre-service teachers are required to take and successfully pass the Praxis assessment as part of their student teaching eligibility. This timeline suggests that pre-service teachers participate in the administration of the assessment approximately between their junior and senior year in order to submit their passing scores at the start of the semester prior to their student teaching semester. If the first attempt is unsuccessful,
pre-service teachers have an opportunity to retest on the individual subtests; all four subtests do not need to be reattempted if a passing score has already been achieved in the applicable subtest. Official score reports are submitted to the University by the individual pre-service teacher as part of their student teaching application, and a data set of test scores for all pre-service teachers during established testing windows is shared by ETS directly with the University and entered into the University’s institutional records. This direct transaction between ETS and the University only occurs when the pre-service teacher selects the University as a score recipient.

The 5001 series of test codes for the Praxis Subject Assessment – Elementary Education: Multiple Subjects test has been active since July 1, 2015 (Virginia Department of Education, 2017), and offers organization of four subtests (individual subtest codes and passing cut scores provided): Reading and Language Arts, Mathematics, Social Studies, and Science. Each subtest has a possible score range from 0 to 200, and while each state establishes a required cut score for their pre-service teachers, the required scores for Virginia are outlined in Table 2. Though the 5001 test code represents the culmination of all four subtests, Virginia pre-service teachers are required to obtain specific passing scores on each subtest; in other words, a culminating score is not directly calculated by ETS for test code 5001. Instead, pre-service teachers earn an individual score for the 5002, 5003, 5004, and 5005 subtests. Subtest scores, number of questions, and time allowance are shared in Table 2. Each subtest reflects several topics within the specific subject area.
Table 2

*Praxis Subject Assessment – Elementary Education: Multiple Subjects Subtests*

<table>
<thead>
<tr>
<th>Subtest (Test Code)</th>
<th>Number of Questions</th>
<th>Time Allowance (minutes)</th>
<th>Passing Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading and Language Arts (5002)</td>
<td>80</td>
<td>90</td>
<td>157</td>
</tr>
<tr>
<td>Mathematics (5003)</td>
<td>50</td>
<td>65</td>
<td>157</td>
</tr>
<tr>
<td>Social Studies (5004)</td>
<td>60</td>
<td>60</td>
<td>155</td>
</tr>
<tr>
<td>Science (5005)</td>
<td>55</td>
<td>60</td>
<td>159</td>
</tr>
</tbody>
</table>

**Reading and Language Arts Subtest**

The Reading and Language Arts subtest, identified as test code 5002, includes categories of reading, writing, speaking, and listening (ETS, 2019). Administration of this subtest consists of 80 questions in 90 minutes. In Virginia, a pre-service teacher must meet the minimum required score of 157 for licensure eligibility.

**Mathematics Subtest**

The Mathematics subtest, identified as test code 5003, includes categories of numbers and operations, algebraic thinking, geometry and measurement, data, statistics, and probability (ETS, 2019). The administration of this subtest consists of 50 questions in 65 minutes. In Virginia, a pre-service teacher must meet the minimum required score of 157 for licensure eligibility.

**Social Studies Subtest**

The Social Studies subtest, identified as test code 5004, includes categories of United States history, government, and citizenship; geography, anthropology, and sociology; and, world history and economics (ETS, 2019). The administration of this subtest consists of 60 questions in
60 minutes. In Virginia, a pre-service teacher must meet the minimum required score of 155 for licensure eligibility.

**Science Subtest**

The Science subtest, identified as test code 5005, includes categories of earth science, life science, and physical science (ETS, 2019). The administration of this subtest consists of 55 questions in 60 minutes. In Virginia, a pre-service teacher must meet the minimum required score of 159 for licensure eligibility.

**Candidate Preservice Assessment of Student Teaching Form**

The Candidate Preservice Assessment of Student Teaching (CPAST) Form is designed to measure a pre-service teacher’s classroom performance (The Ohio State University, 2019). In favor of accreditation expectations, the CPAST Form was configured with CAEP and InTASC standards in mind (Brownstein et al., 2017; The Ohio State University, 2021). Likely due to the relative newness of the instrument, there are no recent, credible studies depicting the instrument’s use, with the exception of a study by Kaplan et al. (2017) that reviewed the reason for other colleges and universities providing willing participation in the initial use of the CPAST Form.

The CPAST Form was specifically developed to be used during the student teaching experience to assess two subscales: pedagogy and dispositions (The Ohio State University, 2019). Development took place across a three-year span (Brownstein, Kaplan, Yao, & Day, 2017) as a multi-institutional collaboration resulting from the Valid and Reliable Instruments for Educator Preparation Programs (VARI-EPP) Project Collaboration (The Ohio State University, 2021). The VARI-EPP’s intent is to “develop instruments that are valid and reliable for use in accreditation” and that are “freely available” (para. 1) to educator preparation programs. During
Year 1, the initial version of the form was constructed and put into practice at just one institute (Brownstein et al., 2017). Year 2 drew participation and revision suggestions from eight programs through a pilot of 322 pre-service teachers from those same programs. Brownstein et al. (2017) analyzed the validity and reliability from the pilot participation. Insight from 10 programs was then taken during Year 3 to further revise the form. In that same year, participation grew to 23 programs with a combined total of 1,203 pre-service teacher candidates, followed by further validity and reliability analyses (Brownstein et al., 2017).

A supplemental “Look Fors” document is provided, as well as a 90-minute training module, to ensure users are interacting with the CPAST Form appropriately and maintaining the validity and reliability of the instrument’s 21 score ratings (The Ohio State University, 2019). University supervisors must obtain at least an 80% on the self-paced 90-minute PowerPoint training, documented through quiz completion, in order to be granted permission to access and use the form (Brownstein et al., 2017; Yao et al., 2017). Three sections make up the 90-minute training (Yao et al., 2017). A self-paced 30-minute PowerPoint training is also provided for University Supervisors as a refresher for use after the initial year (Brownstein et al., 2017), which consists of just one section (Yao et al., 2017). Though not required, a self-paced 20-minute PowerPoint training of only one section is available for the pre-service teachers and their cooperating teachers (Brownstein et al., 2017; Yao et al., 2017). Unlike the version of university supervisors, this optional training for pre-service teachers and cooperating teachers does not conclude with a quiz (Yao et al., 2017).

Of the 21 score ratings across the two primary categories of pedagogy and dispositions, there are 13 ratings for pedagogy categories and 8 ratings for dispositions. Pedagogy ratings address sections categorized as Planning for Instruction and Assessment (includes 4 subtopic
areas), Instructional Delivery (includes 5 subtopic areas), Assessment (includes 3 subtopic areas), and Analysis of Teaching (includes 1 subtopic area) (Brownstein et al., 2017). Dispositions ratings address sections categorized as Professional Commitment and Behaviors (includes 5 subtopic areas), Professional Relationships (includes 2 subtopic areas), and Critical Thinking and Reflective Practice (includes 1 subtopic area) (Brownstein et al., 2017). Specific details of each subtopic area are held confidential until an educator preparation program has processed the necessary contract for institution use. Though “freely available” (The Ohio State University, 2021, use of the CPAST Form does require a formal, contractual agreement, or a memorandum of understanding (Brownstein & Kaplan, 2017) with The Ohio State University (2019), which must be updated every two years for continued use (The Ohio State University, 2021). The university in this study has obtained the necessary agreement to use the form, which grants the University permission to use the data results from the instrument; however, this agreement does not permit a copy of the CPAST Form to be included directly in this study.

For each category or row, a pre-service teacher is scored on a scale of 0-3 (Yao et al., 2017). From left to right, the ratings are Exceeds Expectations (3 points), Meets Expectations (2 points), Emerging (1 point), and Does not Meet Expectations (0 points) (Yao et al., 2017). The “Look Fors” document provides users with specific details that are to be observed in order for a pre-service teacher to achieve particular ratings on the CPAST Form rubric (Brownstein et al., 2017; The Ohio State University, 2019).

The CPAST Form provides multiple scores or data points, though the main data point is identified as the consensus score and is calculated as a midterm score and a final score (Brownstein et al., 2017). A consensus score is calculated from the feedback of three placement stakeholders: the university supervisor, the cooperating teacher or mentor, and the pre-service
teacher (Brownstein et al., 2017). This consensus process takes place at the midway point of the student teaching placement and then again at the end of the placement. Researchers addressed content, construct, and concurrent validity and internal consistency and inter-rater reliability in the development of the CPAST instrument (The Ohio State University, 2017). An average content validity ratio, which measures how many evaluators or experts on the given panel rate an element as necessary (Lawshe, 1975), of .94 was achieved for clarity, 1 was achieved for importance, and .94 for representativeness (The Ohio State University, 2017). The Ohio State University (2017) researchers had three experts on their designated panel (a K-12 teacher, an educator preparation program faculty member, and a psychometrician; Brownstein et al., 2017), which dictated a content validity ratio of .8. Based on the average ratios given, the CPAST instrument qualified for content validity. Correlation was demonstrated for construct validity ($r = .873, p < .001$) between the pedagogy scale and the disposition scale (The Ohio State University, 2017). Internal consistency was confirmed using Cronbach’s alpha: .907 on the pedagogy scale and .831 for the disposition scale, and a combined coefficient of .929 (The Ohio State University, 2017). Other measures of reliability include inter-rater reliability noted through an average adjacent agreement rate of 98% and an average Kappa of .97 (The Ohio State University, 2017).

The CPAST Form serves as an observational tool led by the pre-service teacher’s university supervisor during student teaching. Unlike most conventional observation instruments, the CPAST Form integrates input from all stakeholders: the pre-service teacher or student teacher, the mentor teacher, and the university supervisor. Each participant uses the rubric to evaluate the pre-service teacher, including the pre-service teacher themselves. The unique approach culminates with a conference between all three stakeholders, where ratings are
compared and discussed, resulting in one consensus score for each rating between all three stakeholders. For pre-service teachers at the university, CPAST rubric scores are submitted by each individual via an electronic evaluation system, LiveText by Watermark.

**Procedures**

Before the researcher commenced with the study and collection of data, permission was sought from the university’s Institutional Review Board (IRB) to request approval to use and access to the archived data from Praxis Subject Assessment and CPAST (see Appendix A). After the initial review, it was determined an intermediary would need to be identified to directly collect the data on behalf of the researcher. The need for an intermediary was rooted in the concern that data was being pulled from two data systems and would need to be combined through the use of student identifiers. After aligning the data, the intermediary would be able to strip the data of student identifiers before he passed along the compiled data to the researcher. The Director of Assessment in the School of Education agreed to serve in this role as intermediary for data collection (see Appendices D). An email was submitted to the Associate Dean of the School of Education at the university to request permission to have the data extracted for review. The email submitted to the department included the key information highlighted for the data extract (see Appendix B). Once the approval was received from the School of Education administration (see Appendix C), the approval letter was added to the IRB application and resubmitted for an updated review. Upon approval from the IRB on the second submission (see Appendix A), the next steps consisted of processing a request for the actual data extract, which was primarily managed via email with the intermediary (see Appendix E). Data was pulled from the university’s main data and student record system and the School of Education’s LiveText by Watermark account. Praxis scores and student demographics were
housed in the university’s student information system, and CPAST scores were found in LiveText by Watermark.

The first data extract of the predictor variable, the Praxis Subject Assessment – Elementary Education: Multiple Subjects, was shared with the university’s data management team via the intermediary with a request to have the Praxis scores and student demographics data collected (see Appendix D). An Excel spreadsheet accompanied the request to ensure the correct data was returned. Identifying factors will limit the data parameters. Undergraduate pre-service teachers included in the data extract must have been enrolled in the elementary education program, completed the Praxis Subject Assessment – Elementary Education: Multiple Subjects, and have student taught during the semesters of Spring 2019, Fall 2019, Spring 2020, or Fall 2020. The data extract request also included the pre-service teachers’ gender, age, and race/ethnicity demographics to provide an opportunity for the data to be disaggregated for trends or patterns within the data results. Because the data was being extracted from an archived database, it was necessary to specify that the age be identified as the age when the participant started their student teaching semester.

The second data extract of criterion variable, the CPAST Form, was shared with the School of Education’s Assessment Director, also the intermediary, to request to have the CPAST data collected from LiveText by Watermark (see Appendix E). Only the consensus score on the CPAST Form was extracted for evaluation purposes, rather than the individual stakeholder scores or even the mid-term scores, as the consensus score was considered to be the official data reported to The Ohio State University (2019).

While specific participant names were not necessary for either data extract, a common identifier was necessary to relate and connect the Praxis scores being pulled from the university’s
data system and the CPAST scores being pulled from the LiveText by Watermark system. The connection of the datasets was critical to ensure the intermediary was able to appropriately align the data so that the researcher was able to compare the predictive relationship between the predictor variable and the criterion variable for each pre-service teacher.

Once datasets were extracted, aligned, stripped of student identifiers, and provided to the researcher for both Praxis and CPAST, the researcher maintained the data on a password-protected computer to ensure the confidentiality of pre-service teachers. Only the researcher had access to the password. The initial dataset included all undergraduate elementary pre-service teachers that student taught during the Spring 2019, Fall 2019, Spring 2020, and Fall 2020 semesters. The Excel spreadsheet of data was reviewed to identify any areas where incomplete data was present. Holes in the data were analyzed carefully as incomplete data was not allowed for an analysis of relationship between the two sets of scores. Resolving the incomplete data was critical before moving forward with intricate data analysis. Once data was fulfilled in its entirety, data was entered into the IBM Statistical Package for Social Sciences (SPSS) statistics software program to begin data analysis.

**Data Analysis**

Using a Microsoft Excel spreadsheet, datasets were first reviewed for missing data. Data screening was completed on both the predictor variable, Praxis Subject Assessment, including all subtests, and the criterion variable, the CPAST Form, as well as a screening of the variables combined. Due to missing at least one or more rating on the 21-score CPAST Form, eight pre-service teachers were removed. Once incomplete datasets were removed and the remaining sample was finalized, data analysis will begin.
Further data screening was completed on both the predictor variable, Praxis Subject Assessment, including all subtests, and the criterion variable, the CPAST Form, as well as a screening of the variables combined in SPSS. Some coding was implemented upon entering the data into SPSS in order to analyze the descriptive statistics. For gender, “1” was identified as female and “2” was identified as male. Ethnicity was also coded with the following: “1” for American Indian, “2” for African American/Black, “3” for Hispanic, “4” for two or more, “5” for unreported, and “6” for Caucasian. All other data points were already numerical.

Multiple regression was used to analyze the data to show whether a predictive relationship exists between individual predictor variables on the criterion variable (Warner, 2013). A multiple regression is appropriate because the process “determine[s] the correlation between a criterion variable and a combination of two or more predictor variables” (Gall et al., 2007, p. 353). In the case of this correlational study, the primary predictor variable provides multiple components through the assessment’s four subtests of Reading and Language Arts, Mathematics, Social Studies, and Science. This study intended to examine whether the performance on a content-based assessment could predict the performance of a pre-service teacher in the PreK-12 classroom during their student teaching experience.

Use of the multiple regression requires the use of a series of analyses to identify violations of the assumption of linearity, assumption of multivariate normal distribution, and the assumption of the absence of multi-collinearity (Warner, 2013). The first is the assumption linearity of bivariate outliers and was examined using a matrix scatterplot to recognize normality in variable datasets. This allowed the researcher to identify whether extreme outliers existed related to the predictor and criterion variables. Warner (2013) indicated this to mean that all variables should be “fairly uniform,” and if not, then the “bivariate outliers…require attention”
(p. 348). Similarly, Gall et al. (2007) defined an outlier as “an individual or other entity…whose score differs markedly from the scores obtained by other members of the sample” (p. 154). Outliers typically require the researcher to explore possible reasons for the large discrepancy. In this case, there were no extreme outliers that required additional attention or investigation, so the researcher was permitted to continue with further assumption testing.

Next, the assumption of multivariate normal distribution was tested, which examined how well datasets were equally distributed across the spectrum of results. The matrix scatterplot visualized the data points for each pair of variables in order for the researcher to determine whether results were equally or unequally clustered for all variables (Warner, 2013).

Further, the assumption of non-multicollinearity was enacted. This assumption testing explores whether predictor variables produce a significant correlation with the other predictive variables. If collinearity is present, this dismisses the ability for each predictor variable to hold its own value within the data screening (Gall et al., 2007). Variance inflation factor (VIF) was used to calculate multicollinearity.

After the series of assumption testing was complete, the multiple regression model was continued. Finally, the multiple regression was run at the 95% confidence level. An $F$-stat was reported and $R^2$ was used to explain the variance related to the criterion variable. Model coefficients were run, and Pearson’s correlation $r$ was used to measure effect size.
CHAPTER FOUR: FINDINGS

Overview

This quantitative, correlational study sought to identify whether a predictive relationship existed between content knowledge and pedagogical knowledge for elementary education pre-service teachers. The Praxis Subject Assessment – Elementary Education: Multiple Subjects is the predictor variable measuring content knowledge, and the criterion variable measuring the pedagogical knowledge is the Candidate Preservice Assessment of Student Teaching (CPAST) Form. A multiple regression model was used to test the hypotheses. The findings in Chapter Four disseminate the research question, the two null hypotheses, the descriptive statistics, and the overall results.

Research Question

The research question explored in this study is as follows:

RQ1: How accurately can undergraduate elementary pre-service teacher pedagogical knowledge as measured by the Candidate Preservice Assessment of Student Teaching (CPAST) Form scores be predicted from a linear combination of content knowledge as measured by the Reading and Language Arts, Mathematics, Social Studies, and Science subtests scores from the Praxis Subject Assessment – Elementary Education: Multiple Subjects?

Null Hypotheses

The null hypotheses for this study were:

H₀₁: There will be no significant predictive relationship between the pedagogy subscale of the criterion variable (elementary pre-service teacher pedagogical knowledge as measured by the CPAST Form) and the linear combination of predictor variables (Praxis Subject Assessment
– Elementary Education: Multiple Subjects: Reading and Language Arts, Mathematics, Social Studies, and Science).

**H₀2:** There will be no significant predictive relationship between the dispositions subscale of the criterion variable (elementary pre-service teacher pedagogical knowledge as measured by the CPAST Form) and the linear combination of predictor variables (Praxis Subject Assessment – Elementary Education: Multiple Subjects: Reading and Language Arts, Mathematics, Social Studies, and Science).

**Descriptive Statistics**

Demographics for the study participants are represented in Table 1. To begin the data analysis, data for eight pre-service teachers were removed due to incomplete data from either variable, leaving 167 pre-service teachers for the sample. Of the 167-participant sample, 161 were female pre-service teachers \(n = 161, 96.41\%\) and six were male pre-service teachers \(n = 6, 3.59\%\). The majority of the sample was 128 Caucasian pre-service teachers \(n = 128, 76.65\%\), with the remainder of the sample representing one African American pre-service teacher \(n = 1, 0.6\%\), one American Indian pre-service teacher \(n = 1, 0.6\%\), one Hispanic pre-service teacher \(n = 1, 0.6\%\), three pre-service teachers identifying as having two or more races \(n = 3, 1.8\%\), and 33 pre-service teachers not reporting their ethnicity \(n = 33, 19.76\%\). The majority of the sample, 165 pre-service teachers, were identified as traditionally-aged (25 years or younger) university students \(n = 165, 98.8\%\) with only two pre-service teachers categorized as non-traditionally aged (26 years or older) \(n = 2, 1.2\%\).

Descriptive statistics for the four predictor variables, the subtest scores of the Praxis Subject Assessment – Elementary Education, are displayed in Table 3. The range of possible scores for each subtest is 0 to 200. All subtests had a \(N = 167\). Descriptor statistics for the two
criterion variables, the subscales of the CPAST Form, are displayed in Table 4. The range of possible ratings for each subscale is 0 to 3.

**Table 3**

*Descriptive Statistics for Praxis Subject Assessment – Elementary Education Subtest Scores*

<table>
<thead>
<tr>
<th>Praxis Subject Assessment – Subtest</th>
<th>N</th>
<th>Minimum Score</th>
<th>Maximum Score</th>
<th>Mean Score</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading and Language Arts</td>
<td>167</td>
<td>157</td>
<td>195</td>
<td>174.81</td>
<td>9.34</td>
</tr>
<tr>
<td>Mathematics</td>
<td>167</td>
<td>157</td>
<td>200</td>
<td>182.95</td>
<td>12.66</td>
</tr>
<tr>
<td>Social Studies</td>
<td>167</td>
<td>152</td>
<td>200</td>
<td>171.99</td>
<td>11.73</td>
</tr>
<tr>
<td>Science</td>
<td>167</td>
<td>159</td>
<td>200</td>
<td>173.79</td>
<td>10.13</td>
</tr>
</tbody>
</table>

**Table 4**

*Descriptive Statistics for CPAST Ratings*

<table>
<thead>
<tr>
<th>CPAST Form</th>
<th>N</th>
<th>Minimum Rating</th>
<th>Maximum Rating</th>
<th>Mean Rating</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedagogy</td>
<td>167</td>
<td>1.31</td>
<td>3.00</td>
<td>2.65</td>
<td>.37</td>
</tr>
<tr>
<td>Dispositions</td>
<td>167</td>
<td>1.63</td>
<td>3.00</td>
<td>2.78</td>
<td>.31</td>
</tr>
</tbody>
</table>

**Results**

A multiple regression was used to test each null hypothesis to determine if a predictive relationship existed between Praxis Subject Assessment scores (content knowledge) and CPAST scores (pedagogical knowledge) of elementary pre-service teachers. Examination of the two null hypotheses is modeled through data screening, assumption testing, and explanation of results. Multiple regressions were completed at the 95% confidence level with assumptions of linearity,
assumption of multivariate normal distribution, and the assumption of the absence of multi-
collinearity being met.

Data Screening

A multiple regression was conducted to determine if a significant predictive relationship existed between the criterion variable (pedagogical knowledge as measured by the CPAST Form) and the linear combination of predictor variables for elementary education pre-service teachers. Data screening on both the predictor variables and the criterion variables was conducted to remove any data that were incomplete or inaccurate in relation to the structure of measured scores. There were eight pre-service teacher candidates that were missing at least one rating on the 21-rating CPAST Form or lacked uniformed scores; therefore, they were removed from the sample. Upon removing the eight participants with incomplete data, the sample consisted of 167 pre-service teachers seeking the elementary education endorsement.

Null Hypothesis One

Null hypothesis one stated there was no significant predictive relationship between the pedagogy subscale of the criterion variable (elementary pre-service teacher pedagogical knowledge as measured by the CPAST Form) and the linear combination of predictor variables (Praxis Subject Assessment – Elementary Education: Multiple Subjects: Reading and Language Arts, Mathematics, Social Studies, and Science).

Assumptions

Assumption testing is used to ensure the data is appropriate for multiple regression. Warner (2013) identified assumptions for using the multiple regression model: assumption of linearity, assumption of multivariate normal distribution, assumption of bivariate outliers, and the assumption of the absence of multi-collinearity. All assumptions must be met for each null
hypothesis. Multicollinearity refers to the incident of “extremely highly correlated” variables (Warner, 2008, p. 458). In other words, multiple regression requires that it be possible to identify the unique influence of each variable on the predictive relationship. If any two variables are too highly correlated, it is not feasible to proceed with calculations for a multiple regression.

The first assumption test was the assumption of linearity. A matrix scatterplot was constructed using SPSS to analyze the linearity of data between each predictor variable and the criterion variable. The results showed no concerning outliers requiring further attention or investigation. See Figure 1 for the matrix scatterplot showing each possible pair of variables, showing the assumption of linearity was met.

The second assumption test completed was the assumption of multivariate normal distribution to determine the presence of a linear relationship between each pair of variables, looking for the signature “cigar shape”. Histograms of the four predictor variables were also generated to display the frequency of scores for each subtest and the linear combination of all four subtests. Each predictor variable reflected reasonable normal distribution that is “symmetrical and shaped like a bell-curve” (Rovai et al., 2014, p. 192). Figures 2-5 exhibit the normal distribution for each predictor variable.

The third assumption test completed was the assumption of bivariate outliers that was evaluated through a matrix scatterplot of all pairs of predictor variables, as well as the predictor variables and criterion variable. The results showed no concerning extreme bivariate outliers between the four predictor variables and the criterion variable of pedagogy requiring further attention or investigation, so the assumption of bivariate outliers was met. The matrix scatterplot is included in Figure 1.
Figure 1

Matrix Scatterplot

<table>
<thead>
<tr>
<th>Reading</th>
<th>Math</th>
<th>Social Sciences</th>
<th>Science</th>
<th>Pedagogy</th>
<th>Dispositions</th>
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<td><img src="image29.png" alt="Scatterplot" /></td>
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</tr>
</tbody>
</table>
Figure 2

Histogram of Reading and Language Arts Subtest

Figure 3

Histogram of Mathematics Subtest
Figure 4

Histogram of Social Studies Subtest

Figure 5

Histogram of Science Subtest
The assumption of collinearity, or non-multicollinearity for this multiple regression, was met as Tolerance and the Variance Inflation Factor (VIF) was implemented to show the absence of multicollinearity as the tolerance values were between 0.10 and 1.00 and VIF each calculated under 10 for all four predictor variables. As shown in Table 5, the Reading and Language Arts score reported Tolerance = 0.58, VIF = 1.72; the Mathematics score reported Tolerance = 0.61, VIF = 1.64; the Social Studies reported Tolerance = 0.57, VIF = 1.75; and, Science reported Tolerance = .57, VIF = 1.74. Predictor variables below a 0.10 tolerance value are to be removed due to violation of multicollinearity. All VIFs fall within the acceptable values between 1 and 5; a VIF greater than 10 would be considered too highly correlated to proceed (Rovai et al., 2014). Table 5 demonstrates the assumption of non-multicollinearity being met.

Table 5

Collinearity Statistics

<table>
<thead>
<tr>
<th>Model</th>
<th>Tolerance</th>
<th>VIF</th>
</tr>
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<tbody>
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<td></td>
</tr>
<tr>
<td>Reading and Language Arts</td>
<td>.58</td>
<td>1.72</td>
</tr>
<tr>
<td>Mathematics</td>
<td>.61</td>
<td>1.64</td>
</tr>
<tr>
<td>Social Studies</td>
<td>.57</td>
<td>1.75</td>
</tr>
<tr>
<td>Science</td>
<td>.57</td>
<td>1.74</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Pedagogy

Results of Multiple Regression

A multiple regression was used to evaluate null hypothesis one. Null hypothesis one stated that content knowledge of Reading and Language Arts ($M = 174.81$, $SD = 9.34$),
Mathematics ($M = 182.95, SD = 12.66$), Social Studies ($M = 171.99, SD = 11.73$), and Science ($M = 173.79, SD = 10.13$) cannot predict pedagogical performance as measured by the pedagogy subscale ($M = 2.65, SD = 0.37$). Based on the results, the researcher failed to be rejected null where $F(4, 162) = 1.42, p = .23$. Results of the multiple regression are presented in Table 6 and the ANOVA Analysis in Table 7. The Pearson correlation coefficient ($r = .18$) and the $R^2$ coefficient reflect a small effect size in that only 3.4% of the variance of pedagogical performance was predicted by the linear combination of subtest scores from the content knowledge assessment (Rovai et al., 2014). This determined that the predictor variable of content knowledge (Praxis Subject Assessment) was not found to be significantly correlated to the criterion variable of pedagogy from the CPAST Form pedagogical subscale scores.

**Table 6**

*Multiple Regression Model Summary of Praxis Subject Assessment Scores and CPAST Pedagogy Subscale Scores*

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.18a</td>
<td>.03</td>
<td>.01</td>
<td>.37</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Science, Mathematics, Reading and Language Arts, Social Studies.
Table 7

ANOVA\textsuperscript{a} Analysis

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>.77</td>
<td>4</td>
<td>.19</td>
<td>1.42</td>
<td>.23\textsuperscript{b}</td>
</tr>
<tr>
<td>Residual</td>
<td>21.90</td>
<td>162</td>
<td>.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>22.67</td>
<td>166</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{a} Dependent Variable: Pedagogy
\textsuperscript{b} Predictors: (Constant), Science, Mathematics, Reading and Language Arts, Social Studies

Null Hypothesis Two

Null hypothesis two stated there was no significant predictive relationship between the dispositions subscale of the criterion variable (elementary pre-service teacher pedagogical knowledge as measured by the CPAST Form) and the linear combination of predictor variables (Praxis Subject Assessment – Elementary Education: Multiple Subjects: Reading and Language Arts, Mathematics, Social Studies, and Science).

Assumptions

Assumption testing is used to ensure the data is appropriate for multiple regression. Warner (2013) identified assumptions for using the multiple regression model: assumption of linearity, assumption of multivariate normal distribution, assumption of bivariate outliers, and the assumption of the absence of multi-collinearity. All assumptions must be met for each null hypothesis. Multicollinearity refers to the incident of “extremely highly correlated” variables (Warner, 2013, p. 458). In other words, multiple regression requires that it be possible to identify the unique influence of each variable on the predictive relationship. If any two variables are too highly correlated, it is not feasible to proceed with calculations for a multiple regression.
The first assumption test was the assumption of linearity. A matrix scatterplot was constructed using SPSS to analyze the linearity of data between each predictor variable and the criterion variable. The results showed no concerning outliers requiring further attention or investigation. See Figure 1 for the matrix scatterplot showing each possible pair of variables, showing the assumption of linearity was met.

The second assumption test completed was the assumption of multivariate normal distribution to determine the presence of a linear relationship between each pair of variables, looking for the signature “cigar shape”. Histograms of the four predictor variables were also generated to display the frequency of scores for each subtest and the linear combination of all four subtests. Each predictor variable reflected reasonable normal distribution that is “symmetrical and shaped like a bell-curve” (Rovai et al., 2014, p. 192). Figures 2-5 exhibit the normal distribution for each predictor variable.

The third assumption test completed was the assumption of bivariate outliers that was evaluated through a matrix scatterplot of all pairs of predictor variables, as well as the predictor variables and criterion variable. The results showed no concerning extreme bivariate outliers between the four predictor variables and the criterion variable of pedagogy requiring further attention or investigation, so the assumption of bivariate outliers was met. The matrix scatterplot is included in Figure 1.

The assumption of collinearity, or non-multicollinearity for this multiple regression, was met as Tolerance and the Variance Inflation Factor (VIF) was implemented to show the absence of multicollinearity as the tolerance values were between 0.10 and 1.00 and VIF each calculated under 10 for all four predictor variables. As shown in Table 8, the Reading and Language Arts score reported Tolerance = 0.58, VIF = 1.72; the Mathematics score reported Tolerance = 0.61,
VIF = 1.64; the Social Studies reported Tolerance = 0.57, VIF = 1.75; and, Science reported Tolerance = .57, VIF = 1.74. Predictor variables below a 0.10 tolerance value are to be removed due to violation of multicollinearity. All VIFs fall within the acceptable values between 1 and 5; a VIF greater than 10 would be considered too highly correlated to proceed (Rovai et al., 2014). Table 8 demonstrates the assumption of non-multicollinearity being met.

Table 8

Collinearity Statistics

<table>
<thead>
<tr>
<th>Model</th>
<th>Tolerance</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reading</td>
<td>.58</td>
<td>1.72</td>
</tr>
<tr>
<td>Math</td>
<td>.61</td>
<td>1.64</td>
</tr>
<tr>
<td>Social Studies</td>
<td>.57</td>
<td>1.75</td>
</tr>
<tr>
<td>Science</td>
<td>.57</td>
<td>1.74</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Dispositions

Results of Multiple Regression

A multiple regression was used to evaluate null hypothesis two. Null hypothesis two stated that content knowledge of Reading and Language Arts ($M = 174.81$, $SD = 9.34$), Mathematics ($M = 182.95$, $SD = 12.66$), Social Studies ($M = 171.99$, $SD = 11.73$), and Science ($M = 173.8$, $SD = 10.13$) cannot predict pedagogical performance by the dispositions subscale ($M = 2.65$, $SD = 0.37$). Based on the results, the researcher failed to be rejected where $F(4, 162) = 1.23$, $p = .30$. Results of the multiple regression are presented in Table 9 and the ANOVA Analysis in Table 10. The Pearson correlation coefficient ($r = .17$) and the $R^2$ coefficient reflect a
small effect size in that only 2.9% of the variance of disposition performance was predicted by
the linear combination of subtest scores from the content knowledge assessment (Rovai et al.,
2014). This determined that the predictor variable of content knowledge (Praxis Subject
Assessment) was not found to be significantly correlated to the criterion variable of pedagogy
from the CPAST Form dispositions subscale scores.

Table 9

Multiple Regression Model Summary of Praxis Subject Assessment Scores and CPAST

Dispositions Subscale Scores

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.17a</td>
<td>.03</td>
<td>.01</td>
<td>.31</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Science, Mathematics, Reading and Language Arts, Social Studies.

Table 10

ANOVAa Analysis

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regression</td>
<td>.48</td>
<td>4</td>
<td>.12</td>
<td>1.23</td>
</tr>
</tbody>
</table>

| Residual | 15.7 | 162 | .1 |
| Total    | 16.17| 166 |

a. Dependent Variable: Dispositions
b. Predictors: (Constant), Science, Mathematics, Reading and Language Arts, Social Studies
CHAPTER FIVE: CONCLUSIONS

Overview

This final chapter will examine the results of this quantitative, correlational study that analyzed the predictive relationship between elementary education pre-services teachers’ content knowledge and their pedagogical knowledge. Content knowledge, the predictor variable, was measured by the scores achieved by the pre-service teachers on four subtests of the Praxis Subject Assessment – Elementary Education: Multiple Subjects exam (Reading and Language Arts, Mathematics, Social Studies, and Science). Pedagogical knowledge, the criterion variable, was measured by the 21-score ratings on the CPAST Form. After discussing the results of the study, implications, limitations, and recommendations for future research will be presented.

Discussion

The purpose of this quantitative, predictive correlational study was to explore the relationship between the predictor variable, content knowledge, and the criterion variable, pedagogical knowledge of elementary education pre-service teachers. The original data collection included 175 elementary pre-service teachers, but the final sample included 167 elementary pre-service teachers after 8 participants were removed due to incomplete data. All participants were gathered from one education preparation program with data from two valid and reliable assessment instruments: Praxis Subject Assessment – Elementary Education: Multiple Subjects and the Candidate Preservice Assessment of Student Teaching Form. Both the Praxis Subject Assessment (ETS, 2015) and the CPAST Form (The Ohio State University, 2017) have been confirmed as valid and reliable instruments used to evaluate a pre-service teacher’s licensure eligibility. The CPAST Form aligns with the push for more comprehensive analysis of the pre-service teacher’s readiness to include the entirety of the teacher instruction (planning,
implementation, assessment, reflection, etc.) (Chandler-Olcott & Fleming, 2017; Gargani & Strong, 2014; Spooren et al., 2013). Understanding this relationship will better equip school systems to identify key attributes that distinguish and predict the most effective teachers through such assessments, or offer an argument for higher education institutions, states, and accrediting agencies to review the continued use of such licensure assessments.

While several research studies found concern in the predictability of assessment scores based on race (Elpus, 2015; Kula & Tasdemir, 2014; Nettles et al., 2011; Petchauer, 2016; Petchauer et al., 2015; Shah et al., 2018) and gender (Kula & Tasdemir, 2014; Shah et al., 2018), there was insufficient diversity related to both race and gender represented in this study’s sample to review for similar predictability. Therefore, race and gender were not evaluated as direct variables in the present study.

Attention to the relationship of teacher licensure assessment outcomes to PreK-12 student achievement was highlighted by Belson and Husted (2015) and Goldhaber, Gratz, and Theobald (2017), which can lend itself to the support of such licensure assessments in teacher preparation. From the results of this study showing no significant predictive relationship between the content knowledge assessment and the pedagogical performance evaluations, it seems to question that relationship to student achievement. Of course, the sample of participants does reflect those who passed the content knowledge assessment to be eligible for student teaching. Results may differ if the sample included pre-service teachers that did not pass the assessment but were approved to continue with student teaching.

Similar to Jones’ (2018) correlational study that displayed an insignificant relationship between a content assessment, Praxis II Social Sciences Content Knowledge, and a university’s home-grown performance assessment, Teacher Competency Assessment, this study also rejected
to identify a significant relationship between a content assessment and a pedagogical assessment. Bastian et al. (2016) also found a non-significant relationship between content and pedagogical evaluations. In that study, course grades were used to reflect content mastery and the PACT evaluation was used to measure pedagogical mastery. Some educational researchers offered further attention may need to be directed to preparation of the pre-service teachers to better equip them in both areas of training (Callingham et al., 2016; Moser, 2014; Petchauer, 2016; Voss et al., 2011). Chang and Yung (2018) furthered that argument by suggesting that both pre-service teachers and veteran teachers need increased professional development in specific pedagogical content strategies in order to be successful on those mastery assessments. By contrast, Conrad and Stone (2015) expressed concern that this only encourages educator preparation programs to teach to the test, a trend often looked upon with hesitation at the PreK-12 level. Evidence of teaching to the test became apparent with the transition of defining teacher evaluations by student achievement on such standardized assessments (Deming & Figlio, 2016; Shelton & Brooks, 2019). Further exploration is needed of whether the teaching to the test approach actually impacts success and improvement in effective pre-service teacher quality or if the approach simply assists in marking a checkbox of completion in a pre-service teacher’s pursuit of licensure.

Due to similar expectations, challenges, and outcomes of testing, Koretz (2019) recommended that much of the research founded in PreK-12 standardized testing can easily be related to standardized assessment in higher education. One of the main arguments against such high-stakes assessment is that the test measures a singular moment in time and is only a glimpse into the individual’s performance across the entirety of an academic year, or even several years, which he described as “mistaking the part for the whole” (p. 518). In California, standardized test
outcomes demonstrate that while there are small gains for high-achieving students, students identified as disadvantaged or high needs are continuing to show decreased achievement on the tests, deepening the achievement gap (Ugo & Hill, 2017). Another trend of decreased achievement was observed as PreK-12 school systems replace traditional paper-based assessments with more computer-based assessments (Backes & Cowan, 2019). Though some of this comparison may be attributed to the mode of test delivery, the researchers still found concerns of lowered achievement of students being administered the computer format versus the paper format (Backes & Cowan, 2019). The results, then, indicate that administration of such standardized assessments do not guarantee PreK-12 student achievement. If taking Koretz’ (2019) recommendation into account that the results from the use of PreK-12 testing can be applied to higher education, there are definite cautions in using high-stakes testing to screen for definitive pre-service teacher potential due to the possibility of “mistaking the part for the whole” (p. 518).

In similar studies, Gitomer et al. (2011) and Owens-Oliver (2014) revealed that there was evidence to predict a pre-service teacher’s success on one content exam to another, Praxis I to Praxis II, but those indications do not transfer the same predictive nature from one content exam to a pedagogical exam or actual readiness for the classroom. Sandholtz and Shea (2015) also reinforced that course grades did not predict a pre-service teacher’s pedagogical mastery through the PACT assessment. The argument, then, is not whether educator preparation programs or PreK-12 school systems should screen for teaching effectiveness but rather how to do in a meaningful and efficient manner.

If one of the goals of teacher licensure assessments is to screen for promising, long-term educators, then continual review and construction of assessments and evaluations must endure.
Vagi et al. (2019) advocated for a more intricate partnership between educator preparation programs and PreK-12 school systems to facilitate redevelopment of effective measurement instruments. Gargani and Strong (2014) echoed this partnership would ease the transition of how pre-service teachers are evaluated during student teaching and how they are evaluated as the employed classroom teachers. Though many institutions are working toward shared evaluations that are valid and reliable to meet accreditation demands (Brown et al., 2015; CAEP, 2019), Sandholtz and Shea (2015) recommended that institutes must continue to use a variety of assessment tools and approaches to truly evaluate the entirety of the readiness of pre-service teachers, rather than a singular tool. With the results of the present study showing no immediate significant predictive relationship, it may suggest that educator preparation programs and PreK-12 school systems need to continue to explore the best approaches to identifying and screening for key qualifiers for professional educators.

**Null Hypothesis One**

The first null hypothesis stated there was no significant predictive relationship between the pedagogy subscale of the criterion variable (elementary pre-service teacher pedagogical knowledge as measured by the CPAST Form) and the linear combination of predictor variables (Praxis Subject Assessment – Elementary Education: Multiple Subjects: Reading and Language Arts, Mathematics, Social Studies, and Science). A multiple regression was conducted through SPSS to analyze null hypothesis one. The researcher failed to reject the null hypothesis, $F(4, 162) = 1.42, p = .23, R^2 = .03$. Results of the multiple regression show there was inefficient support that a linear combination of Reading and Language Arts, Mathematics, Social Studies, and Science scores of the Praxis Subject Assessment – Elementary Education could reasonably
predict pedagogical performance of elementary education pre-service teachers through the pedagogy subscale of the CPAST Form.

The multiple regression model demonstrated that only 3.4% of the variance of pedagogical performance was predicted by the linear combination of subtest scores from the content knowledge assessment, which displays a small effect size (Rovai et al., 2014). This determined that the predictor variable of content knowledge (Praxis Subject Assessment) was not found to be significantly correlated to the criterion variable of pedagogy from the CPAST Form pedagogical subscale scores. These results are similar to the results of Jones’ (2018) non-significant correlational study between a Praxis assessment and a university’s home-grown pedagogical evaluation instrument, as well as Bastian et al.’s (2016) non-significant relationship between content and pedagogical evaluations. In that study, grades were used to reflect content mastery and the PACT evaluation was used to measure pedagogical mastery.

**Null Hypothesis Two**

The second null hypothesis stated there was no significant predictive relationship between the dispositions subscale of the criterion variable (elementary pre-service teacher pedagogical knowledge as measured by the CPAST Form) and the linear combination of predictor variables (Praxis Subject Assessment – Elementary Education: Multiple Subjects: Reading and Language Arts, Mathematics, Social Studies, and Science). A multiple regression was conducted through SPSS to analyze null hypothesis two. The researcher failed to reject the null hypothesis, \(F(4, 162) = 1.23, p = .30, R^2 = .029\). Results of the multiple regression show there was inefficient support that a linear combination of Reading and Language Arts, Mathematics, Social Studies, and Science scores of the Praxis Subject Assessment – Elementary
Education could reasonably predict pedagogical performance of elementary education pre-service teachers through the pedagogy subscale of the CPAST Form.

The multiple regression model demonstrated that only 2.9% of the variance of pedagogical performance was predicted by the linear combination of subtest scores from the content knowledge assessment, which displays a small effect size (Rovai et al., 2014). This determined that the predictor variable of content knowledge (Praxis Subject Assessment) was not found to be significantly correlated to the criterion variable of pedagogy from the CPAST Form dispositions subscale scores. These results are similar to the results of Jones’ (2018) non-significant correlational study between a Praxis assessment and a university’s home-grown pedagogical evaluation instrument, as well as Bastian et al.’s (2016) non-significant relationship between content and pedagogical evaluations. In that study, grades were used to reflect content mastery and the PACT evaluation was used to measure pedagogical mastery.

Implications

Licensure assessments are traditionally established to serve as screening tools for new teachers (Shuls & Trivitt, 2015), or as gatekeeping tools as defined by Ledwell and Oyler (2016). Though good intentioned toward accountability of teacher quality and PreK-12 student achievement (Callingham et al., 2016; Chan & Yung, 2018; Fritsch et al., 2015), research has highlighted that the high-stakes licensure assessments may very well be attributing to the increased concerns of teacher retention and the overall teacher workforce (Martin & Mulvhill, 2016; Shuls, 2018). This study sought to determine whether significant indicators existed on such licensure assessments or evaluations to deter those concerns. Unfortunately, an absence of statistical significance in this study suggested there was a lack of sufficient evidence to claim a predictive correlation between content knowledge and pedagogical performance for pre-service
teachers. Further research should continue to analyze potential assessments or measures to screen for effective pre-service teachers.

Though providing no conclusive predictive relationship, this study does add to the literature related to teacher training and high-stakes assessment for licensure eligibility. From the extensive literature review, it was determined there exists a definite gap in literature connected to the CPAST Form. With the exception of literature published by the original CPAST researchers (Brownstein & Kaplan, 2017; Brownstein et al., 2017; Kaplan et al., 2017), little to no research was found discussing CPAST as a pedagogical assessment instrument, so this study easily begins to aid in minimizing that gap.

**Limitations**

This study expands the research surrounding pre-service teacher licensure eligibility from the content knowledge perspective and the pedagogical knowledge perspective, with both attributes contributing to the identification of effective teaching roles. Limitations do exist with the study, particularly related to the sample. A majority of participants were anticipated to be female due to the relative nature of the teacher population, and this was confirmed in the data collection with 161 pre-service teachers of the 167 sample being female. This factored to approximately 96% of the sample being female, well above the 87.1% of all primary teachers in the United States identified as female in 2016 reported by the Organisation for Economic Co-operation and Development (2019). Similar limitations to the gender demographics of the sample are seen in the majority of the sample being Caucasian. Geiger (2018) reported the NCES statistic that 80% of public school teachers are Caucasian, which is similar to the 76.65% of the current study being Caucasian. A more diverse sample would extend the generalization of results to other student populations. Further limitation is seen as the study was completed for an
undergraduate education preparation program. This limited the generalization to primarily traditionally-aged university students.

As this study sample consisted of only one educator preparation program from one university, all pre-service teachers in the sample would have received the same curriculum and training framework. This study only compared the content and pedagogy scores; it did not evaluate the effectiveness of how pre-service teachers were prepared by their institution for those assessments or their general training for the realities and complexities of the PreK-12 classroom.

Within the education field, assessments for licensure eligibility are certain to evolve, even if just general updates that create new versions of the assessment. Therefore, the results of this study have the potential to be limited in use and practicality if the Praxis Subject Assessment and CPAST Form are soon replaced with more preferred assessments and evaluations. Further, results may not be applicable to pre-service teachers across all states due to the variance in assessments and other observation or evaluation tools used from state to state.

**Recommendations for Future Research**

With the field of education maintaining a consistent focus on high-stakes testing for teacher licensure eligibility and a concern for teacher retention, further research should continue to examine how pre-service teachers are assessed. From the thorough literature review, there was little research connected to the use of the CPAST Form; therefore, educator researchers should also continue to inspect how CPAST scores are being used by educator preparation programs. The following are recommendations for future research related to the current study:

1. The current research study focused solely on pre-service teachers pursuing an elementary education endorsement. Future studies should evaluate the other licensure endorsement areas since each endorsement area is assigned a different Praxis Subject Assessment that
evaluates content competency specific to that endorsement. Replacing the predictor variable with test scores specific to those other endorsements would allow the study to be fairly easily replicated.

2. The current research study utilized the CPAST Form, which is just one valid and reliable instrument used by educator preparation programs across the United States to measure pedagogical performance during the student teaching experience. Future studies should evaluate other pedagogical instruments, such as edTPA.

3. As the sample of this study was predominantly female, Caucasian pre-service teachers, duplication of this research study across multiple educator preparation programs is recommended to represent more diverse pre-service teacher populations.

4. The current research study was completed at a traditional, four-year university. This aided in the majority of pre-service teachers in the sample being categorized as traditionally-aged university students. Extending this study to graduate programs would allow for future researchers to determine if the current study’s results are able to be generalized to non-traditional students.

5. To extend the generalization of the study’s results, future studies should consider diverse settings that enable further comparison. Some setting comparisons may include the mode of instruction for pre-service teacher training (in person, online, and hybrid), location of higher education institution (rural, suburban, and urban), and type of institution (public schools and private and faith-based schools).

6. Further research should consider evaluating the value and effectiveness of instruction received by pre-service teachers from their higher education institutions. Both qualitative and quantitative approaches would be viable options to explore how well a pre-service
teacher’s training influences their achievement on such assessments. As the Praxis Subject Assessment measures content knowledge, studies would need to include preparation by educator preparation programs as well as content course instruction.

7. With the intent to recognize attributes that can support PreK-12 schools in identifying teachers that are most likely to be successful in the classroom and that are most likely to remain committed to teaching role, extension of this research should build connection to the practicing teacher from the assessments used for pre-service teachers.
References


https://doi.org/10.1177/1745691617699280


evaluation form. Presentation at the American Association of Colleges for Teacher Education. Tampa, Florida.


*Journal of Teacher Education, 64*(5), 439-453.

https://doi.org/10.1177/0022487113496431


Petchauer, E., & Baker-Doyle, K. J. (2019). ‘Next thing you know, her hair turned green’:


https://ehe.osu.edu/sites/ehe.osu.edu/files/summary-evidences-validity-reliability-CPAST.pdf


APPENDIX A: Institutional Review Board Permission

February 25, 2021

Miranda Arnold

Re: IRB Exemption - IRB-FY20-21-484 The Predictive Relationship between Elementary Pre-Service Teacher Praxis Subject Assessment Scores and Pedagogical Knowledge

Dear Miranda Arnold:

The Liberty University Institutional Review Board (IRB) has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study to be exempt from further IRB review. This means you may begin your research with the data safeguarding methods mentioned in your approved application, and no further IRB oversight is required.

Your study falls under the following exemption category, which identifies specific situations in which human participants research is exempt from the policy set forth in 45 CFR 46: 101(b):

Category 4. Secondary research for which consent is not required: Secondary research uses of identifiable private information or identifiable biospecimens, if at least one of the following criteria is met:

(i) The identifiable private information or identifiable biospecimens are publicly available;

(ii) Information, which may include information about biospecimens, is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained directly or through identifiers linked to the subjects, the investigator does not contact the subjects, and the investigator will not re-identify subjects;

(iii) The research involves only information collection and analysis involving the investigator’s use of identifiable health information when that use is regulated under 45 CFR parts 160 and 164, subparts A and E, for the purposes of “health care operations” or “research” as those terms are defined at 45 CFR 164.501 or for “public health activities and purposes” as described under 45 CFR 164.512(b); or

(iv) The research is conducted by, or on behalf of, a Federal department or agency using government-generated or government-collected information obtained for nonresearch activities, if the research generates identifiable private information that is or will be maintained on information technology that is subject to and in compliance with section 208(b) of the E-Government Act of 2002, 44 U.S.C. 3601 note, if all of the identifiable private information collected, used, or generated as part of the activity will be maintained in systems of records subject to the Privacy Act of 1974, 5 U.S.C. 552a, and, if applicable, the information used in the research was collected subject to the Paperwork Reduction Act of 1995, 44 U.S.C. 3501 et seq.

Your stamped consent form can be found under the Attachments tab within the Submission Details section of your study on Cayuse IRB. This form should be copied and used to gain the consent of your research participants. If you plan to provide your consent information electronically, the contents of the attached consent document should be made available without alteration.

Please note that this exemption only applies to your current research application, and any modifications to your
protocol must be reported to the Liberty University IRB for verification of continued exemption status. You may report these changes by completing a modification submission through your Cayuse IRB account.

If you have any questions about this exemption or need assistance in determining whether possible modifications to your protocol would change your exemption status, please email us at [redacted].

Sincerely,

[redacted]

Administrative Chair of Institutional Research
Research Ethics Office
APPENDIX B: Request to University for Approval to Access Archived Data

From: Arnold, Miranda Lynn (School of Education)
To: 
Subject: Request to Collect Data - Dissertation Research Study
Date: Wednesday, February 10, 2021 9:50:00 AM
Attachments: Permission Letter Template.docx

February 9, 2021

As a graduate student in the School of Education at Liberty University, I am conducting research as part of the requirements for the Ph.D. in Education - Curriculum and Instruction. The title of my research project is The Predictive Relationship between Elementary Pre-Service Teacher Praxis Subject Assessment Scores and Pedagogical Knowledge, and the purpose of my research is to explore the relationship between content knowledge and pedagogical knowledge of elementary education pre-service teachers.

I am writing to request your permission to access and utilize Praxis Subject Assessment test data and Candidate Preservice Assessment of Student Teaching evaluation records of your undergraduate elementary education pre-service teachers. [REDACTED] has agreed to serve as an intermediary to strip the combined data of any student identifiers before the data is shared with me.

The data will be used to identify how accurately an undergraduate elementary pre-service teacher’s pedagogical knowledge as measured by the Candidate Preservice Assessment of Student Teaching (CPAST) Form scores be predicted from a linear combination of content knowledge as measured by the Reading and Language Arts, Mathematics, Social Sciences, and Science subtests scores from the Praxis Subject Assessment - Elementary Education: Multiple Subjects?

Thank you for considering my request. If you choose to grant permission, please provide a signed statement on official letterhead indicating your approval. A permission letter template is attached for your convenience.

Sincerely,

Miranda Arnold, Ed.S.
School of Education
APPENDIX C: University Approval to Access Archived Data

February 9, 2021

Miranda Arnold

Dear Miranda Arnold:

After careful review of your research proposal entitled The Predictive Relationship between Elementary Pre-Service Teacher Praxis Subject Assessment Scores and Pedagogical Knowledge, I have decided to grant you permission to receive access and utilize Praxis Subject Assessment test data and Candidate Preservice Assessment of Student Teaching evaluation records of the undergraduate elementary education preservice teachers.

Check the following boxes, as applicable:

☒ [The requested data WILL BE STRIPPED of all identifying information before it is provided to the researcher.]

☐ [The requested data WILL NOT BE STRIPPED of identifying information before it is provided to the researcher.]

☐ [Add applicable option or delete check box.]

☐ [Add applicable option or delete check box.]

☐ [Add applicable option or delete check box.]

☐ [We are requesting a copy of the results upon study completion and/or publication.]

Sincerely,

[Signature]

[Name]
APPENDIX D: Intermediary Request and Approval

From:
To:
Subject: RE: Dissertation - Data Collection - Intermediary Support
Date: Wednesday, February 10, 2021 9:59:00 AM

Thanks so much! I really appreciate your willingness to help.

I will update my IRB application then and check back in once I have permission to move forward.

Thanks, thanks, thanks!

Miranda Arnold, Ed.S.

From: Miranda Arnold, Ed.S.
To: [Redacted]
Sent: Wednesday, February 10, 2021 9:08 AM
Subject: RE: Dissertation - Data Collection - Intermediary Support

Hi Miranda,

I’ll be glad to.

From: Miranda Arnold, Ed.S.
To: [Redacted]
Sent: Tuesday, February 9, 2021 9:46 PM
Subject: Dissertation - Data Collection - Intermediary Support

Hi,

Hope you are doing well. I am working with the IRB on my application to collect archived data. [Redacted], serving as my chair, shared that I need to coordinate someone to serve as an intermediary that will compile the data and strip the data of identifiers such as ID numbers before the data is shared with me.
There are two sets of data being collected:
  
  - Praxis Subject Assessment scores for undergraduate elementary candidates being collected through ADS
    - Arnold, Miranda Praxis Subject Assessment Archival Data Request (instructions/data needs)
    - Arnold, Miranda Praxis Subject Assessment Archival Data Request Excel (for ADS to report)
  
  - CPAST scores for undergraduate elementary candidates being collected through LiveText
    - Arnold, Miranda CPAST Archival Data Request (instructions/data needs)
    - Arnold, Miranda CPAST Archival Data Request Excel (for you, if willing, to provide CPAST data)

I also have a third Excel (Arnold Miranda Archival Data Request) for the Praxis scores and CPAST scores to be combined with student IDs to be stripped and replaced with just a basic numeral for me to run the data analysis.

I have [redacted] support to use the data, but IRB did ask for me to recruit an intermediary and have [redacted] sign a new letter, so I am working on that too.

Please let me know if you would kindly consider helping me in this intermediary role and any specific steps I can take once I have IRB approval to make this as easy as possible for you. Thanks so much!!
APPENDIX E: Data Extract Request

Thank you so, so much, [Redacted]. I appreciate you helping me get to the finish line for this.

Yes, please! Please align the Praxis ID/information and the CPAST ID/information. That will then let me run the multiple regression.

I appreciate you taking the time to help me!!!

Miranda Arnold, Ed.S.

Hi Miranda,

I have collected the CPAST data. I am assuming from your narrative that you want me to match the Praxis IDs to the CPAST IDs. And assign a number to each individual.
Hope you have a wonderful weekend ahead of you.

I received IRB approval to move forward with data collection. Thank you again for being willing to assist me with the task of collecting the data. I really appreciate your time and support, especially when I know this is such a busy, busy time for [BLANK].

Attached are a few documents:

1. **Praxis Subject Assessment**
   - **SUBMIT TO ADS:**
     - *Praxis Subject Assessment Archival Data Request:*
       - To be used for submitting the ticket information to ADS for the test score and student information.
     - *Praxis Subject Assessment Archival Data Request Excel:*
       - To submit alongside the above ticket for ADS to report the data.
     - *IRB Approval Letter:*
       - If it is needed for ADS and LiveText reports.

2. **CPAST SCORES**
   - **USE TO PULL CPAST SCORES FROM LIVETEXT:**
     - *CPAST Archival Data Request:*
       - To be used by you to pull the CPAST Final Consensus scores from LiveText. The only note I shared there is that there may be multiple versions of the rubric/data sets based on updates that were made from semester to semester, so you may have to pull a couple different data sets and combine from each semester.
     - *CPAST Archival Data Request Excel:*
       - To be used to report and combine both the CPAST scores and Praxis scores from ADS.

3. **FINAL REPORT:**
   - **TO COMBINE ADS AND LIVETEXT DATA**
     - *FINAL Archival Data Report:*
       - This is the FINAL and only spreadsheet that should be sent back to Miranda—with student IDs removed and only numerical listing for students (1, 2, 3, etc.).

I put a turnaround time through March 12, or as early as possible. I know this is also dependent on how quickly ADS can provide their report.

I really appreciate your help in moving my study along. If there is any clarification or help I can provide to make this an easier task for you, please let me know.

Thank you, thank you, thank you!!

Miranda Arnold, Ed.S.