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ABSTRACT

PRESERVICE TEACHERS' PREFERRED DEFINITIONS OF
INTELLIGENCE, AND RELATED DEMOGRAPHICS (AGE,
GENDER, EDUCATIONAL LEVEL, ACADEMIC DOMAINS
AND EDUCATIONAL PSYCHOLOGY ENROLLMENT),
AS PREDICTORS OF THEIR IMPLICIT BELIEFS
ABOUT INTELLIGENCE

By

Michelle A. Bacchiocchi

Chair: Elvin Gabriel

ABSTRACT OF GRADUATE STUDENT RESEARCH

Dissertation

Andrews University

School of Education

Title: PRESERVICE TEACHERS' PREFERRED DEFINITIONS OF INTELLIGENCE, AND RELATED DEMOGRAPHICS (AGE, GENDER, EDUCATIONAL LEVEL, ACADEMIC DOMAINS AND EDUCATIONAL PSYCHOLOGY ENROLLMENT), AS PREDICTORS OF THEIR IMPLICIT BELIEFS ABOUT INTELLIGENCE

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Name and degree of faculty chair: Elvin Gabriel, Ed.D.

Date completed: March 2020

Problem

Just as teachers help their students bridge their prior knowledge to new understandings of ideas including conceptions of intelligence, preservice teachers as future teachers are undergoing the same training and work environment. Preservice teachers' implicit beliefs and their preferred definitions of intelligence are important, since as persons of authority they influence children and their beliefs about ability. For future teachers, there is limited empirical evidence exploring preservice teachers' implicit beliefs about intelligence and how they define intelligence.

Method

A survey was used to collect data on implicit beliefs about intelligence and definitions of intelligence from a sample of 262 preservice teachers from the Midwestern United States. Data was analyzed to understand the relationship between the independent variables of age, gender, educational level, academic domains, and educational psychology coursework, and the dependent variables of implicit beliefs about intelligence and preferred definitions of intelligence.

Results

The study showed that, in general, preservice teachers have a growth mindset regarding intelligence and ability. With non-parametric chi-square testing, the analysis demonstrated that preservice teachers have a preferred definition of intelligence and the majority preferred a definition that supports different learning styles. Using linear regression, the results indicated that preservice teacher's implicit beliefs about intelligence predicted their preferred definition of intelligence. Utilizing multiple linear regression, the study also indicated that younger teachers and females were more likely to endorse a growth mindset.

Conclusions

Implicit beliefs about intelligence and the preferred definitions of intelligence for preservice teachers were confirmed. With this information, preservice teachers can be better prepared to serve their future students. The conclusions collected from this study can be a stimulus for conversations among educator preparation institution faculty who are training preservice teachers and give them insights into how they can better support those preservice teachers who have fixed views of intelligence.

Andrews University

College of Education

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OF INTELLIGENCE

A Dissertation Proposal

Presented in Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

by

Michelle A. Bacchiocchi

July 2020

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DEDICATION

This dissertation is dedicated to the family who fiercely loved and raised me: my tata, Ivan Josip Kucelj; mama, Olga Zic Kucelj; and baka, Maria Zic.

TABLE OF CONTENTS

LIST OF TABLES	viii
LIST OF ABBREVIATIONS	ix
ACKNOWLEDGEMENTS	x
Chapter	
1. INTRODUCTION	1
Introduction	1
Statement of the Problem	11
Purpose of the Study	12
Conceptual Framework	12
Significance of the Study	16
Research Questions	16
Delimitations	17
Limitations	17
Definition of Terms	17
Organization of Study	19
2. LITERATURE REVIEW	20
Introduction	21
Selection of Literature	22
Criteria for Selection of Material	22
The Search for Literature	23
Sources of Material	24
Background and Overview of Preservice Teacher Assessment	24
Historical Context of the Intelligence Construct	25
Conceptual Overview of Beliefs about Intelligence	27
Explicit Beliefs about Intelligence	28
Dweck's Theory of Implicit Beliefs	31
Dweck's Implicit Beliefs About Intelligence Theory	32
Summary of Explicit and Implicit Theories of Intelligence	35
Implicit Beliefs about Intelligence and Behaviors Among Inservice Teachers	36
Classroom Climate	36

Classroom Instruction	39
Teachers' Judgments About Students	47
Implicit Beliefs About Intelligence and Student Achievement	51
Inservice Teachers Implicit Beliefs about Intelligence.....	59
Implicit Beliefs About Intelligence: Inservice Teachers Compared to Preservice Teachers	60
Preservice Teachers Implicit Theories of Intelligence	63
Definitions of Intelligence.....	70
Preservice Teachers' Definitions of Intelligence as Predictors of Implicit Beliefs About Intelligence	73
Dweck's Implicit Theories of Intelligence as Related to Demographic Variables.....	76
Age	76
Gender.....	79
Educational Level	81
Academic Domains	84
Enrollment in Educational Psychology Courses.....	86
Demographic Variables and Enrollment in Educational Psychology Courses as Predictors of Implicit Beliefs about Intelligence .	89
Age as a Predictor of Implicit Beliefs About Intelligence	89
Gender as a Predictor of Implicit Beliefs About Intelligence.....	92
Educational Level as a Predictor of Implicit Beliefs About Intelligence	96
Academic Domains and Implicit Beliefs About Intelligence	98
Assessment of Preservice Teachers' Definitions of Intelligence Related to Demographic Variables.....	106
 3. METHODOLOGY	 109
Introduction	111
Type of Study	111
Population and Sample.....	112
Hypotheses	114
Hypothesis 1:	114
Hypothesis 2:	114
Hypothesis 3:	114
Hypothesis 4:	114
Variable Definitions	115
Implicit Beliefs About Intelligence.....	115
Personal Preference of Definition of Intelligence.....	116
Demographic Variables	116
Instruments	118
Data Collection.....	119
Data Analysis	120
 4. RESULTS	 120

Overview	122
Participant Demographic Data	123
Midwestern States	123
Gender, Age, and Race.....	123
First Year of Field Experience, Educational Level, and Type of Educational Institution	125
Academic Domains and Educational Psychology Enrollment.....	126
Implicit Beliefs about Intelligence	126
Preferred Definition of Intelligence	130
Hypothesis Testing.....	131
Hypothesis 1.....	131
Hypothesis 2.....	132
Hypothesis 3.....	132
Hypothesis 4.....	133
Summary and Conclusions.....	134
 5. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS	 135
Introduction	137
Summary of the Literature Review	138
Summary of the Methodology	140
Summary of Major Findings	142
Research Question 1	143
Summary of Findings.....	143
Interpretation and Discussion of Findings	143
Research Question 2.....	145
Summary of Findings.....	145
Interpretation and Discussion of Findings	147
Research Question 3.....	148
Summary of Findings.....	148
Interpretation and Discussion of Findings	149
Research Question 4.....	150
Summary of Findings.....	150
Interpretation and Discussion of Findings	151
Limitations of the Study	152
Recommendations for Practice.....	153
Recommendations for Future Research	156
 APPENDICES	
A. Schedule and Budget	159
B. Operational Definitions of Variables.....	161
C. IRB Documents	165
D. Letter and Survey	169

REFERENCE LIST	173
VITA	183

LIST OF TABLES

1. Behaviors Related to intelligence	66
2. Title II 2015-2016 Preservice Teacher Demographics: Data from Midwestern States (Enrollment, Gender, & Race)	113
3. Preservice Teacher Participant Demographic Variables (n = 262).	124
4. Implicit Beliefs of Intelligence Items: Percentage, Mean, and Standard Deviation.....	129
5. Coefficients: Hypothesis 4.....	134

LIST OF ABBREVIATIONS

CHC	Cattell-Horn-Carroll's theory of intelligence
EPI	Educator preparation institution
g (factor)	General intelligence (Spearman, 2004)
IHE	Institutions of higher education
K-12	Kindergarten through 12th grade
MI	Gardner's multiple intelligences theory
NCTQ	National Council on Teacher Quality
NF	Normative failure
NS	Normative success
PEET	Perceptions of an environment entity theory
ST-IAT	Single-Target Implicit Association Test
TD	Temporal decline
TI	Temporal Improvement
TIS	Implicit theory of intelligence scale

ACKNOWLEDGEMENTS

I wish to acknowledge, with much gratitude, the assistance of my committee in completing this dissertation. Special thanks go to Dr. Elvin Gabriel and Dr. Rudolph Bailey, who took over the chairmanship, and helped extensively. Thanks also go to Dr. Tevni Grajales Guerra, who wisely supported the statistical process and lead me to deeper understanding. Thanks to Dr. Jeannie Montagano, for honest assessments. And to Dr. Alice Williams for the keen editing and gentle spirit.

On a further personal note, I would like to thank my family who helped me in all the ways possible. My husband, Daniel, for the love and sacrifice of years; my son, Christian, who assisted with early editing and recommendations; and my daughter, Lauren, for being my ardent supporter. To my beloved parents, Ivan and Olga Kucelj and Samuele and Anna Bacchiocchi, for unswerving faith. And to my sisters, Nancy Kucelj Petersen, Loretta Bacchiocchi, and Silvia Canale Bacchiocchi for the uplifting winds of prayer. For all this assurance I owe my family a huge debt.

Lastly, thanks to the Department of Teaching, Learning, and Curriculum who allowed me a year leave to pursue my doctoral research. And to Dr. Luana Greulich for being *my* voice of hope.

CHAPTER 1

INTRODUCTION

Introduction

Preservice teachers in the United States attend one of over 1,400 educator preparation institutions (EPs) and are enrolled in traditional or alternative programs in institutions of higher education (IHE). Over three-fourths of preservice teachers are white or Caucasian, with Black and Hispanic preservice teachers the next most frequently enrolled in education programs. Females make up almost 90% of those enrolled in programs. Teacher education programs consist of four to five years of coursework. Preservice teachers are teacher candidates in programs of education preparing for the teaching profession. Traditionally these students have a variety of experiences in an education program consisting of field experiences, teaching internship, and coursework (Hollins, 2011).

Preservice teachers take courses in academic domains, such as mathematics, history, and language arts. In addition, preservice teachers take education courses on society, philosophy, diverse learners, and educational psychology in order to gain knowledge about human growth and development. A part of preservice teacher training also includes methodology courses, learning how to integrate subject area material and instructional strategies. Integrated into methodology courses, preservice teachers are often placed in field classrooms to observe inservice teacher practices. Additionally, at the end of teacher candidate training, preservice teachers are placed in a classroom with a

cooperating inservice teacher for potential collaboration on planning and teaching for one or two semesters of an internship (Young & Knestrict, 2012). Preservice teachers are trained in classroom routines, planning, and organization. They engage in activities such as co-planning of units, lessons, and instruction; co-teaching to small and whole groups; behavior management; and evaluation of student performance and learner outcomes (Darling-Hammond, 2016). Preservice teachers train in the classroom setting to gain important skills from an experienced cooperating inservice teacher. This multiple experience approach of internship, field experiences, and coursework is used to train effective future teachers.

Preparing effective teachers is a priority for parents, schools, education programs, and the government. In a 2009 speech, the secretary of U. S. Department of Education publicly stated that “mediocre teacher preparation programs” exist in most of the 1,450 teacher education programs. In 2014, the National Council on Teacher Quality (NCTQ) found that 53% of 1,100 education programs were assessed as failing (2016). These findings resulted in yearly assessments of preservice teachers based on student learning outcomes, preservice teacher employment, plus employer and new teacher perceptions about the education programs they completed. So, “As (a) result of their findings, preservice teacher effectiveness assessment has been included in teacher training programs evaluations since 2014.” (Kumashiro, 2015, p. 2 Implications for the preservice teacher, especially during internships, include a focus on learner outcomes as they plan, teach, and assess students collaboratively with the inservice teacher.

Preservice teachers are placed in diverse classrooms where meeting learner outcomes requires effective and time-intensive engagement. Preservice teachers are

required to accrue over 300 hours of field experience. The NCTQ Report (2013) noted that almost all states require no less than 10 weeks of field internship with a cooperating inservice teacher. A significant portion of the internship involves assessing and evaluating the learning of the students in their classroom (Young & Knestrict, 2012). Preservice teachers become part of the education process of effective teaching. Preservice teachers are involved and responsible for student learning and the school experience. These future teachers are to become competent in student development, learning and motivation, curriculum, instruction, assessment, and professionalism (Hollins, 2011).

Teacher training programs emphasize the importance of knowledge, skill building, and experiential learning. Encompassed in teaching new information are beliefs about intelligence (Beach & Dovemark, 2005). Educators influence students' views about their intelligence (Jonsson & Beach, 2010). A link has been found between the implicit beliefs about intelligence and the scientific theories of intelligence for inservice teachers (Jonsson, Beach, Korp, & Erlandson, 2012) and preservice teachers (Jonsson & Beach). Furthermore, evidence has revealed that beliefs about intelligence are developed from messages expressed by individuals with authority (Elliot & Dweck, 2005; Hadley, 2017). According to Dweck (2007) educators tend to believe student's academic accomplishment stems primarily from natural-born ability. Evidence suggests these preservice teacher beliefs are difficult to alter (Pajeres, 1992). However, other studies demonstrate that preservice teachers' implicit beliefs can change with added exposure to scientific theories (Jonsson & Beach). This later evidence concurs with findings from Blackwell, Trzesniewski, and Dweck (2007), who confirmed that beliefs about intelligence can change.

Preservice teachers are future inservice teachers; thus their implicit beliefs about intelligence and definitions of intelligence will influence their judgments and behavior toward students in their classrooms. Future teacher beliefs about the stability of intelligence is an important area of study because they will make judgements and assessments of students. Added research and evidence about implicit beliefs of preservice teachers will assist in bringing increased awareness of beliefs and provide an opportunity for prospective teachers to better understand how their beliefs are formed and how they inadvertently influence their students. Studies investigating preservice teachers' implicit beliefs about intelligence may present further understanding about decision-making processes. Implicit beliefs about intelligence influence a teacher's approach to the teaching process, including managing classroom climate, selecting instructional activities, and performing student evaluation (Butler, 2000; Leroy, Bressoux, Sarrazin, & Trouilloud, 2007; Rattan, Good, & Dweck, 2012).

Implicit beliefs about intelligence are especially important in the classroom. These beliefs in the malleability or fixedness of intelligence create patterns of behaviors and thoughts. To illustrate, an individual with a malleable view of ability, or an incrementalist, is more likely to focus on the process of developing new knowledge and skills. This person will be likely to persist in the face of challenges. An individual with a fixed view of intelligence, or an entity theorist, is more likely to focus on intelligence and performing well. In challenging situations, the entity theorist may demonstrate helpless responses to learning. For this reason, the study of implicit beliefs and how the beliefs of preservice teachers influence students is salient.

This study uses the implicit belief theory of Dweck's (2000) as the conceptual framework to analyze preservice teacher implicit beliefs regarding the nature of intelligence and their influence on teaching decisions. As suggested by Dweck, implicit beliefs provide meaning and organization to one's world. As a result, different individuals in the same situation or experiencing a similar event will have different thoughts, behaviors, and emotions due to their implicit beliefs. Regarding inservice teachers, implicit beliefs have been found to vary from teacher to teacher. These implicit beliefs influence classroom climate (Deemer, 2015), judgment of student performance (Butler, 2000), and teacher instruction (Rattan, et al., 2012). The available research on preservice teacher implicit beliefs is scant. Because inservice and preservice teachers share the same training and working environments, the implicit beliefs research on inservice teachers is important. Studying the implicit beliefs about intelligence and ability of preservice teachers is valuable, because, in their future roles as inservice teachers, they will influence children's implicit beliefs about their own capabilities.

Implicit beliefs are theories that organize and frame meaning including how one explains information, the goals pursued, and the circumstances which influence decisions and behaviors. The framework of implicit belief theory creates a spectrum with one end favoring incremental beliefs and the other favoring entity beliefs (Dweck, 2000). The incremental theory assumes that human traits are changeable and there is potential for learning and development. An individual having an entity theory or belief assumes that human traits are constant and unchanging. Individuals with an entity belief mindset are less likely to believe there is potential for change. Holding an entity belief interprets that outcomes are based on innate ability, often with little to no effort. Students endorsing an

entity view when describing the success of another student are more likely to give reasons such as inborn abilities, success coming naturally, and overall being smarter than others (Dweck). Endorsing an entity theory encourages questioning of ability and a helpless pattern of behavior in the face of failure and challenges (Dweck & Leggett, 1988). Individuals holding entity beliefs are concerned about their ability and intelligence and thus are oriented toward performance goals (Dweck & Elliott, 1983).

An individual holding an incremental belief theory interprets outcomes based on the effort and strategy used in achieving an outcome. Dweck (2000) found that students endorsing an incremental view when evaluating the success of another student, were more likely to give explanations of preparation, practice, and persistence. Individuals endorsing an incremental belief were less likely to judge success or failures as resulting from inborn talent or ability (Dweck). Similarly, endorsing incremental beliefs encourages effort which leads to mastery learning and growth. An underlying incremental belief creates a mastery orientation, one of believing that behavior comes from the pursuit of learning goals (Dweck & Leggett, 1988).

Dweck, Chiu, and Hong (1995a, 1995b) examined the frequency of implicit belief, finding that most individuals endorse either entity or incremental theories. According to Dweck et al., equal percentages of individuals endorse entity and incremental beliefs. Abd-El-Fattah (2006) investigated the available research and found that 45% of individuals hold entity beliefs, 45% hold incremental beliefs, and about 10% do not endorse either belief. Identifying the implicit beliefs of individuals is important for further study and improved understanding.

A method of identifying implicit beliefs was developed by Dweck (2000) and colleagues called “self-theories.” Researchers investigated responses of young children, observing their reactions to puzzle-assembling tasks. They found that after failure at completing a difficult puzzle, some participants were more interested in repeating the easily solved puzzles, but not the ones they found unsolvable. Participating children were classified into two groups. One group was interested in demonstrating ability by repeating the solvable puzzle. The second group was interested in improving ability by attempting the unsolvable puzzle again. These studies suggest that implicit beliefs are developed in early childhood.

Since these studies demonstrated that young children endorse implicit beliefs, the roots of these beliefs are of interest. Heyman, Dweck, and Cain (1992) found that kindergarten children responded differently upon hearing stories with and without negativity and criticism. Children who were read negatively-critiqued stories were more likely to make negative judgments about others and themselves and to give helpless responses. Subsequent studies (Mueller & Dweck, 1998; Kamins & Dweck, 1999) on children’s implicit beliefs found that children expressed different reactions to various types of messages or feedback including praise, process, and criticism. They demonstrated that praise for ability and intelligence increased endorsement of entity beliefs (Mueller & Dweck). Moreover, young students receiving feedback about using good strategies increased in task persistence while feedback for ability increased helpless responses and behavior (Kamins & Dweck).

Investigating implicit beliefs of preservice teachers is an important beginning to understanding the influences on their preferred teaching approaches and consequently the

effects on student learning. Further, investigating preservice teachers' definitions of intelligence will give a clearer understanding of the relationship between implicit beliefs of intelligence and preferred definitions of intelligence. To understand how these implicit beliefs develop, a survey of preservice teachers regarding how they define intelligence is indicated.

Jones, Bryant, Snyder, and Malone (2012), using an open-ended question about definitions of intelligence, found seven themes. The themes included achievement, declarative knowledge, procedural knowledge, self-regulation, cognitive processes, motivation, and personal characteristics, derived from a total of forty-two categories. Some of the categories were similar, showing a fixed view of intelligence such as "has fixed, innate abilities." Jonsson and Beach (2010) examined preservice teachers' credibility about intelligence theories, by providing added exposure to Cattell-Horn-Carroll's general intelligence theory (CHC), then having them read summaries about multiple intelligence (MI) theory, the triarchic theory of intelligence, and the sociocultural theory of intelligence. The results demonstrated that preservice teachers increased their believability about the scientific theory compared to the control group. The theories discussed include the CHC general intelligence theory, MI theory, triarchic theory, and sociocultural theory were discussed in this study.

According to the CHC theory (Carroll, 1997; Cattell, 1963), intelligence involves inherited factors including a two-pronged view which states that fluid and crystallized concepts make up general intelligence. Fluid intelligence is influenced by heredity and environment, and includes reasoning and environmental influences; crystallized intelligence is learned content knowledge from an individual's culture. This theory has

three levels of ability. The first level includes narrow abilities such as reading and writing. The second layer contains broad abilities including fluid intelligence, crystallized intelligence, general memory and learning, visual and auditory perception, cognitive retrieval, and speed and reaction time. The third level includes both broad and narrow abilities.

A multidimensional view of intelligence proposed by Gardner (Anderman & Corno, 2016) described intelligence as diverse human abilities which were termed multiple intelligences (MI). According to Gardner, intelligence is defined as “the capacity to solve problems or to fashion that are valued in one or more cultural settings.” (Gardner & Hatch, 1989, p. 26). Using findings from young children, he proposed that individuals have more than one type of ability, but demonstrate “independent profiles of strength,” (Gardner & Hatch, 1989). The intelligence styles first identified were musical-rhythmic, visual-spatial, verbal-linguistic, logical-mathematical, bodily-kinesthetic, interpersonal, intrapersonal, and naturalist. Existential and moral intelligences were added later.

The triarchic theory of intelligence was developed by Sternberg (1985). Sternberg’s theory of intelligence involves types of thinking: analytical thinking, creative thinking, and contextual thinking. Analytical thinking includes critical cognitive processing with the ability to identify the components of a situation or problem. Creative thinking involves an experiential component with new and familiar situations. The third type of cognitive processing is contextual thinking, involving practical application that adapts and shapes responses depending on the setting.

Finally, the sociocultural definition of intelligence by Vygotsky (Daniels, 2016; Grigorenko, 2004) is based on developmental psychology. This understanding of

intelligence is individualistic, holding that it is developed in each individual through actions, experiences, and interactions with other individuals and situations.

As examining the relationship between definitions and implicit beliefs of intelligence of preservice teachers is important, so too are their relationships with demographic variables such as age, gender, academic domains of study, and enrollment in an educational psychology course. Age may play a role in implicit beliefs about intelligence among inservice teachers (Georgiou, 2008; Jonsson et al., 2012; Lynott & Woolfolk, 1994). There are differences between younger and older teachers, with the latter tending to endorse an entity view of intelligence. In addition, gender of the inservice teacher may demonstrate a relationship with implicit beliefs of intelligence (Good, Aronson, & Inzlicht, 2003; Mascaret, Roussel, & Cury, 2015). The academic domain, such as liberal arts vs. sciences, of teachers appear to be related to their implicit beliefs regarding intelligence (Garcia-Cepero & McCoach, 2009; Jonsson & Beach, 2010; Jonsson et al., 2012; Mascaret et al., 2015). Educational level is another variable which appears to correlate with implicit beliefs of intelligence (Georgiou, 2008; Jones et al., 2012; Jonsson, et al., 2012; Lynott & Woolfolk, 1994). Further, enrollment of preservice teachers in an educational psychology course, which is a standard and required course in most teacher education programs, may be associated with understanding the importance of implicit beliefs of intelligence.

Preservice teachers' implicit beliefs about intelligence may be dependent on many factors. This study will examine the relationships among implicit beliefs, preservice teachers' preferred definition of intelligence, age, gender, educational level, academic domains, and educational psychology coursework. Understanding preservice teachers'

implicit beliefs regarding intelligence is essential as these beliefs will influence how preservice teachers will perform as future inservice teachers in their areas of instruction (Epler, 2011; Rattan, et al., 2012; Rogers, 2009) and management of classroom climate (Deemer, 2004; Leroy, et al., 2007).

Statement of the Problem

Preservice teachers' implicit beliefs concerning intelligence is a particular concern. Teachers bridge and connect prior knowledge with new understandings of facts, figures, and ideas including conceptions of intelligence (Beach & Dovemark, 2005). It is important to determine preservice teachers' implicit beliefs and the definitions of intelligence they prefer. Communication from a person of authority, such as an educator, influences children and their beliefs about their own abilities (Dweck & Leggett, 1988; Elliot & Dweck, 1988). A common belief among teachers is that a major influence on student achievement is inherent intelligence (Dweck, 2000). Some studies on teacher beliefs found changing the beliefs of preservice teachers a challenge, because their prior beliefs have been developed from years of being a student (Pajares, 1992). However, in surveying initial and last semester preservice teachers in their educational program, Jonsson and Beach (2010) found that preservice teachers' beliefs about intelligence can change. This is consistent with findings from Blackwell, et al. (2007) which demonstrated that student beliefs about intelligence can be altered with intervention, improving achievement and application of beliefs in novel situations (Dweck, 2000, 2017). Preservice teachers must understand the role that their implicit beliefs toward intelligence play in the classroom.

Purpose of the Study

The purpose of this study is to investigate preservice teachers' preferred definitions of intelligence and related demographic variables (age, gender, educational level, academic domains, and a course in educational psychology) as predictors of their implicit beliefs of intelligence.

Conceptual Framework

This study is based on the implicit belief theory of Dweck (2000). Implicit beliefs are unconscious beliefs or theories held by individuals about valued human traits such as personality and intelligence. According to this theory, implicit beliefs affect how people respond to and judge experiences. Of particular interest are preservice teachers who work with students, assessing learner outcomes and performance during internships. These students' beliefs about intelligence are influenced by their knowledge of various theories of intelligence and the particular theory to which they subscribe.

In this framework, the implicit beliefs of intelligence are on a continuum from entity to incremental. A person may hold an entity or incremental theory and can also adopt different implicit beliefs for various traits (Dweck, 2000). An individual holding a fixed mindset believes human traits are stable and finds definitions of intelligence that involve inheritable traits more trustworthy. An individual holding an incremental theory, or a growth mindset, believes human traits are malleable and may be more likely to favor definitions of intelligence that include change and malleability over time when effort is applied. The question is whether preferred definitions of intelligence of preservice teachers are associated with their beliefs about the malleability of intelligence.

The evidence regarding the implicit theory of intelligence indicates these beliefs are present from an early age (Dweck, 2000; Dweck & Leggett, 1988). Individuals with an entity theory believe human characteristics are innate and thus stay unchanged over time and circumstances. An entity theory may lead one to interpret the actions or information about others as indicative of their ability and intelligence. In addition, individuals with a fixed mindset may be less inclined to consider subsequent information which is not consistent with their initial judgment (Plaks, Stroessner, Dweck, & Sherman, 2001). In contrast, individuals with an incremental theory believe human characteristics are changeable over time and situations. An incremental theory may lead one to avoid making judgments about an individual's intelligence from a limited amount of information. Evaluating and judging student progress and performance is part of being an educator. It has been found that teachers hold a common belief that student academic success is largely due to innate traits (Dweck, 2007). Further, studies disclose teachers are twice as likely to hold an entity view of intelligence when compared to their students (Butler, 2000). This study will examine how their demographic variables of age, gender, educational levels, academic domains, and definitions of intelligence are associated with the implicit beliefs of intelligence of preservice teachers.

Increased exposure to scientific theories increases preservice teachers' credibility about scientific theories of intelligence (Jonsson & Beach, 2010). When preservice teachers were asked to define intelligence, major themes were discovered including achievement, declarative and procedural knowledge, self-regulation, and cognitive abilities (Jones et al., 2012). Added study will increase understanding of the relationship

between implicit beliefs of intelligence and definitions of intelligence among preservice teachers.

Furthermore, implicit beliefs about intelligence appear to have a relationship with age. Older and more experienced inservice teachers are more likely to display a fixed view of intelligence (Georgiou, 2008; Jonsson et al., 2012). In a study of adult twins in Germany, older persons were more likely to endorse an entity belief of intelligence (Spinath, Spinath, Riemann, & Angleitner, 2003). However, students from adolescence to adulthood are influenced by their implicit beliefs of intelligence. These beliefs about intelligence influence achievement in teenage students (Blackwell et al., 2007; Diseth, Meland, & Breidablik, 2014). Further, older students returning to school for a high school diploma are more likely to endorse an incremental view of intelligence (Dupeyrat & Marine, 2005).

Gender is another demographic variable related to implicit beliefs about intelligence. Male inservice teachers are less likely to associate intelligence with a malleable view (Mascret, et al., 2015). Good et al. (2003) found that females and males showed improvement in mathematics grades after learning that intelligence is malleable; females were able to decrease the achievement gap.

Implicit beliefs about intelligence appear to have associations across educational levels. Elementary and adolescent students' transition and achievement are associated with their implicit beliefs about ability (Blackwell et al., 2007; Diseth, et al., 2014). Post-secondary students in college/university and returning adult students demonstrate differences in effort, degree of satisfaction, and achievement associated with their

implicit beliefs about intelligence (Aronson, Fried, & Good, 2002; Braten & Stromso, 2004; Dupeyrat & Marine, 2005).

Implicit beliefs about intelligence are found to influence individuals across different academic domains. Individuals in science fields are less likely to associate malleable concepts with intelligence (Mascret et al., 2015). In a study about identification of gifted students, teachers who used IQ as a distinguishing factor were less likely to hold concepts associated with malleable ability (Garcia-Cepero & McCoach, 2009). Others have investigated relationships between fixed beliefs of intelligence and STEM fields (Jonsson & Beach, 2010; Jonsson et al., 2012). Recently, a study found a relationship between implicit beliefs of intelligence and several academic domains (Patterson, Kravchenko, Chen-Bouck, & Kelley, 2016).

Investigation of the relationship of preservice teachers' implicit beliefs about intelligence is conducted often during courses in teacher preparation programs. Most programs require educational psychology courses. Studies found that examination of preservice teacher beliefs occurred during their psychology course work (Jones et al., 2012; Lynott & Woolfolk, 1994).

Studying preservice teachers' implicit beliefs toward intelligence with consideration of their age, gender, educational level, academic domains, prior psychology coursework, and preferred definitions of intelligence will be a step forward in training future teachers effectively. Programs of education are designed to prepare preservice teachers to instruct students effectively in the classroom. Having a better understanding of preservice teachers' implicit beliefs about intelligence prior to their entering the classroom provides an opportunity to modify beliefs. This study was a quantitative,

correlational study of preservice teachers' implicit beliefs and definitions of intelligence. Preservice teachers were surveyed using Dweck's implicit theory of intelligence scale (TIS) (2000) to determine their implicit beliefs about intelligence. They were also asked to identify which definition of intelligence they endorse, based upon a scenario.

Significance of the Study

The overarching significance of this study is increased understanding of preservice teachers' implicit beliefs relative to intelligence with the goal of improving teacher preparation programs. This study may serve to increase awareness among inservice teachers who mentor preservice teachers about the benefits of adopting an incremental and growth view of intelligence. Further, this study may inform school administrators with ideas for inservice teacher workshops and professional development. Lastly, this study will add to the existing research on implicit beliefs of intelligence by better understanding preservice teachers' implicit beliefs of intelligence and the association to their preferred definitions of intelligence.

Research Questions

This study answered the following research questions:

1. What implicit beliefs of intelligence do preservice teachers endorse or hold?
2. Which definitions of intelligence do preservice teachers prefer, given a list of options?
3. Do the implicit beliefs of preservice teachers have any relationship with their preferred definition of intelligence?

4. Do demographic variables of age, gender, educational level, academic domain, and educational psychology course enrollment have any relationship with preservice teachers' implicit beliefs?

Delimitations

The sample was limited to preservice teachers in traditional and alternative IHE programs in the Midwestern United States. Individuals in these programs were future elementary and secondary teachers in K-12 grades.

Limitations

This study was limited to preservice teachers with two years or fewer of teaching experience who agreed to participate in the study and who returned the digital survey questionnaire. These results may not be generalized to other groups of individuals in educational settings, such as administrators; but were generalizable to teacher preparation programs. Responses to questionnaire items cannot be evaluated for truthfulness or thoughtfulness. Preservice teachers may have perceived the questions differently than the researcher intended.

Definition of Terms

Academic domain: A current term for subject areas among teachers and used in academic programs. Common academic domains include language arts, science, social studies, and mathematics (Patterson, et al., 2016).

Entity theory of intelligence (fixed mindset): The belief that intelligence is an inborn and unchanging characteristic (Dweck, 2000).

General intelligence (g): “General ability is almost wholly governed by heredity,” a belief that human intelligence is, for the most part, stable, unchanging, and fixed (Spearman, 1904, p. 272).

Implicit theories: Theories, ideas, or conceptions which are adopted by an individual, are not openly stated, but are implied and in one’s mind (Dweck, 2000).

Implicit theories of intelligence: Beliefs that are specifically related to views on the intelligence of oneself and of others (Dweck, 2000).

Incremental theory of intelligence (growth mindset): The belief that intelligence is dynamic and malleable (Dweck, 2000).

Inservice teacher: An individual working as a full-time teacher in a classroom for over a year (Patterson, et al., 2016).

Lay theories: Beliefs in one’s mind which are not openly expressed about people, places, and things (Dweck, Chiu, & Hong, 1995a, 1995b).

Multiple intelligence (MI) theory: Intelligence viewed as varied human abilities or intelligences (Gardner, 1983).

Mixed beliefs of intelligence: Beliefs that intelligence is neither inborn nor developed, but is somewhere in between; therefore, the beliefs are neither exclusively incremental or entity theories of intelligence (Hong, Chiu, Dweck, Lin, & Wan, 1999).

Preservice teacher: A student teacher in an education program preparing for the profession of teaching with zero to two years of student teaching experience (Patterson, et al., 2016).

Self-theories: Beliefs that organize and give meaning to one's world, circumstances, and experiences; the driving factor of one's personality, motivation, and development (Dweck, 2000).

Sociocultural theory: The view that intelligence is something within which can be developed. (Grigorenko, 2004).

Teacher education: The training of preservice teachers with the theory, knowledge, and skills needed for the profession of teaching.

Three-stratum theory: The view that intelligence is made up of narrow, broad, and general cognitive abilities (Carroll, 1997).

Triarchic theory: Intelligence is made up of critical, creative, and analytic mental processing (Sternberg, 1985).

Organization of Study

Chapter 1 is the introduction and overview of the study. **Chapter 2** contains the historical and conceptual overview of intelligence and the relationship between inservice and preservice teachers' implicit beliefs of intelligence. The review will include the relationship between Dweck's implicit theory of intelligence and age, gender, educational level, academic domains, and educational psychology coursework. This chapter also includes definitions of intelligence and observed relationships with the variables of age, gender, educational level, academic domains, and educational psychology coursework as related to implicit beliefs of intelligence. The chapter concludes with the relationships among preservice teachers' definitions of intelligence and their demographic variables. **Chapter 3** is a description of the methodology of the study, the type of research used, the participants, the instrumentation, data collection, and analysis. **Chapter 4** contains the

results and findings of the study. **Chapter 5** contains conclusions and recommendations based on the results of the study. The appendix and reference list follow.

CHAPTER 2

LITERATURE REVIEW

Introduction

This literature review was comprised of pertinent subject matter, topics, and schemes. It included the criteria for literature selection, the search for literature, and sources for material. Further, the background and overview section focused on EPIs and preservice teachers. The literature review provided an overview of the historical context of the intelligence construct and an examination of beliefs about intelligence, which included Dweck's (2000) theory of implicit beliefs about intelligence. The historical context included the implicit beliefs about intelligence of inservice teachers and the association of those beliefs with behaviors in the classroom. A review of the implicit beliefs of inservice teachers, as a context for preservice teachers, was examined. Next, a review of preservice teachers' implicit beliefs about intelligence is included.

The review considered definitions of intelligence from a conceptual perspective. An examination of the research about how preservice teachers' definitions of intelligence relate to their implicit beliefs about intelligence follows. The review examined evidence regarding Dweck's implicit beliefs about intelligence theory and the demographic variables of age, gender, educational level, academic domains, and educational psychology enrollment. In addition, age, gender, educational level, academic domains, and educational psychology enrollment as predictors of implicit beliefs about intelligence were surveyed. In conclusion, the review assessed how preservice teachers' definitions of

intelligence and demographic information correlate to their implicit beliefs about intelligence. The literature review helped connect prior discoveries on preservice teachers' implicit beliefs of intelligence, their definitions of intelligence, and the current outcomes obtained from the study.

Selection of Literature

Criteria for Selection of Material

The subject matter, topics, and schemes for this literature review were based on the variables pertinent to this study. The themes involved trustworthiness of the sources from which material was collected, value of the material, and the author's objectivity. Except for the context of inservice teacher's beliefs about intelligence and behaviors, the scope of the searches were limited to preservice teachers and the variables of interest in relationship to implicit beliefs about intelligence. For the most part, the articles were from primary sources.

In addition to articles from primary sources, articles selected focused on the variables of the study. Based on the relevancy of the topic of study, findings were generated and arranged. Articles were considered for range of time, pertinence to the research questions, subject matter examination, and association to the study. The findings and research articles were then organized.

A table or worksheet was created, organizing the findings and confirming the necessary components of the reviewed literature. The worksheet included area of study, date, instruments, methodology, statistical analysis, strengths, and areas of needed improvement. Summaries and analyses of the literature were included for relevance and importance.

The Search for Literature

Various types of materials and databases were accessed for the search. Key words and terminology were identified. Articles for the literature review were evaluated, organized, and selected for the document.

The literature search included salient topics such as considerations of historical arguments regarding intelligence (Binet, 1909, 1973; Dweck & Leggett, 1988; Weschler, 1974); explicit and implicit theories of intelligence (Jonsson et al., 2012; Sternberg, 2005); Dweck's implicit beliefs and Dweck's implicit beliefs about intelligence (Dweck, 2000; Dweck, Chiu, & Hong, 1995a, 1995b; Dweck & Leggett, 1988); inservice teachers' implicit beliefs about intelligence and their practices and behaviors (Butler, 2000; Leroy et al., 2007; Rattan et al., 2012); achievement and implicit beliefs about intelligence (Butler, 2000; Mueller & Dweck, 1998; Spitzer & Aronson, 2015); inservice teachers implicit beliefs about intelligence (Epler, 2011; Jones et al., 2012; Mascaret et al., 2015); implicit beliefs about intelligence of inservice teachers compared to preservice teachers (Fang, 2017; Patterson et al., 2016); implicit beliefs about intelligence of preservice teachers (Gutshall, 2014); definitions of intelligence (Carroll, 1997; Cattell, 1963; Gardner, 1983; Grigorenko, 2004; Sternberg, 1985); preservice teachers' definitions of intelligence as predictors of implicit beliefs about intelligence (Jones et al, 2012); Dweck's implicit theories of intelligence and age (Blackwell et al., 2007); Dweck's implicit theories of intelligence and gender (Romero, Master, Paunesku, Dweck, & Gross, 2014); Dweck's implicit theories of intelligence and educational level (Dupeyrat & Marine, 2005); Dweck's implicit theories of intelligence and academic domains (Romero, et al., 2014); Dweck's implicit theories of intelligence and educational

psychology enrollment (Jones et al., 2012; Lynott & Woolfolk, 1994); demographic variables as predictors of implicit beliefs about intelligence and age (Diseth et al., 2014); demographic variables as predictors of implicit beliefs about intelligence and gender (Diseth, et al., 2014); demographic variables as predictors of implicit beliefs about intelligence, and educational level (Jonsson & Beach, 2010); demographic variables as predictors of implicit beliefs about intelligence and academic domain (Mascret et al., 2015); and assessment of preservice teachers' definitions of intelligence and demographic variables (Jonsson & Beach, 2010).

Sources of Material

Documentation for this literature review was found through databases including Psych INFO, Academic Search Complete (EBSCO), ERIC, Sage Publications, and ProQuest Dissertations and Theses. Additionally, articles and books have been located using Google Scholar and James White Interlibrary Loan service. Keywords used in the searches were the following: definitions of intelligence, incremental theory of intelligence, growth and fixed mindset of teachers, inservice teachers' implicit theories of intelligence, inservice teachers' definitions of intelligence, preservice teachers' implicit theories of intelligence, preservice teachers' definitions of intelligence, preservice teachers, and predictors of implicit beliefs about intelligence.

Background and Overview of Preservice Teacher Assessment

Arnie Duncan, then Secretary of Education, made a public statement that most of the 1,450 institutions of education are “doing a mediocre job of preparing teachers for the realities of the 21st century classroom” (Kumashiro, 2015). As a result, new federal regulations followed in 2015 for EPIs, which included greater accountability for teacher

preparation programs. This provided unprecedented attention to federal expectations about accountability for preservice teachers. The focus being put on preservice education, rather than on inservice teachers implies that the beliefs and preparedness of preservice teachers are of value. The purpose of this study was to investigate preservice teachers' preferred definitions of intelligence and how related demographics (age, gender, educational level, academic domain, and a course in educational psychology), predict their implicit beliefs about intelligence. The goal of this literature review was to answer the following questions: (a) what were preservice teachers' implicit beliefs about intelligence; (b) how do preservice teachers' definitions of intelligence relate to their implicit beliefs about intelligence; and (c) were there relationships between preservice teachers' demographic information (age, gender, educational level, academic domains, and educational psychology enrollment) and their implicit beliefs about intelligence.

Historical Context of the Intelligence Construct

Early philosophers in history attempted to explain the natural world. Two central concepts existed: The world was in constant flux and the world was stable. These alternate views of the natural world also influenced their views about one of humanity's most treasured traits: intelligence. The first attempt to explain human ability and intellect was by Heraclitus (ca. 540-480 B.C.), who described human intelligence as a constant state of change or "becoming." His conception of human ability was that it evolved from one form to another, like the weather. Parmenides (ca. 511 B.C.) described human ability as a state of "being." This idea of human intelligence was like the view of nature as without change, just existing. These diverse views about human ability and intelligence as either dynamic or stable continue today. Interest in the study of human intelligence

endures. Steven J. Gould, a 20th century paleontologist wrote: “We recognize the importance of mentality in our lives and wish to characterize it. . . . We therefore give the word intelligence to this wondrously complex and multifaceted set of human capacities” (Gould, 1981, p. 24). These conceptions of intelligence have spurred more research. The efforts of Spearman (1904), Binet (1909, 1973), Jensen (1969), Wechsler (1974), and Dweck & Leggett (1988) were noteworthy.

Charles Spearman, a psychologist, studied intelligence using formulas and statistics. He derived “g” for General Intelligence, a single mental test score of a person. Spearman viewed intelligence as “general ability almost wholly governed by heredity,” a belief that human intelligence is stable for the most part (Spearman, 1904, p. 273). Alternatively, Alfred Binet, a French child psychologist and creator of the IQ test, advocated training children in order to improve their abilities, especially those with developmental delays (Binet, 1909, 1973). He believed humans could improve their intelligence and their ability to integrate new information, thus viewing intelligence as changeable. Another scientist, Arthur Jensen, studied genetic factors related to intelligence, specifically the g factor, positing a biological mechanism of intelligence. He viewed human intelligence as a cognitive process primarily (Jensen, 1969) and extended the connection to the socioeconomic status of individuals. David Weschler (1974) worked with and developed scales for testing intelligence. He developed the Weschler Intelligence Scale for Children and the Weschler Adult Intelligence Scale. The Weschler scales were to be multidimensional compared to earlier scales and viewed motivation as a component of intelligence (Wechsler, 1974). From the examination of past studies, researchers Dweck & Leggett (1988) developed a model demonstrating implicit beliefs

about intelligence were related to behavior patterns. In a later study by Dweck & Leggett (1988), students were given the option to engage in performance or learning activities. They found that individuals with a fixed view of intelligence chose performing options that were less challenging and responded more negatively to failure; a maladaptive response was observed. Alternately, the study found individuals with a growth view of intelligence chose learning options and pursued challenging tasks, responding more positively to setbacks, or an adaptive response.

In summary, looking back in history, the trait of human ability has been described as either immutable or changing. Human intelligence was described as a constant, inherited genetic trait by the philosopher Parmenides (ca. 511 B.C.) and others such as Spearman (1904) and Jensen (1969). This static view of intelligence lends itself to testing of cognitive processes and development of an intelligence score that describes an individual's ability holistically. However, human intelligence can be described as a dynamic, malleable trait that with learning may develop further. Binet (1909, 1973) believed children could improve their intelligence with the integration of new knowledge. Dweck & Leggett (1988) developed a model based on a belief in the malleability of intelligence, which suggested that one's belief regarding intelligence influences choices and guides behavior. The following section will review the concept of implicit beliefs and specifically the implicit beliefs about intelligence.

Conceptual Overview of Beliefs about Intelligence

Beliefs about intelligence are either explicit or implicit (Sternberg, 2005). Explicit theories describe intelligence using scientific methods which are visible and quantifiable. Scientific methods use mathematical equations to measure intelligence. Implicit theories

are based on one's notions and beliefs about intelligence. Implicit theories of intelligence are not necessarily observed in a structured environment. Implicit and explicit theories of intelligence are unique perspectives of human ability.

Explicit Beliefs about Intelligence

Explicit theories of intelligence are scientific theories developed from cognitive measurements. These theories are constructed from researchers of observations based on various assessments. Some mental abilities assessed are "recall speed, memory, problem solving, inference-making, and knowledge acquisition" (Sternberg, 2005, p. 429). The research of Jonsson and Beach (2010) and Jonsson et al., (2012) demonstrates the relationship of scientific theories of intelligence and implicit beliefs about intelligence.

Jonsson and Beach (2010) conducted a study of Swedish preservice teachers and their implicit beliefs about intelligence. Preservice teachers' implicit beliefs about intelligence in the academic domains of mathematics and social science and their exposure to the CHC scientific *g*-factor theory were examined. As a group, the distribution of the participants ranged in age from 17 to 45, with females ($n = 151$) substantially outnumbering males ($n = 25$). Participants completed a 10-item (1 = strongly disagree; 10 = strongly agree) Swedish version of the TIS for mathematics and social science. A portion of the participants received the mathematics TIS first; the other participants received the social science TIS first.

Preservice teachers were divided into two groups, a control and experimental group. Only the experimental groups read a summary of the CHC *g*-factor intelligence theory; the control group was not primed with the scientific theory. In the significant findings, using ANOVA analysis, the participants in the experimental group changed

their views regarding mathematics. Preservice teachers in the experimental group changed both their entity and incremental views of intelligence in mathematics. In the experimental group there was an increase in entity views and a decrease in incremental views. The control group, when compared to the experimental group, demonstrated an increase in entity views about intelligence. However, the effect size was small.

Similar findings were exposed when comparing the control group and experimental group results in the social science domain. There was an increase in entity beliefs about intelligence in the experimental group when compared to the control. In addition, incremental views about intelligence decreased among preservice teachers when comparing the two groups, control versus experimental. However, the analysis found that the effect size ($\alpha = 0.03$) of the findings was small. The results of these analyses, comparing control and experimental conditions, may be questioned as the confidence was low. Further investigation is reasonable.

The implications of the study suggest, but not strongly, that preservice teachers exposed to a scientific theory of intelligence were more likely to increase their fixed views about intelligence and decrease their pliable views about intelligence in the subject areas of social science and mathematics. The subsequent study investigates inservice teachers' implicit views about intelligence and the influence of scientific theories of intelligence.

Jonsson and colleagues (2012) studied 226 Swedish high school teachers from practical and theoretical programs who completed a translated TIS, the eight-item format. The inservice teachers read short summaries of the CHC theory of intelligence, a scientific theory of intelligence; Sternberg's triarchic theory of intelligence, Gardner's MI

theory, and Grigorenko's sociocultural theory of intelligence. The inservice teachers were then asked to rate the credibility of the different theories of intelligence. Participants finding the CHC theory credible were moderately correlated with a static view about intelligence and weakly negative with dynamic view about intelligence.

The implications of this study suggested that inservice teachers finding the scientific theory of intelligence more credible were more likely to have a fixed view about intelligence. And at the same time, these inservice teachers were less likely to view other theories of intelligence as believable.

Some of the strengths of Jonsson et al. (2012) and Jonsson and Beach's (2010) studies were that the investigation of both preservice and inservice teachers' exposure to scientific theories of intelligence of finding this theory more credible, was related to fixed views about intelligence. In addition, those who gave credibility to scientific theories of intelligence had weak associations with dynamic beliefs about intelligence (Jonsson et al., 2012) while those who read the scientific g-factor theories were also less likely to have incremental views about intelligence (Jonsson & Beach, 2010). Both studies used the same scientific theory of intelligence, the CHC theory. The directionality of both studies findings was congruent with different participant groups.

Some of the weaknesses of the studies were that the effect size, which indicates confidence in the results, was small (Jonsson & Beach, 2010) and the correlations observed were weakly negative for individuals finding scientific theories of intelligence credible and having malleable beliefs about intelligence (Jonsson et al., 2012). Future studies should consider investigating both inservice and preservice teachers' exposure to scientific theories using an experimental method with a control group. In addition, studies

should compare preservice and inservice teachers' implicit beliefs about intelligence and credibility about scientific theories of intelligence for associations. Larger sample sizes of participants may provide stronger confidence in the results. The following section reviewed the implicit theories of belief.

Dweck's Theory of Implicit Beliefs

Dweck's theory of implicit beliefs about intelligence (2000) incorporated a personality theory from *Personal Construct Psychology* by Kelly (1955). Personality theories generally describe an individual's character traits, such as shyness, without explanations for the expression of them. Dweck's model of implicit beliefs incorporates a social-cognitive approach to personality theory. The social-cognitive approach to personality explained how an individual processes information, how behavior is influenced, and how emotion is affected.

The social-cognitive approach organizes beliefs, giving meaning to experiences and interactions. This approach provides understanding of the self, also known as "self-theories." Self-theories are beliefs explaining how individuals see events, others, and their own behavior. Dweck's implicit theory of beliefs is a type of self-theory that creates assumptions (Whitehead, 1938) about important human traits such as personality, morality, relationships, and intelligence. The assumptions of the implicit theory's structure have one of two results. In the first, one's competence is validated which is a fixed entity theory, focusing on proving one is competent. Or the assumptions enable an incremental or growth theory, in which an individual chooses "let's go and develop(s)" (Dweck, 2000, p.17). This framework of assumptions, "entity" versus "incremental," facilitates understanding of people's beliefs prior to an outcome. The beliefs about valued

human traits vary; individuals can hold different implicit beliefs about these qualities. One can adopt a static view of morality and still have a dynamic view of relationships (Dweck). As such, Dweck's theory of implicit beliefs is unique when compared to other theories of personality, in that it identifies the belief and predicts one's belief based on observable behavior. The next section will review Dweck's implicit beliefs about intelligence theory.

Dweck's Implicit Beliefs About Intelligence Theory

Dweck's (2000) implicit beliefs of intelligence theory has two assumptions. The entity assumption about intelligence is that human ability is innate and constant. Accordingly, the individual is born with a certain amount of intelligence; there is no change over time. The incremental assumption about intelligence is that human ability is fluid and malleable. As such, individuals who exert effort and use productive strategies develop their abilities.

The endorsement of various beliefs about intelligence has implications. A person endorsing an entity view about intelligence may fall into a pattern of learned helplessness when presented with a challenge (Dweck & Leggett, 1988). Success for an entity thinker is assumed when a task or skill is performed accurately with little effort or practice. A failure outcome for an entity individual often leads to attributions of lack of ability and less effort in similar future situations (Dweck & Elliott, 1983). Alternately, an individual endorsing an incremental belief about intelligence will orient toward goals of learning. This individual focuses on gaining new information, strategies, and skills to develop mastery (Dweck, 2000). Success for an incremental theorist means effort is needed to perform or accomplish a task. In situations of failure, the incremental student attributes

lack of success to insufficient and/or ineffective effort. Presented with similar situations, incremental individuals increase effort or improve their strategies to achieve success (Dweck, 2000).

The research of Dweck, et al. (1995a, 1995b) reviewed six studies assessing the implicit theory of intelligence and the intelligence measure, which was a questionnaire including three entity-style items:

1. You only have a certain amount of intelligence and you really can't do much to change it.
2. Your intelligence is something about you that you can't change very much.
3. You can learn new things, but you can't really change your basic intelligence.

Using a six-point scale, the possible responses ranged from strongly agree (1) to strongly disagree (6). Dweck et al. (1995a, 1995b) found that 85% of the participants were evenly split between entity theory and incremental theory with the remainder of the individuals, 15%, being mixed. Cronbach's alpha for internal reliability of the six studies was 0.94 to 0.98, with a test-retest statistic of $\alpha = 0.80$. These findings were validated by assessing the internal reliability across all six studies of the implicit theory for intelligence.

The Dweck et al. (1995a, 1995b) study suggests that most individuals fall into one of three categories: entity, incremental, or mixed theories of intelligence. The strength of the research is that the reliability of six studies was strong and the test-retest finding was moderately strong for the TIS instrument.

According to Dweck (2000), one's implicit theory of intelligence influences goal orientation. The entity theorist, or an individual with a fixed mindset, is oriented toward

performance goals and demonstrating competence. Individuals with performance goals often strive for positive judgments. The individual may behave in ways so as to avoid revealing perceived incompetence. The incremental theorist, or an individual with a growth mindset, orients toward learning goals. These individuals desire to increase learning and ability from experience. They focus on developing a skill despite what it may reveal about current ability. Goal orientations for such an individual create patterns of thought and action based on implicit theories of intelligence (Dweck). The relevance of implicit beliefs about intelligence was demonstrated in a study by Blackwell et al., (2007).

Implicit beliefs about intelligence were important when demonstrated in a study of middle-school students. Blackwell et al. (2007) investigated implicit beliefs about intelligence and student performance during adolescence across a two-year period. The transition to junior high and adolescence is a time of social turmoil and changing academic expectations which creates a challenging environment which impacts student performance. Seventh grade participants ($n = 373$) from a New York public school were examined for their beliefs regarding intelligence. Achievement baselines were established from the New York State standardized tests (a citywide achievement test). Using a 6-point Likert-type scale, the students were surveyed about their implicit theories of intelligence, beliefs about effort, and attribution responses to failure. The results found that students with malleable beliefs about intelligence more strongly endorsed learning goals and effort as integral to achievement compared to students with a fixed belief about intelligence. In addition, students with a malleable view about intelligence made fewer ability-based, helpless attributions in the face of failure and, if given an opportunity to

remedy situations, would put more effort into the situation compared to those with a fixed view about intelligence. These differing views affected student performance even after two years. Students with an incremental perspective of ability at the beginning of junior high had better grades in mathematics relative to students with a fixed perspective about intelligence. Students with an entity view about intelligence demonstrated a decline in mathematics performance.

Implicit beliefs of intelligence were also found to be salient with students transitioning to high school. Yeager et al. (2016) used the Blackwell et al. (2007) intervention TIS. The first study employed a growth mindset intervention using 7,501 students. They found these students improved their grade point averages. In a second study, Yeager et al., found a decrease in the number of failing grades for the poor-performing students ($n = 3,676$). King (2019) studied students in the Philippines using the TIS. Students were surveyed initially and again seven months later. The first study included 676 students in 19 classes; the second, 848 students in 30 classes. The results showed that the implicit belief about the intelligence of one student in the classroom at the first survey predicted another student's implicit beliefs about intelligence at the second survey only months later. These findings suggest that the implicit beliefs about intelligence of one student can influence or spread to another student via social interaction in the classroom.

Summary of Explicit and Implicit Theories of Intelligence

The contrasting research about the implicit theories of intelligence by Dweck et al. (1995a, 1995b), Blackwell et al. (2007), Yeager et al (2016), and King (2019) and the explicit theory research of Jonsson, et al. (2012) and Jonsson and Beach (2010)

demonstrates different views about human ability. Blackwell et al., and Yeager et al., highlight the presence of differing implicit beliefs about intelligence and the role these beliefs play for adolescent learners. Further, implicit beliefs about intelligence can spread among classmates (King, 2019). The review by Dweck, et al., of prior research strongly confirmed the measurement of implicit beliefs about intelligence and differences among individuals. Persons giving credibility to explicit scientific theories of intelligence were less likely to view other theories, including implicit theories of intelligence, as trustworthy (Jonsson et al.). Likewise, individuals who were exposed to explicit scientific theories of intelligence were more likely to view this theory as more credible than other theories (Jonsson & Beach). The following section reviews inservice teachers' implicit beliefs about intelligence and behavior in the classroom.

Implicit Beliefs about Intelligence and Behaviors Among Inservice Teachers

Inservice teachers' behavior in the classroom and implicit beliefs about intelligence have been examined. Since inservice and preservice teachers share the same training and working environments, it is appropriate to refer to the implicit beliefs research on inservice teachers. The next section reviews studies on inservice teachers' implicit beliefs about intelligence and their influence on classroom climate, instruction, and judgement.

Classroom Climate

Classroom climate includes the physical, emotional, and social atmosphere of a classroom. Classroom climate may encourage or discourage learning (Çengel &

Türkoglu, 2016). Leroy, et al. (2007) and Deemer (2004) studied implicit beliefs about intelligence and the classroom climate among inservice teachers.

Leroy et al. (2007) studied the relationship between the classroom climate and inservice teachers' implicit beliefs about intelligence. Three hundred thirty-six 5th grade teachers in France across 269 schools, with an average of 18.68 years of teaching experience, participated in this study. The teachers completed a French translated booklet of questionnaires including the teacher's efficacy scale, which measured teacher opinions about their behavior toward students, a nature of ability beliefs questionnaire to measure inservice teachers' implicit beliefs about intelligence, and a constraints at work scale measuring perceptions about the pressures of the work environment. Students were surveyed with the learning climate questionnaire to measure how the level of motivation was associated with classroom climate.

Leroy et al. (2007) found positive correlations between an autonomous supportive climate and an incremental theory, and significant negative correlations with entity theory. An autonomous supportive climate was found to correlate strongly with seniority of teachers and correlate negatively with teachers' perceived pressures at work. The path analysis model revealed that an entity theory of intelligence directly influenced creation of an autonomous supportive climate, while incremental theory facilitated an influence on the climate by mediating self-efficacy. Seniority and years of teaching experience mediated the influence of self-efficacy in an autonomous supportive climate and directly influenced the climate.

The researchers found that an inservice teacher with an entity theory negatively and directly affects the supportive and autonomous climate of the classroom. An

incremental belief about intelligence has an indirect effect on classroom climate by increasing the teacher's belief about his/her effectiveness in the classroom. Increased teaching experience has both direct and indirect influences on the autonomous and supportive climate of the classroom. Teachers' beliefs in the malleability of intelligence influence their beliefs of their own effectiveness. In turn, this improved self-efficacy influences the autonomous and supportive climate they create in the classroom; believing in the incremental theory can influence the ability of their students.

Deemer (2004) investigated science high school inservice teachers' beliefs about intelligence, and how they influence classroom climate and which goals they promoted. There were 99 voluntary participants in the study, 49 male and 50 female science teachers, with an average of 11 years teaching experience, who were selected from across the state of Delaware. Participants taught in the following science domains: biology, chemistry, physics, environment, anatomy, technology, and geology. Inservice teachers completed the following surveys: mastery instructional practices, performance instructional practices, mastery school culture, TIS, personal teaching efficacy, and performance school culture. In addition, one of the inservice teachers' classroom of students completed the mastery classroom goal orientation.

Inservice teachers' beliefs about intelligence varied. Using path analysis, a model was developed and appeared to demonstrate a significant relationship between inservice teachers' implicit beliefs about intelligence and teacher efficacy. He found that inservice teachers' implicit beliefs about intelligence were related to students' perceptions of classroom goal structures which create classroom climate (Deemer, 2004).

In summarizing classroom climate effects of implicit beliefs about intelligence, we find that Deemer (2004) and Leroy et al. (2007) studied inservice teachers' implicit beliefs about intelligence and their effect on classroom climate. Inservice teachers with incremental views about intelligence were more likely to facilitate a positive classroom climate (Leroy et al.) or a mastery-oriented environment Deemer compared to inservice teachers with an entity view of intelligence. The strengths of the studies indicate a supportive autonomous climate was negatively related to entity views using direct (Leroy et al.) and indirect (Deemer) methods of investigation. These results confirm that inservice teacher's implicit beliefs about intelligence were associated with classroom climate whether in elementary single grade classrooms (Leroy, et al., 2007) or at the high school level in multiple academic domains (Deemer).

A weakness of the studies was whether the results from French inservice teachers in the Leroy, et al. (2007) study can be generalized to teachers in other countries. Further, Deemer (2004) used volunteer inservice teachers, a convenience sample, which may lend itself to responses considered desirable if compared to a stratified random sample (Howell, 2007). Both Leroy, et al., and Deemer utilized years of teaching experience of the participants; a consideration for future studies could be the age of inservice teachers. The next section will examine classroom instruction and inservice teacher's implicit beliefs about intelligence.

Classroom Instruction

The implicit beliefs of intelligence adopted by inservice teachers orients them to either performance or mastery instructional practices (Park, Gunderson, Tsukayama, Levine, and Beilock, 2016). Further, inservice teachers' instructional feedback in the

form of incremental or entity messages plays a critical part in classroom instruction (Schmidt, Shumow, & Kackar-Cam, 2017). The studies of Rattan, et al. (2012), Rogers (2009), and Epler (2011) found evidence demonstrating relationships between implicit beliefs and views about intelligence and instruction in the forms of interpretation of performance, feedback given, and instructional investment toward future performance.

Rattan et al. (2012) completed several studies investigating implicit beliefs about intelligence and their relationship with instruction. In the first study, forty-one university students were asked to complete an online mathematics survey, with items scored on a 6-point scale (1 *strongly agree*, 6 [*strongly disagree*]). The survey included four items relating to mathematics ability, four items about belonging in a mathematics setting, four items regarding enjoyment of mathematics, and twelve items dealing with the usefulness of mathematics. Participants were given a hypothetical situation where a middle school teacher was to meet with a female student to discuss poor performance in an end-of-the-year exam. Participants were asked what percentage of the student's performance they believed was due to effort and what percentage was due to mathematics intelligence. The study found that individuals with entity beliefs versus incremental beliefs were more likely to interpret the student's performance as related to mathematics ability.

In the second study, Rattan et al. (2012) investigated differences in beliefs about mathematics intelligence and influence on behavior and conduct. The participants ($n = 95$) were college students from an American university. The students read a passage about mathematics intelligence, which contained entity or incremental narrative intended to manipulate their beliefs about mathematics ability. The students were then provided a hypothetical situation as a middle-school teacher with a student, either male or female,

who had received a 65% on a first-year exam. Participants then indicated what percentage of performance was due to ability versus that due to effort. Further, students were asked to complete items about the degree to which they would console the student for poor performance.

The study found that individuals with an entity view of intelligence were significantly more likely to attribute student exam performance to “not being smart in math” compared to those with an incremental view of ability. In addition, those with entity beliefs compared to those with incremental beliefs were more likely to attribute poor performance to “lacking in mathematics intelligence” versus to “lack of hard work” respectively. Moreover, beliefs were turned into potential strategies and procedures. Individuals with entity beliefs were generally more likely to support the use of strategies to console with suggestions to decrease exposure to mathematics and decrease opportunities for future mathematics engagement and success. Analysis discovered individuals, male or female, with entity beliefs as compared to incremental beliefs approved of reassuring poor performers and using instructional approaches that decreased student engagement.

In a third study, Rattan et al. (2012) used graduate student instructors and assistants ($n = 36$) from an American university. Each participant completed two surveys, an attitude toward instruction survey (6-point Likert scale, 1 [*strongly agree*] to 6 [*strongly disagree*]) and a survey about views of mathematics intelligence. Following completion of the surveys, the participants read a scenario in which they were instructing a group of students in an introductory mathematics course. The participants would be meeting with students to discuss their performance on the first exam of the course. A

male student received a failing grade. The participants were asked to complete several items on how they would respond to the failing student. The first item was to describe effort and student ability based on the test score by completing “His grade on the test = ____% of lack of hard work + ____% lack of mathematics intelligence” (sum = 100%). The second item asked participants “in your opinion, what is the likelihood that he will improve his grade substantially on the next test?” (7-point Likert scale of 1 [*not at all*] to 7 [*extremely*]). The last six items asked participants to complete a 7-point Likert scale of 1 (*not at all*) to 7 (*extremely*) for the degree to which they would console student for his failing performance.

Rattan et al. (2012) found that graduate teaching assistants with an incremental view of mathematics ability were less likely to associate a failing grade to a lack of ability when compared to participants with an entity view of mathematics intelligence, who were more likely to ascribe a failing grade due to a lack of ability. Further, participants with an entity view of mathematics intelligence were more likely to have lower expectations for an individual with poor performance and more likely to console students for poor performance, using ineffective strategies which would not help improve performance in the future. Participants with an entity theory of mathematics intelligence were more likely to implement less rigorous and less effective instructional strategies.

Rattan et al. (2012) conducted a final study with college students ($n = 54$). The participants read a hypothetical situation in which they were meeting with their calculus professor to discuss results on the first exam and learning about their poor performance (65%). Following the reading of the situation, the students received one of three possible responses from the professor: “comfort feedback,” “strategy feedback,” or “control

feedback.” The “comfort feedback” (entity professor’s belief) assured students of their overall talent and comforted the student and express intent to stay in continued communication regarding progress in the course. The “strategy feedback” (incremental professor’s belief) also assured the student of overall talent but gave procedures which would improve mathematics skills, as well as increasing questioning during class time, concluding with the intent to stay in continued communication about the student’s progress in the course. The “control feedback” assured the student of their overall talent, the professor’s interest in the student, and a plan to communicate about progress in the course. The participants then responded to the following measures: perceptions of an environment entity theory (PEET), perceptions of low expectations by the professor, student motivation, and what they believed would be their final grade in the mathematics course (35%, 50%, 65%, 80%, or 95%). The study found differences related to the nature of the feedback. Individuals receiving consoling responses viewed professors as holding an entity belief of intelligence more strongly and perceived they had reduced future potential which decreased the student’s motivation, sense of encouragement, and end-of-course grade predictions. Further, there were no differences found between the strategy and control feedback styles except for influencing student perceptions of their future potential and vested interest. Higher expectations and investment resulted from “strategy feedback” versus “control feedback,” demonstrating that a plan of action was considered more positive for future learning and potential. Entity beliefs by professors influenced student perceptions for potential improvement and an induced more negative view of future learning.

Rogers (2009) investigated teachers' implicit beliefs about intelligence as they related to teacher practices, specifically in relation to high and low achievers. The participants of the study were inservice teachers ($n = 315$) from urban areas of California, teaching 4th through 9th grades. There were 213 males and 102 females with an average teaching experience of 15.4 years. The teachers completed a survey which used a 4-item, 6-point Likert scale of the TIS and a 7-item, 6-point Likert scale about instructional approaches. The findings revealed that teaching higher order thinking skills was related to implicit beliefs about intelligence; there was no difference between those holding incremental vs. entity beliefs. Moreover, the study showed that teaching higher-order thinking skills to high achievers confirmed that there was no difference between teachers with differing beliefs about intelligence. However, teaching higher order teaching skills to low-achieving students showed differences between teachers with incremental versus entity beliefs about intelligence.

Teachers with incremental beliefs spent more time teaching higher-order teaching skills to all students in their classroom compared to teachers with entity beliefs. The teaching of higher-order thinking skills was unrelated to teacher gender, grade level taught, subject area most frequently taught, or years of teaching experience. Rogers (2009) also found inservice teachers' implicit beliefs about intelligence were related to the type of instruction given to high versus low performing students.

In a doctoral dissertation, Epler (2011) investigated inservice teacher beliefs about intelligence and their influence on instructional practices, using a mixed method approach of a quantitative survey and a qualitative semi-interview. Traditional and non-traditional middle and high school teachers ($n = 292$) from Virginia, having an average age of 46

years, and 15.6 years of teaching computer technology courses, participated in a mailed survey. The survey contained three inventories: the TIS, an epistemic belief inventory, and a teaching practices scale. The epistemic belief inventory measures beliefs about knowing and learning based on knowledge structure, knowledge stability, knowledge source, knowledge control, and knowledge acquisition speed. The teaching practices scale measures student-centered versus teacher-centered instructional practices. Lecture and demonstrations are examples of teacher-centered practices, while role-play and group work are student-centered.

Epler (2011) found TIS scores ranged from 16 to 48 out of a possible range of 8 to 48. Lower values identified entity beliefs; incremental beliefs were associated with higher values. Inservice teachers demonstrated a range of implicit beliefs, indicated by a high mean, showing that many of the teachers had incremental beliefs about intelligence. Incremental theories of intelligence had a weakly negative relationship to the use of demonstrations and a weakly positive association with experiments. The presence of entity beliefs were likely to be related to demonstrations, which were teacher-centered instructional activities. Instructional activities that were created, transmitted, and presented solely by the educator, which do not provide the student an opportunity to construct meaning and learning were less likely to engage students (Anderman & Patrick, 2012). Inservice teachers with incremental beliefs were more likely to prefer experiments, which are student-centered activities. Educators who use student-centered activities were more likely to engage students in developing understanding and to encourage independent learning (Anderman & Patrick).

Examining the studies about classroom instructional practices, we find demonstrations of relationships between implicit beliefs about intelligence and instructional practices (Epler, 2011; Rattan et al., 2012; Rogers, 2009). Strengths of these studies included Rattan's group's conduct of four studies with teaching assistants and graduate assistants from different American universities demonstrating the differences between those with incremental and those with entity beliefs about intelligence and the relationship to instruction. The four studies found that a teacher with fixed views about intelligence, even those with manipulated entity views, were more likely to attribute poor mathematics performance to a lack of ability or not being smart. Moreover, an individual with a fixed view about intelligence would use less constructive feedback for future improvement in order to console a poor performing student. Rattan et al. (2012) further found those with a with an entity view of intelligence were more likely to have lower standards for poor performing students. Further confirming these outcomes was Roger's (2009) dissertation which found inservice teachers with a fixed view of intelligence offered less time for teaching effective strategies to low achieving students. Epler's dissertation demonstrated that inservice teachers with an entity view of intelligence were more likely to implement teacher centered instructional activities, such as demonstrations, compared to the incrementally minded teachers. Demonstrations were less effective instructional strategies when compared to experiments. Collectively these studies demonstrate the unique instructional behaviors of entity and incrementally minded individuals. A weakness in the study was that Rattan, et al., (2012) used small convenience samples. In addition, the dissertation studies of Rogers and Epler used self-reporting surveys which rely on participant honesty and an understanding of the questions

in the way the researcher intended (Howell, 2007). A consideration for future study would be to repeat the studies of Rattan, et al., (2012) with larger numbers and random sampling. Participant surveys should include an interview for some of the individuals. In addition, future research should examine inservice teachers' implicit beliefs about intelligence and their preferred instructional methods. The next section will review inservice teacher's implicit beliefs about intelligence and the relationship with their judgments about students.

Teachers' Judgments About Students

Inservice teachers' judgments of students and their implicit beliefs about intelligence is an important area to review. Teachers' beliefs about intelligence influences their perceptions of student abilities. Hong, Chiu, and Dweck (1995) found a relationship between implicit beliefs about intelligence and the judgments by individuals. Butler (2000) and Rattan, et al. (2012) reported evidence of an association between teachers' implicit beliefs about intelligence and their judgments about students' abilities.

Butler (2000) examined teacher's implicit beliefs about intelligence and the judgements made regarding mathematics ability. Middle-school mathematics teachers ($n = 42$) from Jerusalem participated in this study. Mathematics teachers were given the following contexts: "Teachers have different views about mathematical ability" or "teachers have different views about mathematical ability." The participants also completed Dweck and Henderson's (1986) 3-item TIS, using a Likert scale, with a 6-point scale (6 [*strongly agree*], 1 [*strongly disagree*]). The inservice teachers were given a description of a junior-high pupil and asked to judge the mathematics ability of this hypothetical student, on a 7-point scale (7, *very high*). They were given ascending and

descending performance trends of two pupils and asked “who has greater mathematical ability.” A relationship between ability appraisals, the implicit theory, and trend of performance was revealed. Inservice teachers who endorsed an entity view of intelligence were readier to assume mathematics ability based on an initial high score. These inservice teachers were more likely to view initially higher mathematics scores as demonstrating mathematics ability, even though later scores were declining. Those with an entity theory of intelligence viewed ascending mathematics scores following an initial poor score as fortuitous and not based on ability. Alternatively, preservice teachers with an incremental view of intelligence were more likely to view the ascending mathematics performance as a demonstration of mathematics skill.

A more recent study about instructor judgements was reported by Rattan, et al. (2012). This study investigated the beliefs of individuals who instruct students in mathematics at the college level. Graduate students, instructors, teaching assistants, and doctoral students who teach ($n = 36$) participated. They completed the TIS and responded to questions about mathematics intelligence and teaching attitudes, then read a passage about teaching to a group of students as if they were a teaching assistant discussing exam performance with all the students in the class. In the hypothetical passage, one male student failed the first exam. Participants were then asked to respond, stating whether the student’s performance was due to mathematics ability or lack of effort. Then participants completed the following survey items how they would respond to the student: consoling him for lack of ability; expectations of improvement, support, and comforting strategies with encouragement of unproductive learning procedures; and encouraging the student to decrease commitment to mathematics subjects in order to avoid potential future failure.

Results indicate that individuals with entity beliefs (30.11%) were more likely to endorse lack of mathematics ability versus effort compared to those with incremental beliefs (20.68%) from the information given regarding a failing grade. Further, individuals with entity beliefs versus incremental beliefs were more likely to instinctively support consoling the failing student and used unproductive instructional procedures. Entity-believing individuals were more likely than those with incremental beliefs to openly support consoling the failing student for not having abilities in math; they were also more likely to use unproductive instructional approaches. The actual teachers in the program endorsing entity beliefs were less likely than those with incremental beliefs to have higher expectations for future student improvement. Entity beliefs about intelligence influenced teachers and instructors' beliefs about the reasons for failure; considering it to be due to lack of ability, and were less hopeful for improvement compared to those with incremental beliefs about intelligence.

To summarize, the studies of Rattan et al. (2012) and Butler (2000) found evidence that implicit beliefs about intelligence influence perceptions of how inservice teachers view ability. Some of the strengths of these studies were that Rattan et al. (2012) and Butler discovered inservice teachers with entity views about intelligence to be more likely to judge an individual's mathematics ability from a single assessment. Further, Butler revealed that entity-minded inservice teachers judged students based on an initial performance score despite subsequent performances. Rattan, et al. (2012) revealed that an initial performance score for an entity-minded inservice teacher would influence the type of feedback given to a student. This feedback was confirmed by Rattan, et al. (2012)

when they manipulated the participants' implicit beliefs by having them read a passage that was either entity or incrementally focused.

A weakness in the study was that Rattan, et al., (2012) used small convenience samples. Another limitation was that Butler (2000) investigated middle school Israeli inservice teachers, limiting generalizations to other countries. Future studies could repeat the studies by Rattan, et al., (2012) with larger random samplings of participants. Future research could examine inservice teachers' judgments about initial mathematics performance scores in relation to their implicit beliefs about intelligence in other countries and across the United States at various educational levels.

The strengths in the preceding articles provide evidence that inservice teachers' practices and behaviors were associated with their implicit beliefs about intelligence. Specifically, the climate of the classroom differs between inservice teachers having entity or incremental views of intelligence (Deemer, 2004; Leroy, et al., 2007). Further, an autonomous, supportive classroom climate was related to the incremental beliefs of the inservice teacher and was found to be related to the instructional methods selected by the teacher (Deemer; Leroy, et al.). Inservice teachers with an incremental view of intelligence were more likely to implement student-centered strategies compared to instructors with a fixed view of ability (Epler, 2011), give constructive feedback to lower performing students (Rogers, 2009), and were less likely to attribute poor performance on an assignment as an indicator of the student's intelligence (Butler, 2000; Rattan, et al., 2012). Some of the weaknesses of the preceding studies were that not all the findings were generalizable to all inservice teachers in all countries. Butler (2000) examined inservice teachers from Israeli middle schools, while Leroy et al., studied 5th grade

French teachers. The broad range of levels of education could also affect generalizability, since university faculty seldom receive as much training in how to teach as K-12 teachers receive. Additionally, the sample sizes of some studies were small (Rattan, et al., 2012). Further investigation may consider asking open-ended questions using interviews and quasi-experimental methods with control groups. The next section will review inservice and preservice teacher's implicit beliefs about intelligence.

Implicit Beliefs About Intelligence and Student Achievement

Inservice teacher's beliefs about the intelligence of students has been shown to be associated with student achievement and performance. Implicit beliefs about intelligence appear to mediate and be associated with achievement (Claro, Paunesku, & Dweck, 2016) via effort and decreased procrastination (Mouratidis, Michou, & Vassiou, 2017). Incremental beliefs of intelligence support achievement and academic learning especially (Zeng, Hou, & Peng, 2016) and interest in learning (DeBacker et al., 2018). The studies of Rosenthal & Jacobson (1968), Rheinberg and Enseger (2010), Mueller & Dweck (1998), and Butler (2000) all found relationships between the implicit beliefs about intelligence of an inservice teacher or other person of authority and student performance.

The seminal study of Rosenthal & Jacobson (1968) examined inservice teachers' influence on student achievement with an experiment in California. The public-school participants were from grades one through five and came from low-income families. Students were given an ability assessment at the beginning of a school year. Following the results some of the teachers were told that a number of their students in their classroom, about five per classroom, were shown to have a higher potential for growth and ability. The experimental group was made of about 20% of the students who were

randomly assigned as having academic potential. The control group was the rest of the students. At the end of the year, the students were given another ability test. Students in the experimental group demonstrated a significant increase in academic performance compared to the students not flagged as having academic ability. For grades and IQ, students in the experimental group showed improvement; however, students in the early grades, 1st and 2nd, demonstrated a significant difference in grades and IQ. Of special note, the students who were randomly chosen and demonstrated low ability on the initial assessment made significant improvements within that school year. Rosenthal & Jacobson reasoned that teacher beliefs regarding students' academic potential affected academic achievement. The researchers posited that inservice teachers' communication and interaction were different with students identified as having academic potential.

The studies by Rheinberg and Enseger (2010) in Germany examined the form of feedback (social referencing as compared to self or individual referencing) inservice teachers utilized with students in the classroom and the influence of that on academic achievement. Inservice teachers implement various forms of referencing, such as individual compared to social, as a form of motivation. Rheinberg and Enseger posited that the types of referencing an inservice teacher used was an indication of their implicit beliefs about intelligence. Social references attribute student performance to be constant relative to other students; expectations are established from student levels of achievement when compared to others. This type of referencing involves uniform instruction for all students with less individualization. Individual referencing characteristics compare achievements of the individual student to oneself or personal progress. This type of

referencing attributes student performance dynamic and relative factors. Individual references base achievement on the growth of the individual student over time.

The findings of Rheinberg and Enseger (2010) demonstrated a pattern when comparing inservice teachers with an individual-referencing orientation to those with social referencing. The orientation of their referencing was found to affect student achievement. The students in classrooms with individual-referencing-orientation teachers demonstrated the greatest improvement in academic achievement. The students with inservice teachers that used social referencing decreased their hopefulness compared to the students with individual-referencing teachers. Students with inservice teachers' who individually referenced increased in hopefulness; the significant differences between the two groups extended to the next four years. Additionally, these studies found that students in classrooms with social-referencing teachers increased their fear of failure in the lower- and middle-grade levels. Conversely, students' fear of failure decreased with individual-referencing teachers in the lower grades and middle grades, but most significantly in the lower grades. Rheinberg and Enseger found inservice teachers who had individual-referencing orientations had a positive influence on student performance. Referencing and messaging from inservice teachers and individuals in authority were found to influence achievement.

Mueller and Dweck's (1998) first study found evidence that student performance was influenced by messages about ability by an individual in authority. These studies compared the impact of praise for intelligence versus praise on effort on fifth-grade students. In the first study, researchers assessed fifth graders ($n = 128$) for ability and gave praise for the task as a reference point. The students were randomly organized into

praise, effort, and control groups. The preliminary assessment was used as a general indication of their ability. The students were then were given ten problems. After completing the problems, students were given either ability or effort praise. The experimental groups were asked if they desired to pursue performance activities which would affirm their ability or learning activities, which would challenge their ability with a set of harder problems. Students were then given negative feedback on performance. Following the negative feedback, students were asked about the desire to continue, their enjoyment level, and the attributions for failure. A third set of problems were administered with similar difficulty as the first set to assess student performance after the negative feedback. Mueller & Dweck found that students praised for intelligence were more likely to choose goals that affirmed their ability or performance goals. Students praised for effort were more likely to choose learning goals. Praise for effort was less likely to communicate messages about intelligence and therefore students were more likely to desire to continue choosing their learning activities. The type of praise was found to be related to students' choice of learning vs. performance goals. Using one-way ANOVA, Mueller & Dweck found that different types of praise influenced students' views of their ability. Students praised for intelligence were more likely to attribute their performance to their ability when compared to students who were praised for their effort.

In study two, Mueller & Dweck (1998) analyzed students' response to performance goals after completing a set of problems and receiving praise. Fifth-grade students ($n = 51$) were classified into groups reflecting the type of praise they would receive. In group one, praise was given for intelligence; in a second group, praise was given for effort. No feedback was given for a third control group. The students were

given a set of problems to complete and received the type of praise related to their grouping. After completing the set of problems, the students were asked to respond to their desire to continue working on these types of problems; they were also asked to predict: “How well do you expect to do on another set of problems like these?” Students praised for intelligence did not differ from those praised for effort or the control in persistence of task completion. However, students praised for intelligence (69%) were more likely to choose performance tasks, which affirmed their ability. Students praised for effort were more likely to choose learning tasks, which would influence achievement. The control group evenly split between performance and learning tasks. The varying messages by an individual in authority were demonstrated to have a significant influence on student choices for learning goals versus affirming ability goals.

Mueller & Dweck (1998) conducted a third study using fifth graders ($n = 88$), comparing praise for ability versus praise for effort after a setback, what goal choices were made, and how students communicated their performance to others. Students praised for intelligence were more likely to choose a task highlighting performance. Students praised for effort were less likely to choose performance goals. Students in the control group chose performance goals. These results were in line with earlier findings. Further, Mueller & Dweck found students praised for intelligence were more likely to focus on the performance of other students when compared to the individuals praised for effort. Students receiving praise for intelligence were more interested in comparing themselves to the scores of others and discussing their mistakes for a goal of future improvement. Further, the students praised for intelligence were more likely to misrepresent their

performance and embellish their results compared to the students that were praised for effort and those in the control group.

The Mueller & Dweck (1998) studies indicate that messages about intelligence versus effort, have different meanings and affect student choices. These choices can lead to increased learning or a demonstration of intelligence. Various types of praise can lead students to focus on their relative performance or on their individual improvement. These choices can influence student achievement. Learning tasks, focusing on personal growth and opportunities, can improve student performance and achievement.

Butler (2000) investigated the influence of implicit beliefs about intelligence on temporal and narrative comparison feedback. The research examined junior high students in Jerusalem ($n = 389$) and the impact of various types of comparative feedback over a couple of class periods. The students were given booklets which included one of two tasks, spatial or verbal. Each task item had a one best answer, one slightly reasonable response, one incorrect response, and one response that was neither good nor bad. Following task completion, all students received misleading feedback. Students were randomly placed in one of the conditions and given temporal or normative feedback. The instructional feedback included temporal improvement (TI) which stated “Now you can see whether your scores changed over time as you worked. Your scores for each problem were 1, 2, 1, 2, 3, and 3.” The temporal decline (TD) feedback mirrored the TI instruction but added declining scores. The normative success (NS) feedback stated “Now you can see how you did compared with other pupils. We randomly chose six pupils in Grade 8 (or 9) in another school who worked on the same questions you did. Their total scores were 9, 11, 10, 9, 11, and 9.” The normative failure (NF) statement was similar to the NS

feedback, but the scores were “15, 13, 14, 15, 13, and 15”. The students also completed an implicit theory survey (Dweck & Henderson, 1986) and the perceived competence in children scale (Harter, 1982), in handout material. The students were also asked to complete four questions about their level of intrinsic motivation. The intrinsic motivation questions included “How interesting did you find the problems? How interested are you in receiving more problems like the ones you worked on? How many extra problems would you like to receive? How interested would you be in working on extra problems during recess?”

Butler (2000) found that 44% of the students were incremental theorists, 39% were entity theorists, and 17% had neither an implicit nor an explicit theory of intelligence. Using ANOVA analysis, interaction was found between implicit beliefs about intelligence, the type of feedback, and intrinsic motivation. Students with an incremental view of intelligence who received temporal feedback had greater intrinsic motivation and TI than those with TD. TI and TD feedback did not have an effect on intrinsic motivation for entity-theory students. However, in general, normative feedback, specifically NS influenced intrinsic motivation for entity students as compared to incremental students respectively. Students that rated their ability higher were more likely to have a higher intrinsic motivation.

Butler (2000) found that students appraised their ability differently depending on their theories of intelligence. Students with an incremental theory were more likely to view their intelligence as higher following TI, meaning their initial score was low but over time scores improved. Students with an entity theory were more likely to appraise their ability as higher following TD, meaning their initial score was high and subsequent

scores were lower. Temporal feedback, TI or TD did not significantly affect the students' rating of their intelligence. Narrative feedback demonstrated a significant interaction with students' rating of their intelligence. Entity students were more likely to rate their intelligence as higher following NS when compared to NF. Incremental students' rating of their intelligence was not significantly influenced with any normative feedback.

In summarizing the relationships between inservice teachers' implicit beliefs about intelligence and student achievement, strengths of the studies of Rosenthal & Jacobson (1968), Rheinberg and Enseger (2010), Mueller and Dweck (1998), and Butler (2000) include evidence of an association between inservice teachers' implicit beliefs about intelligence and student achievement. Rosenthal and Jacobson (1968) found that inservice teachers' belief in the intelligence of highlighted students influenced measurable improvements in grades and IQ. Further, findings were significant for low ability students. Rheinberg and Engeser confirmed the influence of an inservice teacher's implicit beliefs about intelligence with the types of referencing chosen. Inservice teachers with a dynamic view of intelligence used individual referencing when communicating with students; their students demonstrated the largest improvement in achievement. Inservice teachers who used social referencing were more likely to have students who increased in fear and decreased in hope. Further support of the influence of inservice teacher's beliefs about intelligence influencing student achievement was found in the three studies of Mueller & Dweck, who gave fifth graders different feedback regarding their ability: praise or effort; they found an association with choices for learning or performance goals; the results of the studies supported each other. Butler added to these

findings by revealing that the type of feedback given them interacted with students' theories of intelligence.

Feedback giving praise versus feedback about effort was found to influence students' inferences about their intelligence and was associated with their motivation. Incrementally-minded students were most motivated with temporal improvement feedback, where they improved over time; they also rated their intelligence highest. This was in comparison to entity-minded students who were only motivated normative success feedback for which they rated their intelligence the highest. A limitation of the findings of Rosenthal & Jacobson (1968) was that they were completed over half a century ago; were an experiment in a public school, grades 1-5; may be difficult to generalize to other students; and it was unclear whether any confounding variables existed. Rheinberg and Engeser's (2010) studies examined inservice teachers' patterns of referencing, but did not include a survey or interview of their beliefs regarding intelligence. Further, Rheinberg and Engeser investigated inservice teachers in Germany, Butler's (2000) studies were conducted with students in Jerusalem; both limit the ability to generalize the findings to other studies. Improvements for future research would be to incorporate qualitative methods in the research of Rosenthal and Jacobson and Rheinberg and Engeser to get a better understanding of the outcomes. The next section will review the implications of inservice teachers' implicit beliefs about intelligence.

Inservice Teachers Implicit Beliefs about Intelligence

A study of inservice teachers' implicit beliefs about intelligence is essential to understanding the implicit beliefs of preservice teachers. The research of Lynott and Woolfolk (1994), Butler (2000), Garcia-Cepero and McCoach (2009), Epler (2011),

Jones, et al. (2012), and Mascaret et al. (2015) will be examined in regard to current studies of implicit beliefs about intelligence of inservice teachers.

Lynott and Woolfolk (1994) found that the implicit beliefs about intelligence of inservice teachers varied. The teachers with the least and the most teaching experience endorsed an incremental view of intelligence. Butler (2000) established that inservice teachers (50%) were more likely than their students (26%) to hold fixed views of intelligence. However, Garcia-Cepero and McCoach, (2008) found that inservice educators of gifted students did not appear to prefer one view of intelligence over another, but their views did appear to influence their methods of identifying students with superior ability. The more recent study by Jones et al. (2012) found the majority of inservice teachers ($n = 33$) to endorse incremental beliefs about intelligence. Mascaret et al. (2015) demonstrated that a majority of teachers in that study endorsed an incremental view of intelligence.

Implicit Beliefs About Intelligence: Inservice Teachers Compared to Preservice Teachers

The implicit beliefs about intelligence of inservice teachers, considered experts in teaching, when compared to preservice teachers, assumed to be untrained student teachers, were of particular interest. The studies of Jones, et al. (2012), Patterson et al. (2016), and Fang (2017) will be examined.

Jones et al. (2012) specifically examined beliefs in the implicit theories of intelligence of preservice teachers. The participants of this study were preservice teachers ($n = 270$) taking educational psychology courses; individuals with no training or teaching experience were classified as preservice teachers ($n = 237$); the comparison group were inservice teachers ($n = 33$). The students were asked to complete Dweck's (2000) TIS-

self form for adults (1 = strongly disagree; 6 = strongly agree), consisting of three questions: “You have a certain amount of intelligence and you really can’t do much to change it;” “Your intelligence is something about you that you can’t change very much;” and “You can learn new things but you can’t really change your basic intelligence.” The results of the TIS were averaged, yielding an intelligence theory score where 6 represented strong entity beliefs and 1 represented strong incremental beliefs. They found no significant differences on the TIS between preservice and inservice participants. Consequently, the researchers combined the mean results of the TIS for preservice and inservice teachers, finding that 77.9% reported an incremental view of intelligence. Jones’ group concluded that the majority of inservice and preservice teachers endorsed an implicit view of intelligence.

Patterson et al. (2016) examined beliefs about intelligence in undergraduate and graduate programs of education. The participants included inservice teachers ($n = 53$) and preservice teachers ($n = 73$). Preservice teachers with more than two years of teaching experience were omitted from the research. The individuals completed online surveys, including items about their perceptions of how to influence student performance, using Dweck’s (2000) TIS, views of ability, and effort as related to academic domains. Using a one-way ANOVA from the TIS items, the study found inservice and preservice teachers had similar implicit beliefs about intelligence. Both groups were more likely to endorse an incremental view of intelligence.

In a recent dissertation, Fang (2017) directed a study on implicit beliefs about intelligence which included individuals from the general population ($n = 60$), inservice teachers ($n = 23$), and preservice teachers ($n = 21$), using an online platform with offline

data gathering. The participants completed three scales using a 30-item questionnaire with a 5-point Likert scale 1 (*strongly disagree*) to 5 (*strongly agree*). The survey included three items from the TIS (Blackwell, et al., (2007), which included three academic domain items for mathematics, three items for language arts, and three items for science, yielding a total of 9 items. Further, the participants completed twelve items of the epistemological beliefs questionnaire.

Fang (2017) found that the groups from preservice teachers, inservice teachers, and the general population each have unique perspectives about attributes of intelligence. When comparing inservice teachers with the general population, the attributes of rational/logical/analytical and quick thinking were rated more important by the general population. These attributes were in line with entity views of intelligence. Inservice teachers were more likely than either of the other groups to prefer attributes of good communication skills and social skills, but the differences were not significant. Secondly, using MANOVA analysis of implicit beliefs about intelligence (Dweck, 2000) found for that for fixed general mathematics and fixed language abilities the three groups of participants had differing views. The general population group was more likely to have an entity view of intelligence when compared to the teachers, whether inservice or preservice. For general mathematics or language ability, inservice and preservice teachers had a more incremental view of intelligence than the general public.

In summary, strengths of the studies by Patterson et al. (2016) and Jones et al. (2012) were the findings that there were no differences between preservice and inservice teachers' implicit beliefs about intelligence. Additionally, both inservice and preservice teachers were more likely to hold an incremental view of intelligence (Patterson et al.;

Fang, 2017). Further, Fang found that both inservice and preservice teachers, when compared to the general population, were more incrementally minded. In addition, Patterson et al., included preservice teachers with less than two years of teaching experiences, increasing the accuracy of the data.

Limitations of the studies include small sample sizes in Patterson et al., (2016) and Fang (2017), making a representative distribution from a normal population less likely. For Jones et al. (2012) the purpose of the study was not to compare inservice and preservice teachers, but to examine preservice teachers enrolled in an educational psychology course. However, some of the participants were inservice teachers. Suggestions for future research would include purposeful comparison studies of inservice and preservice teachers, using larger sample sizes. The inclusion of qualitative methods such as short-answer questions and/or structured interviews would improve understanding of the results. The following section will review studies on preservice teachers' implicit beliefs about intelligence.

Preservice Teachers Implicit Theories of Intelligence

Research on preservice teachers' implicit theories of intelligence is limited. Studies investigating preservice teacher's implicit beliefs about intelligence include Lynott and Woolfolk (1994), Jonsson and Beach (2010), Jones et al. (2012), Gutshall (2014), Palazzolo (2016), Smith (2014), and Small (2018).

Lynott and Woolfolk (1994) sought to identify behaviors of “ideally intelligent” individuals using preservice and inservice teachers. Phase 1 of the first study began with 41 elementary preservice and 40 inservice teachers who were given a questionnaire with directions to list behaviors that they believed were characteristic of intelligence, academic

intelligence, everyday intelligence, or unintelligence. Randomly assigned lists for each of these intelligences were handed out to the participants. The final master list was comprised of 100 behaviors that were considered characteristic of three types of intelligences: intelligence, academic intelligence, and everyday intelligence. These behaviors were identified, consolidated into separate lists, and used in the second phase of the study.

In Phase 2 of the first study the 100 behaviors related to intelligence were reduced to underlying dimensions by asking preservice teachers ($n = 115$) enrolled in an educational psychology course to rate behaviors based on Dweck and Bempechat's (1983) research, using a Likert scale of 1 (*least characteristic*) to 9 (*most characteristic*) to describe behaviors of an ideally intelligent person. The practical/academic intelligence factor ($\alpha = .91$) had the following items: "good study habits; setting and meeting priorities each day; disciplined; good reading, speaking, and writing skills; self-control; dedicated; amount of knowledge one has of subject matter; confidence; unusually good job performance; budgeting time; well read; and knowledge of world affairs and other aspects of life." This was a meaningful result as it indicates that these preservice teachers value practical and academic abilities as part of their beliefs about what constitutes an intelligent person. The conceptual or thinking factor ($\alpha = .93$) had the following items: "reasoning skills, conceptualizes, able to make observations, able to evaluate facts and information, problem-solving ability, inquisitive, logical, capability to understand information, abstract thinking, ability to gather information, desire to learn more, and ability to create and be original in thought and action." The social adaptiveness factor ($\alpha = .90$) had the following items: "able to interact well with different types of people, ability

to adapt, can use good judgment, sensible, coping with emergencies, have a wide range of interests, thoughtful, able to complete the functions of a normal day, ability to get along with others, self-awareness, able to participate in and understand things in society, and common sense.” Table 1 summarizes these findings.

Lynott and Woolfolk (1994) concluded that preservice teacher’s beliefs about intelligence appear to differ when compared to the lay people and experts studied by Sternberg, Conway, Ketron, and Bernstein (1981). The current study found that preservice elementary teachers believed social adaptiveness was a dimension of intelligence. Lynott and Woolfolk found that preservice teachers believed there were differences between practical/academic/self-management skills and general conceptual/reasoning abilities.

Jonsson and Beach (2010) conducted a study of preservice teachers and their implicit beliefs about intelligence in regard to academic domains. This study examined future teachers’ implicit beliefs about intelligence in the areas of mathematics and social science in relation to the CHC scientific *g*-factor theory. Participants ($n = 151$), ranging in age from 17 to 45 years, were preservice teachers enrolled in preschool educations ($n = 110$) and secondary programs ($n = 13$). All participants completed a 10-item (1-strongly disagree; 10-strongly agree) Swedish version of the TIS for mathematics and social science. Half of the participants received the mathematics TIS first and the other half the social science TIS first. Using ANOVA analysis the researchers found that prior to any intervention preservice teachers were significantly more likely to endorse a growth mindset view of intelligence in mathematics. Similar results were found for social

Table 1*Behaviors related to intelligence*

Factor	Statistic	Items Included
Practical/academic intelligence	$\alpha = .91$	good study habits setting and meeting priorities each day disciplined good reading, speaking, and writing skills self-control dedicated amount of knowledge one has of subject matter confidence unusually good job performance budgeting time well read knowledge of world affairs and other aspects of life
Conceptual or thinking	$\alpha = .93$	reasoning skills conceptualizes able to make observations able to evaluate facts and information problem-solving ability inquisitive logical capability to understand information abstract thinking ability to gather information desire to learn more ability to create and be original in thought and action
Social adaptiveness	$\alpha = .90$	able to interact well with different types of people ability to adapt can use good judgment sensible coping with emergencies have a wide range of interests thoughtful able to complete the functions of a normal day ability to get along with others self-awareness able to participate in and understand things in society common sense

Note: Lynott and Woolfolk (1994)

science. Preservice teachers were more likely to endorse an incremental view of intelligence in social science, with a strong effect size. Specifically, for the areas of mathematics and social sciences, preservice teachers were more likely to have an incremental view of intelligence.

Jones et al. (2012) examined beliefs in the implicit theories of intelligence of preservice teachers. Preservice teachers, with no teaching experience ($n = 270$) from three universities, two public and one private, in the United States taking an educational psychology course were surveyed. Participants were asked to complete Dweck's (2000) TIS self-form for adults (1-6 pt.), consisting of three questions: "You have a certain amount of intelligence and you really can't do much to change it;" "Your intelligence is something about you that you can't change very much;" and "You can learn new things but you can't really change your basic intelligence." The scores on the TIS were averaged, yielding an intelligence theory score, where 6 represented a strong entity perspective and 1 represented a strong incremental perspective. Mean and standard deviations were computed. The results demonstrated that 77.9% of the participants reported an incremental view of intelligence. The findings suggest that a majority of preservice teachers believed that one can change the amount of basic intelligence.

A study by Gutshall (2014) examined the implicit beliefs of preservice teachers ($n = 113$) from an American university in the southern part of the United States. Participants were surveyed at the beginning and end of their teacher education program using Dweck and Henderson's (1986) 3-item scale for implicit beliefs about intelligence (identified above). Chi-square analysis indicated that a large majority of these preservice teachers

endorsed an incremental view of intelligence; they demonstrated no difference between the beginning and end of their program.

A master's thesis by Palazzolo (2016) examined the implicit beliefs about intelligence and self-efficacy of preservice teachers ($n = 89$) in a Canadian education program. The 8-item instrument used was the general TIS developed by Dweck (2000). Palazzolo found that the majority of preservice teachers endorsed an incremental view of intelligence; there was no change in their implicit views during their first year in the education program.

In Kentucky, Smith's (2014) doctoral dissertation on preservice teachers ($n = 235$) used Dweck's (2000) TIS adult form, finding that these future teachers endorsed a growth-minded view of intelligence ($M = 4.71$, $SD = 0.27$; $\alpha = 0.91$). They found a small variability in the responses, demonstrating a high degree of agreement with this view of intelligence.

In summary, a review of the studies by Lynott and Woolfolk (1994), Jonsson and Beach (2010), Jones et al. (2012), Gutshall (2014), Palazzolo (2016), and Smith (2014) demonstrates some strengths, weaknesses, and considerations for future investigation. A strength of these studies was that preservice teachers were found consistently more likely to endorse an incremental view of intelligence (Gutshall; Jones et al.; Jonsson and Beach; Palazzolo). Further, consistency was found in endorsement of incremental views of preservice teachers in education programs, whether within the first year (Palazzolo) or from the beginning to the end of the education program (Gutshall, The theory of intelligence instruments used to investigate preservice teachers' implicit beliefs about intelligence were valid and reliable, having high Cronbach alphas in a range of 0.92 to

0.98, (Jones et al.). The studies by Gutshall, Palazzolo, and Jonsson and Beach found Cronbach alpha scores of 0.70 to 0.87, using the Swedish translation of the TIS by Dweck (2000). An additional strength of these studies was that various statistical methods were implemented, with all studies finding that the majority of preservice teachers were incrementally minded (Smith).

Some limitations of these studies were small sample sizes (Gutshall, 2014; Lynott and Woolfolk, 1994; Palazzolo, 2016). Further, the studies of Lynott and Woolfolk, Jonsson and Beach (2010), Jones et al. (2012), Gutshall, and Palazzolo contained mostly females, questioning the ability to generalize to males. All of the studies utilized self-surveys, which means that verification of responses and a desire for social favorability could influence the results. Smith (2014) conducted an examination of preservice teachers only in Kentucky, so the results might be generalizable only to individuals from this state. Finally, some of the studies were conducted outside the United States (Jonsson & Beach; Palazzo) and were thus limited in the ability to generalize to other populations.

Suggestions for future studies include implementation in the TIS instrument of a 7-point Likert scale, including a “neither” option since fifteen percent of the population surveyed endorses neither incremental or entity views of intelligence (Dweck, 2000). Studies should use larger sample sizes to represent a normal distribution of the population. Further, preservice teachers sampled should have zero to two years of teaching experience to ensure confidence in the results. The following section reviews definitions of intelligence.

Definitions of Intelligence

The definitions of intelligence chosen for this study were from the research of Jonsson and Beach (2010); these authors examined preservice teachers' preferred theory of intelligence by giving them summaries of the CHC general intelligence theory, Gardner's MI theory, Sternberg's triarchic theory, and Vygotsky's sociocultural theory, then asking them to rate which theory was more credible. In the study by Jones et al., (2012), preservice teachers were given an open-ended scenario asking what makes one person more intelligent than another. The statements of definitions used for this study were not quotes from the Jones et al., or Jonsson and Beach, but gleaned from personal summaries of the works of Carroll (1997), (Cattell, 1963), Gardner (1983), Grigorenko (2004), and Sternberg (1985).

Definitions of intelligence contain some common concepts, such as an individual's task performance, interaction with nature, and adjustments to changing situations (Legg & Hutter, 2007). There are multiple definitions of intelligence; currently there is no universally accepted definition of intelligence. The following section will review the four definitions of intelligence used for the current study, which are the CHC general intelligence theory, Gardner's MI theory, Sternberg's triarchic theory, and Vygotsky's sociocultural theory.

The CHC theory defines intelligence as being partly fluid and partly crystallized (Carroll, 1997; Cattell, 1963), based on Spearman's (1904) hierarchical factor analyses developed from a range of mental effort tests and named *g* for general intelligence. The *g* factor positively correlates with a variety of ability assessments of an individual's performance. General intelligence is considered inherited and stable over time. The CHC

theory also includes *s* or special intelligence factor which is an individual's performance on specific tests such as attention, memory, vocabulary, and comprehension. Cognitive differences between individuals were identified using IQ, a single value. Fluid intelligence is influenced by heredity which includes neural and cognitive abilities of reasoning. The crystallized part of intelligence is learned content knowledge and skills which are influenced by experiences. This theory of intelligence is based on empirical data. The CHC theory of intelligence is a scientific *g*-factor variant theory that suggests intelligence is innate and cannot be significantly altered.

The MI theory developed by Howard Gardner (1983) is a systems-based perspective of a network of diverse human abilities. According to Gardner, intelligence is “the capacity to solve problems or to fashion solutions that are valued in one or more cultural settings,” including the concept that individuals have “independent profiles of strength” (Gardner & Hatch, 1989). Gardner (1983) originally identified and proposed that all individuals have the basic intelligences of musical-rhythmic, visual-spatial, verbal-linguistic, logical-mathematical, bodily-kinesthetic, interpersonal, intrapersonal, and naturalist. MI may be used as an activity to stimulate learning and interest, to facilitate diverse perspectives of a main concept, or to construct meaning from prior knowledge by connecting it to new ideas (Gardner, 1999). The empirical data for this view of intelligence was lacking. However, Shearer and Karanian, (2017) found empirical evidence by applying neuroscience findings when they reviewed over 300 studies. The researchers reported that MI may be a link between cognitive processes and instruction. The MI definition of intelligence is about the styles of learning and does not posit anything about the pliability of intelligence.

The third definition of intelligence used in this study is the triarchic view of intelligence developed by Robert Sternberg (1985), who believes that intelligence is comprised of three primary types of cognitive functions: analytical thinking, creative thinking, and practical thinking. This definition of intelligence includes reasoning abilities, speed, and flexibility of thought. This view of intelligence lacks strong data and investigation. The triarchic definition of intelligence is comprised of types of mental processing. This description of intelligence is neither stable nor dynamic.

The final definition of intelligence used in this study is based on a sociocultural theory by Vygotsky (Grigorenko, 2004). Vygotsky's sociocultural theory was developed in the Soviet Union, now Russia, and is not fully understood in Western culture (Daniels, 2016). This definition considers intelligence to be a human trait that exists in all humans and is a developmental trait. As such, according to Grigorenko, intelligence can be fostered, shaped, and enhanced through experiences and interactions with society. This description of intelligence is dynamic, pliable, and incremental.

To summarize, the definitions of intelligence used in this study were derived from the sociocultural, triarchic, multiple intelligences, and general intelligence theories. The strength of these definitions was that they were examined in other studies to identify inservice and preservice teachers' implicit beliefs about intelligence (Jonsson & Beach, 2010; Jonsson et al., 2012). Each definition was associated with an implicit belief about intelligence. The CHC definition is an entity definition. The MI and triarchic definitions are a mixed or neither view of intelligence. And the sociocultural definition is an incremental view of intelligence. Another strength of the CHC definition is that mental assessments such as speed of recollection were used to develop a single value, the IQ,

which may be used to compare and contrast all individuals. This definition is commonly used and familiar to individuals living in the United States. Further strengths of the MI and triarchic definitions of intelligence were that they are implemented in classrooms in western cultures. Weak points of the definitions were that empirical data was scant as a foundation for multiple intelligences, triarchic intelligence, and sociocultural intelligence (Gardner, 1983; Grigorenko, 2004; Sternberg, 1985). Another weakness of the sociocultural definition of intelligence was that this view of ability is common in totalitarian countries but not in western society. A consideration for future research is to conduct experimental evaluation of the definitions for quantitative reliability. The following section will review preservice teachers' definitions of intelligence as predictors of implicit beliefs about intelligence.

Preservice Teachers' Definitions of Intelligence as Predictors of Implicit Beliefs About Intelligence

Research regarding the definitions of intelligence and implicit beliefs about intelligence among preservice teachers is limited. Two studies, Jones et al, (2012) and Jonsson and Beach (2010), investigated implicit beliefs about intelligence and definitions of intelligence of preservice teachers. Those studies will be reviewed here.

Jonsson and Beach (2010) investigated the definitions of intelligence and implicit beliefs of preservice teachers in Sweden ($n = 102$). Half of the preservice teachers taking their first semester were matched with half taking the last semester in the education program; the groups were split randomly into experimental and control groups. Participants in the experimental group received a brief summary of the scientific g -factor theory CHC. Both groups were surveyed for their implicit theories of intelligence using a

translated version of Dweck's TIS (2000). Cronbach's alpha scores for entity and incremental views of intelligence confirmed the reliability of the measure. Then all the participants were given summaries of additional theories of intelligence including CHC theory, Sternberg's triarchic theory, Gardner's MI theory, and Vygotsky's sociocultural theory and asked to rate the credibility of each of the theories. This exposed the experimental group to the CHC theory for a second time. The results showed that participants in the experimental group, whether in their first or last semester, increased their beliefs about entity types of intelligence when compared to the control group. The researchers also found an increase in entity beliefs and a decrease in incremental beliefs after exposure to the CHC scientific theory; this appears to confirm the impact of experience for the experimental group. Results of a credibility analysis of the scientific theories demonstrated that individuals in the experimental group increased their believability of the CHC theory when compared to the control group. Further, the experimental group demonstrated a decrease in their credibility about the other three theories of intelligence. The statistical interaction of believability to extra exposure to the CHC theory was significant.

Jones et al. (2012) examined beliefs about the implicit theories of intelligence among preservice teachers using a survey plus an open-ended question. Students were asked to complete Dweck's (2000) TIS self-form for adults (scale of 1 [*strongly agree*] to 6 [*strongly disagree*]). They found that the majority of preservice teachers believed that one can change the amount of basic intelligence. The students were also given a scenario that read "Imagine that you believe your friend Janice is more intelligent than your friend Amy. Based on your beliefs, what characteristics does Janice have that make her more

intelligent than Amy? In other words, what would make you think that one person is more intelligent than another?” and asked to explain their answers. The question was coded by each of the authors, finding a strong interrater reliability (86.7%). The analysis found seven themes among the preservice teachers’ definitions of intelligence. Their definitions of intelligence were comprised of academic achievement, declarative knowledge, procedural knowledge, self-regulation, thinking processes, motivation, and personality traits.

Only the studies of Jones et al. (2012) and Jonsson and Beach (2010) investigated preservice teachers’ implicit beliefs about intelligence and definitions of intelligence. Some of the strengths of the studies were that Jones et al., used a quantitative and qualitative approach (both a survey and an open-ended question) to better understand the implicit beliefs of preservice teachers. They discovered that more than three-quarters of the preservice teachers endorsed an incremental view of intelligence; they defined intelligence as including a number of themes such as high achievement in school, knowledge, motivation, and cognitive skills. Further strengths in the study by Jonsson and Beach include demonstration of preservice teachers’ preference for incremental beliefs about intelligence. However preservice teachers in the experimental group, who had an extra exposure to the CHC theory of intelligence were influenced by it and were more likely to describe this theory as credible. Moreover, individuals with extra exposure to the CHC theory were more likely to prefer entity beliefs about intelligence. These findings appeared to suggest that one’s definition of intelligence was associated with one’s implicit beliefs about intelligence.

The limitations of Jonsson and Beach's (2010) study included small effect sizes for the decrease in incremental beliefs and the increase in entity beliefs about intelligence after exposure to the CHC definition of intelligence. The theoretical construct and direction were consistent; however, confidence in the results was low.

Further investigation of preservice teacher's implicit beliefs and their definitions of intelligence is essential. Additional studies using larger sample sizes, which are more likely to represent a normal distribution, would be valuable to assess further the relationship between definitions of intelligence and implicit beliefs about intelligence.

Dweck's Implicit Theories of Intelligence as Related to Demographic Variables

The following section reviewed the relationships between the implicit theory of intelligence (Dweck, 2000), which identifies entity and incremental views, with demographic variables. This information includes age, gender, educational level, and academic domains.

Age

Research studies of the implicit theory of intelligence began with young children. Herbert and Dweck (1985) cited in Dweck (2000, p. 97), investigated three-and-a-half- to five-year olds using large colorful puzzles. The children were given three puzzles which were too difficult to solve. Then children were offered a fourth puzzle with the assurance of success. The results found that children demonstrated response patterns of persistence and non-persistence. A later study by Bandura and Dweck (1985) examined late grade-school-aged children's problem-solving preferences and confidence with challenging tasks. The results found that students with an incremental view of intelligence were more likely to persist after failure, even thriving in the face of challenging problems as they

afforded them opportunities to learn more. Students with an entity view of intelligence chose to repeat prior solved problems and to avoid challenging ones. Blackwell et al. (2007) conducted a longitudinal study of adolescents which included intervention with the implicit theory of intelligence. They used student grade-point averages (GPA) to demonstrate that different implicit beliefs about intelligence were associated with overall achievement; students with an incremental view of intelligence were more successful than students with an entity view of intelligence during adolescence.

Hong, et al. (1995) conducted a study of university students in Hong Kong. They examined students' prior English proficiency scores and had participants' complete surveys about implicit theories of intelligence and their desire for remedial action in English. For students with low English proficiency, they found that students with an entity view of intelligence were less likely to choose an English course in remediation, compared with students with an incremental view of intelligence. Implicit theories of intelligence have demonstrated that choices, actions and persistence of individuals ranging from young child to adulthood age can be influenced.

Published in 2004, Braten and Stromso investigated post-secondary students in Norway ($n = 80$). The participants were in their first and second year of study in an educational program, ages 19 to 46 years. They were surveyed with Dweck's (2000) TIS items. The findings suggest that first and second year students with an incremental view of intelligence were more likely to have an orientation toward mastery learning, an incremental view of intelligence. Students who endorsed an entity view of intelligence were more likely to be focused on performance.

A study by Dupeyrat and Marine (2005) examined French students returning to school for a one-year diploma program. The participants ranged from 20 to 49 years of age, with an average age of 31. On the last day of class, the students completed a survey including the scale of implicit theories of intelligence (Hong, et al., 1995) as well as items about goal orientation, cognitive engagement, and their use of learning strategies. Dupeyrat and Marine found that the participants in this study were more likely to endorse an incremental view of intelligence. Further, the returning adults were more likely to endorse mastery goals instead of performance goals. These adult-age students also were less likely to avoid work.

Considering the strengths of these studies they examined a range of age groups from early childhood (Herbert & Dweck, 1985) to college age individuals (Hong et al., 1995). These studies found that incremental beliefs about intelligence create patterns of persistence in the face of challenges which were observed in very young children (Herbert & Dweck) and late-grade-school students (Bandura & Dweck, 1985). College students in Norway were more likely to be mastery oriented in their programs (Braten & Stromso, 2004), and French adults returning to school were less likely to avoid work (Dupeyrat & Marine, 2005) Further, findings among adolescents with an incremental mindset were positively related to higher grade point averages (Blackwell et al., 2007); growth-minded college-age students with low proficiency in English were more likely to pursue remediation (Hong et al., 1995).

The use of self-surveys (Braten & Stromso, 2004; Dupeyrat & Marine, 2005; Hong et al., 1995) may be a limitation because participants may have biases or be likely to give socially appropriate responses. The use of correlational studies to indicate a

relationship between implicit beliefs about intelligence of varied-aged individuals and an influence on persistence or academic success do not equate to causality; as such alternative explanations cannot be ruled out. Future studies should consider a mixed method approach including open-ended questions, interviews, and quasi-experiments with control groups to improve understanding of relationships and increase confidence in the generalizability of findings.

Gender

As shown above regarding research into implicit beliefs about intelligence and age, researchers have conducted examinations of the associations between beliefs about intelligence and gender. The studies of Good, Rattan, and Dweck (2012) and Romero et al., (2014) will be explored for relationships between gender and implicit beliefs about intelligence.

Views persist that mathematics ability is a fixed inherited trait and that males are more likely to have this ability when compared to females (Dweck, 2000). Good et al. (2012) investigated the reasons why females choose not to stay in a calculus course. Participants from a university in the United States included males ($n = 471$) and females ($n = 534$). They completed a sense of belonging to mathematics, and PEET from Dweck's implicit theories of intelligence. Items included "People in my calculus class believe that you have a certain amount of mathematics intelligence and you can't really do anything to change it". Further, students answered surveys of perceptions of environmental stereotyping, an item about their intent to pursue math: "How likely are you to take mathematics classes in the future beyond Calculus II?" (8-item scale, 1 [*strongly disagree*] to 8 [*strongly agree*]), and an interest in mathematics item: "I enjoy

mathematics.” The mathematics grades of the participants in the calculus course were obtained.

Good et al. (2012) found that females were less likely to feel they belonged in the mathematics course. This result appeared to predict future choices about pursuing mathematics in that female participants with lower feelings of belonging were less likely plan to pursue a future in mathematics, when compared to males. Of particular interest was the participants’ perceptions of an entity environment and associated messages. Using regression analysis of the PEET and perceptions of environmental stereotyping scales, they found that females were more susceptible to a lower sense of belonging. Perceptions of an entity environment found females less likely to have a sense of belonging and less likely to pursue a future in mathematics. An incremental course environment found females had a higher sense of belonging and were more likely to consider a future in mathematics. Messages of pliable intelligence in a classroom were associated with females’ improved perceptions of belonging and the desire to choose more mathematics courses in the future.

Romero et al. (2014) examined the relationship between implicit theories of intelligence and academic outcomes of adolescents, including gender. Participants in the study were middle school students (females = 67; males = 48). The students completed a three-item Dweck’s (2000) TIS and a 10-item children’s short scale depression inventory. They found a relationship between students endorsing an incremental view of intelligence and higher grades over time. A relationship between implicit theories of beliefs and emotion was not observed, demonstrating that these were separate with no interaction. No relationship was found between implicit theories of belief and gender.

This review of studies investigating relationships between gender and Dweck's implicit theories of intelligence revealed strong and weak points. Strong points of these studies included moderate (Romero et al., 2014) to large (Good et al., 2012) sample sizes. Good et al., revealed that entity or incremental classroom environments may influence a sense of belonging for females. A limitation of these studies was that they were correlational, demonstrating associations, but not causation. Only one of the studies (Good, et al.) found a relationship between implicit beliefs about intelligence and gender. This suggests a need for future research into implicit beliefs about intelligence and their relationship to gender. Also, future studies should include a qualitative method to examine reasoning behind implicit beliefs and gender. The next section will review Dweck's implicit beliefs about intelligence and educational levels.

Educational Level

Another demographic variable of interest is the education level of an individual and the correlation with Dweck's implicit beliefs about intelligence. Implicit beliefs about intelligence and level of education were examined in the studies of Blackwell et al. (2007), Hong et al. (1999), Kennett and Keefer (2006), and Dypeyrat and Marine (2005).

Blackwell et al. (2007) found that implicit beliefs about intelligence were associated with behaviors among students at the middle-school level. They examined students entering the 7th grade of an urban east coast public middle school ($n = 373$) over a period of five years. Students completed a 6-item TIS, a patterns of adaptive learning survey, and a helpless-response-to-failure reading. The results found that middle-school students with an incremental belief in intelligence were more likely to have associations with beliefs about effort, in learning goals, and effective strategies of learning. Further,

students with incremental beliefs about intelligence were less likely to give helpless explanations for outcomes.

A study by Hong et al. (1999) investigated university students ($n = 97$) in the United States. The students completed surveys on the implicit theory of intelligence and self-confidence. They then completed an ability test. All students received negative feedback using a graph representation that included one other participant. Following negative feedback, participants were asked to complete an evaluation explaining their test outcomes. The study found that individuals with an incremental view of intelligence explained poor test performance with both effort ($M = 27.3\%$) and ability ($M = 30.4\%$). The students with an entity view of intelligence explained poor test performance by focusing primarily on their lack of ability (effort, $M = 17.8\%$ vs. ability, $M = 33.9\%$, $t(29) = 3.39$, $p < 0.01$).

In a study of Canadian university students, Kennett and Keefer (2006) investigated relationships between implicit theories of intelligence and resourcefulness. They found that students who endorsed an entity view of intelligence were more likely to attribute poor grades to lack of ability, when compared to students with an incremental view of intelligence.

Dupeyrat and Marine (2005) investigated implicit beliefs of adults returning to school for a one-year diploma high-school-equivalent degree in France. The students were surveyed at the end of the year prior to final exams. The results showed that an incremental view of intelligence was associated positively with an orientation toward mastery and deeper cognitive processing when compared to individuals with an entity view of intelligence. Further, students who endorsed an entity view of intelligence had a

negative relationship with deep mental processing and effort. These findings were corroborated using path analysis and regression modeling.

A review of these studies demonstrates the following strengths. The studies by Hong et al. (1999), Blackwell et al. (2007), Kennett and Keefer (2006), and Dupeyrat and Marine (2005) found that individuals' implicit beliefs about intelligence from various education levels (middle school, post-secondary, and university) were related to outcomes from academic achievement, effort, learning strategies used, and explanations for particular outcomes. Kennett and Keefer conducted studies of college-age students from different countries, finding that all students benefited from having an incremental view of intelligence compared to viewing intelligence as stable and fixed. For adult students returning to the classroom, Dupeyrat and Marine found those who endorsed an entity view of intelligence were more likely to avoid work and use shallow learning strategies. Added strengths of these studies, specifically Hong et al. (1999), and Blackwell et al., include the use of ability or achievement test scores of the participants to interpret results and increase accuracy of descriptions of the sample. Hong, et al. (1999), used an experimental method, giving negative feedback to all students regarding test scores, then surveying students for their explanations of the results. Differences in explanations were identified for individuals with disparate views of intelligence. Those with an entity view of intelligence were far more likely to explain poor test scores by ability. However, an individual with an incremental belief about intelligence was more likely to attribute poor test results to lack of effort. Blackwell, et al., studied middle school students' implicit beliefs about intelligence, following them over a two-year

period, and found those with an incremental view of intelligence were more successful making the transition to and through this educational and maturational stage.

A limitation in the study by Hong et al. (1999) was the small sample size. Future research could repeat their research methods using larger samples from multiple universities across the United States.

Academic Domains

As observed in research analyzing relationships between Dweck's implicit theories of intelligence and education levels, there exist studies examining associations between theories of intelligence and academic domains. Some recent research observed students with an entity view of intelligence were more likely to drop out of STEM courses (Dai & Cromley, 2014) while students with an incremental view of intelligence were more persistent in mathematics courses (Boaler, 2015). The studies of Farrell and Dweck (1985), Rattan, et al. (2012), and Romero, et al. (2014) will be reviewed.

Farrell and Dweck (1985) examined middle-school students in the classroom setting. Students were categorized by their learning goal types, mastery (incremental) or performance (entity). Student were pretested for ability and found to be equivalent. The students were instructed with a one-week long science unit and given new processing rules to assist their learning. Following the science unit, the students were given an exam with new problems which were indirectly related to the instructional material. The findings showed that students with mastery-oriented goals or incrementalists had higher scores on the new science problems when compared to the performance oriented, entity-believing students. These results suggest that individuals with mastery orientation and

incremental mindset worked harder and scored better on the novel problems encountered on the exam following the science unit.

The study by Rattan, et al. (2012) examined the effect of implicit theories of intelligence on inferences about ability in mathematics. Undergraduate students ($n = 95$) participated, reading an implicit theory of intelligence passage to manipulate their perspective, whether entity or incremental. They found that individuals with an entity theory perception were more likely to view mathematics ability as static compared to the individuals with an incremental theory condition.

Romero et al. (2014) used students in junior high ($n = 115$) to investigate implicit theories of intelligence and enrollment in advanced mathematics courses. The students with an incremental view of intelligence were more likely to enroll in advanced mathematics classes.

Summarizing implicit beliefs about intelligence and a relationship to academic domains reveals strengths and weaknesses. Strong points of Farrell and Dweck (1985), Rattan, et al. (2012) and Romero, et al. (2014) were that they include the findings that incrementally minded individuals were more likely to succeed in their science or mathematics courses. An additional strength was that Rattan, et al. (2012) manipulated the participant's implicit beliefs about intelligence by having them read a passage, which further confirmed the differences between individuals with entity and incremental mindsets. The limitation of Farrell and Dweck was that it was an excerpt in Dweck (2000, p. 17), rather than a published work, thus it lacks specifics about design and methodology. A single classroom was used for the science unit, so it may be difficult to generalize to other settings. Future research should consider repeating the studies of

Farrell and Dweck with larger samples, using control groups. The studies of Rattan et al. (2012) and Romero et al., (2012) should be conducted in language arts and other academic domains.

Enrollment in Educational Psychology Courses

The examination and study of Dweck's implicit theories of intelligence and student enrollment in educational psychology was limited. Lynott and Woolfolk (1994) and Jones et al. (2012) used preservice teacher in the examination of implicit beliefs about intelligence.

Jones et al. (2012) examined preservice ($n = 237$) and inservice ($n = 33$) teachers from three American universities taking programs that included educational psychology curricula. Using Dweck's (2000) 3-item TIS scale, they found that over 75% had an incremental theory of intelligence. The preservice teachers were then asked to identify traits of intelligence, given a situation of explaining differences in characteristics with a more intelligent friend. Results from this open-ended question found that preservice teacher identified seven themes of intelligence including academic achievement, declarative knowledge, procedural knowledge, self-regulation, thinking processes, motivation, and personality traits. No relationships were observed between educational psychology enrollment and implicit beliefs about intelligence.

Lynott and Woolfolk (1994) investigated preservice teachers ($n = 115$) in educational psychology courses in the United States. The individuals received a master list of one hundred representative behaviors in categories of intelligence, academic intelligence, everyday intelligence, and unintelligence. The preservice teachers were to rate the representative behaviors in each category on a 9-point Likert scale of 1 (*least*

characteristic) to 9 (*most characteristic*) of intelligence. The results found that preservice teachers identified the three factors of intelligence: practical and academic intelligence, conceptual thinking, and social adaptiveness. No associations were identified between educational psychology enrollment and implicit beliefs about intelligence.

Examining the findings of studies about enrollment in educational psychology courses and implicit beliefs about intelligence yields strengths and weaknesses. The studies of Jones et al. (2012) and Lynott and Woolfolk (1994) both used students in programs that included the study of educational psychology. Topics covered in educational psychology course work commonly include theories of intelligence (Beach & Dovemark, 2005). A strong point of these studies was the research on implicit beliefs about intelligence; sampling individuals with exposure to theories of intelligence would result in more confidence in the responses. That is, the participants were more familiar with the area of investigation. A limitation was that the sample was a convenience sample, rather than a random sample, relying on the enrollment in the classes; therefore, the sample may not be representative of a diverse perspective. Another weak point was that the studies did not reveal a relationship between educational psychology coursework and implicit beliefs about intelligence. A consideration for future studies would be to compare individuals' views of intelligent behaviors and their implicit beliefs about intelligence across university courses in general education and educational psychology.

Dweck's implicit theory of intelligence and relationships with the demographic variables of age, gender, educational level, academic domain, and enrollment in educational psychology has been reviewed. A relationship between one's beliefs regarding the pliability of intelligence can be observed at multiple ages, from early years

through to adulthood (Bandura & Dweck, 1985; Blackwell, et al., 2007; Herbert & Dweck, 1985 [cited in Dweck, 2000]; Hong, et al., 1995). Individuals at various ages benefit from endorsing an incremental mindset in the face of challenges, including puzzle activities (Herbert & Dweck), developmental transitions (Blackwell, et al.), and opportunities for learning (Hong, et al., 1995). Further, relationships between Dweck's implicit beliefs about intelligence and various educational levels have been demonstrated. Examination of college level students (Hong et al., 1995) and junior high students (Blackwell et al.) demonstrated similar associations with implicit beliefs about intelligence. Findings included an association between implicit beliefs about intelligence and the academic domains of mathematics and science. Students with an entity theory of intelligence were more likely to view mathematics ability as stable (Rattan, et al., 2012), be less likely to enroll in advanced mathematics classes (Romero, et al., 2014), and be less likely to be mastery-oriented in a science classroom (Farrell & Dweck, 1985). An association between Dweck's implicit beliefs about intelligence and gender has not been established from the studies. However, females were more likely to feel accepted in a mathematics class with an incremental environment compared to being in an entity-oriented classroom, and to plan a future in the field of mathematics (Good, et al., 2012). Finally, there only two studies (Jones et al., 2012; Lynott & Woolfolk, 1994) which examined Dweck's implicit beliefs about intelligence in individuals enrolled in educational psychology coursework; no relationship was demonstrated. The next section will review the possibility of relationships between demographic variables and educational psychology coursework as predictors of implicit beliefs about intelligence.

Demographic Variables and Enrollment in Educational Psychology Courses as Predictors of Implicit Beliefs about Intelligence

Age as a Predictor of Implicit Beliefs About Intelligence

Implicit beliefs about intelligence research have been conducted on various age groups of individuals. The studies reviewed demonstrate that diverse ages of individuals can detect implicit beliefs about intelligence. The studies of Lynott and Woolfolk (1994), Spinath et al. (2003), Braten and Stromso (2004), Georgiou (2008), Jonsson et al. (2012) and Diseth, et al. (2014) will be reviewed.

Diseth et al. (2014) examined the implicit beliefs of students in Norway. The research studied 11- and 13-year old students ($n = 2,062$). The participants completed the 4-point Rosenberg Self-Esteem scale, self-efficacy items from the Motivated Strategies for Learning Questionnaire, and a 5-point Dweck's (2000) TIS questionnaire, Norwegian version. Using confirmatory factor analysis, Diseth et al. found that older students demonstrated a stronger negative covariance, or understanding of the differences between incremental and entity beliefs about intelligence, when compared to younger students. In addition, a relationship was found between achievement and incremental views of intelligence vs. entity views of intelligence, but only for the 13-year-olds. Diseth et al. found that younger and older aged students have different levels of understanding regarding implicit beliefs about intelligence. Older students were more likely to associate achievement positively with a malleable view of intelligence and to negatively associate academic achievement with a static theory of intelligence. However, there were no differences between the implicit beliefs of the younger and older students, only their understanding of the differences between fixed and malleable views of intelligence.

The Jonsson et al. (2012) study evaluated Swedish high school teachers, ranging from 21 to 65 years of age, with 0 to 40 years of teaching experience. The researchers used a 2 x 2 ANOVA to examine relationships among the age of inservice teachers, the subject area taught, years of experience, and implicit theories of intelligence. The analysis found that older teachers with more experience, when compared to older teachers with less experience, preferred an entity theory of intelligence. Younger teachers with less experience were more likely than younger teachers with more experience to prefer entity beliefs about intelligence. To summarize, older teachers with more experience and younger teachers with less experience were more likely to prefer an entity view of intelligence.

Georgiou (2008) examined inservice and preservice teachers in Greece, finding associations with age and underlying beliefs about the nature of ability. Georgiou found the average age of inservice teachers to be 42.7 years. Preservice teachers averaged 22.8 years of age. The researchers administered a 20-item beliefs about school achievement survey to assess stereotypic thinking and reasons for student achievement. Using explanatory factor analysis, five belief factors were extracted: ability, teacher, family socio-eco, effort, and gender. A confirmatory factor analysis of belief factors was conducted and a structural equation model developed. The model consisting of the five belief factors extracted using achievement, teacher, family socioeconomic level, effort, and gender as factors was confirmed. A model was developed and identical regression coefficients were observed, allowing the model to be generalizable to the whole sample. Using MANOVA, the findings suggested that there were differences in the beliefs of older inservice teachers compared to younger preservice teachers. Older teachers were

more likely to believe that ability, family background, and gender play important roles in student achievement. These factors were not controllable by the student. Younger preservice teachers were more likely to believe that teachers play an important role in facilitating student achievement. Both inservice and preservice teachers believed that a student's effort plays an important role in achievement. Differences between older inservice and younger preservice teachers were significant for views about ability, family, teachers, and gender.

Lynott and Woolfolk's (1994) research evaluated inservice teachers on relationships between the nature of intelligence and two dimensions of intelligence with age groups. They discovered that inservice teachers between the ages of 31-40 showed a negative correlation with practical knowledge; teachers over 50 years of age demonstrated a negative relationship with the nature of intelligence. Older aged teachers were more likely to have entity beliefs about intelligence. They also found that the older the individuals, the more likely they were to endorse a fixed view of intelligence.

Spinath et al. (2003) investigated adult twins (ages 18-70) in Germany, extracted from a larger study conducted by Rienmann, Angleitener, and Strelau (1997). A subgroup of participants ($n = 592$) completed a 32-item, 5-point Likert scale implicit beliefs questionnaire which was designed to measure intelligence, personality, specific abilities, and implicit beliefs regarding human traits in general. Also, the participants were given two ability assessments: "leistungspruefssystem" (Horn, 1962) and Raven's Advanced Progressive Matrices (Raven, 1958). Using descriptive analysis, this study found that age was related to implicit beliefs about intelligence. However regression analysis revealed

that as an independent variable age accounted for only a small variance and did not appear to be highly predictive of implicit beliefs about intelligence.

Reviewing the section above, a strong point of the Lynott and Woolfolk (1994), Braten and Stromso (2004), Georgiou (2008), Jonsson et al. (2012), Diseth et al. (2014), and Spinath et al. (2003) studies was that they appear to find the age of individuals predictive of implicit beliefs about intelligence. When comparing older and young adults, they found that older adults were more likely to have an entity view of intelligence (Lynott & Woolfolk; Georgiou; Jonsson et al.). While a relationship between implicit beliefs and age has been revealed, a limitation of the studies concerns the small variances for this prediction (Spinath et al.). Comparing older and younger children, older children were more likely to understand the differences between a fixed and malleable view of intelligence, but age was not necessarily found to be predictive of implicit beliefs about intelligence (Diseth et al.). A number of the studies examined individuals from other countries (Braten & Stromso; Diseth et al.; Georgiou; Jonsson et al.; Spinath et al.) deserving cautious generalizability to individuals in the United States. Future research should consider populations of young and older adults in America. Further studies of implicit theories of intelligence should include predictive statistical methods such as regression analysis, using age as the independent variable to investigate the predictability. The following section reviews gender and implicit beliefs about intelligence.

Gender as a Predictor of Implicit Beliefs About Intelligence

Research connecting gender and implicit beliefs about intelligence was limited but some evidences and trends appear. Some studies investigate implicit beliefs about intelligence; some of the results indicate an interaction with gender. The studies of Good,

et al. (2003), Spinath, et al. (2003), Diseth, et al. (2014), and Mascaret et al. (2015) will be reviewed.

A study by Spinath et al. (2003) examined adult twins ($n = 592$) across Germany using self-report methodology. There were 471 females and 121 males, the age ranged from 18 to 70 years with a mean of 32.8 years. The participants completed an implicit theory questionnaire using an adapted assessment for intelligence from Dweck et al, (1995a, 1995b). The implicit beliefs about intelligence scale consisted of four items using a Likert scale, with 1 (*strongly agree*) to 5 (*strongly disagree*). Results found a relationship between gender and implicit theories of intelligence, indicating that females were more likely to endorse a malleable view of intelligence. However, regression analysis using gender as an independent variable found only a small variance with weak predictability of implicit beliefs about intelligence.

Diseth et al. (2014) also examined the relationship between implicit beliefs about intelligence and gender ($n = 2,062$) among middle school students (6th and 8th grade) in Norway. The participants completed Dweck's (2000) TIS questionnaire, Norwegian version. Using structural equation modeling, an analysis of gender differences was performed. The findings showed that entity beliefs about intelligences were negatively related to achievement for both groups of boys. Further, evidence found that boys' achievement was less likely to be related to an incremental theory of intelligence when compared to girls. However, in the initial assessment, achievement was positively related to incremental views of intelligence. Comparing boys and girls, the males were more likely to adopt an incremental view of intelligence both in sixth and eighth grades.

Mascret et al. (2015) investigated implicit theories of intelligence among sixty-one French high school teachers using a Single Target Implicit Association Test (ST-IAT), measuring word-attribute relationships. The teachers were categorized by subject area: science or liberal arts. Science teachers volunteered from mathematics and biology disciplines. The disciplines of language arts teachers included history, language arts, and language courses. Students ranged in age from 11 to 15 years. A 15-word list of vocabulary stimuli for categories of “stable” and “modifiable” intelligence was developed and tested. The words for “stable” were “consistent, balanced, stationary, immobile, and permanent,” The words for “modifiable” were “mutable, convertible, malleable, progressive, and adaptable.” The words for “intelligence” were “understanding, capacity, skill, aptitude, and discernment.” The stable and modifiable words were the distinguishing concepts, while intelligence was the focus concept. Male teachers were more likely to relate the constructs of “intelligence” and “modifiable” negatively when compared to female teachers. Male science teachers related more negatively to “intelligence” and “modifiable” words when compared to male liberal arts teachers. When compared to female science teachers, male science teachers demonstrated more negative relationships between “intelligence” and “modifiable” words. No differences were demonstrated between male and female liberal art teachers in the association of “intelligence” and “modifiable” words

Good’s group (2003) investigated seventh-grade students ($n = 138$) in Texas taking a computer class. Students were assigned to four intervention groups. One group received a message that intelligence is unstable, the brain is malleable, and change can occur. The second group received a message that most students struggle with difficult

academic material, but can overcome the challenges, see improvement over time, and reach higher levels of success. A third group received a message combining those given to groups one and two. The fourth group received messages about the dangers of drugs. All students created a digital final project and at the end of the year completed the Texas Assessment of Academic Skills.

Good, et al. (2003) found that all students in the first three intervention groups improved in mathematics. Only the males in the fourth, or control group, performed better than the females. The results using ANOVA (gender x condition) found that female students in the sections of incremental, attributions, and combination, improved their mathematics scores and showed a decrease in the differences with male students.

To summarize, the studies of Good et al. (2003), Spinath et al. (2003), Diseth, et al. (2014), and Mascaret et al. (2015) vary in methods and the populations studied. Strengths of these studies include the consistent findings that females were more incrementally minded when compared to males. This was demonstrated with females in the twins study (Spinath et al.), French science high school teachers (Mascaret et al.), adolescents in an intervention study (Good et al., 2003), and students from Norway (Diseth et al.). Additional strengths were found with higher samples of populations, Spinath et al., had almost six hundred participants; Diseth et al., evaluated data from over two thousand participants.

The study by Good et al. (2003) analyzing gender and condition found a Cohen's *d* of 1.13, meaning the differences were one standard deviation; this was a large effect size and indicative of strong significance. Further strengths of these studies were that both Good et al. (2003), and Mascaret et al. (2015) implemented methods other than self-

reports. Mascaret et al., developed a malleable and stable word list to assess participants using an ST-IAT administered on a computer. Good et al. (2003), used an experimental method with a control group, dividing participants into four groups, each receiving a different incremental beliefs message about intelligence.

Some weak aspects of these studies were that some sample sizes were small: Good et al., (2003) ($n = 138$) and Mascaret et al. (2015) ($n = 61$). A further limitation was that only the Good et al. (2003) study was conducted in the United States; the others were in Germany (Spinath et al., (2003), France (Mascaret et al.), and Norway (Diseth, et al., 2014), thus requiring caution with generalizations to other populations. Future research should be conducted in other countries to enhance generalization to more populations. Larger sample sizes from more than one school or district should be studied. In addition, researchers should consider open-ended questions and interviews to increase their understanding of survey responses. The following section reviews educational level as a predictor of implicit beliefs about intelligence.

Educational Level as a Predictor of Implicit Beliefs About Intelligence

The educational level of individuals is another potential predictor of implicit beliefs about intelligence. Diseth et al. (2014) examined the implicit beliefs of middle school students; Jonsson and Beach (2017) investigated Swedish high school students.

Diseth et al. (2014) studied Norwegian 6th and 8th grade students and found positive correlations between incremental implicit beliefs about intelligence and achievement. They investigated two grades of students, 6th and 8th, finding a significant relationship between implicit beliefs about intelligence and academic performance. Further, students in the eighth grade were more likely to see the relationship between

incremental beliefs about intelligence and achievement when compared to the sixth grade students.

Jonsson and Beach (2017) examined implicit beliefs about intelligence in Swedish students ($n = 845$) in the 10th to 12th Grades. Students were selected from the following courses: natural sciences, mathematics, general science, social sciences, and aesthetics. Two measurement scales were administered to the students, the patterns of adaptive learning scale, and a 10-item Swedish version of Dweck's TIS (2000). Prior to administration of the TIS, participants were asked to think about social science ($n = 300$) or think about mathematics ($n = 538$) to prime the student's implicit beliefs about intelligence. ANOVA was used to evaluate relationships among academic domain, grade level, and the implicit theory of intelligence. Findings included a main effect between the length of time in the program and the entity theories of intelligence. Students in the tenth grade had the lowest entity theories of intelligence; the greatest entity theories were manifest in the twelfth grade. The students in the twelfth grade had the highest entity views of intelligence in the natural science program, with tenth graders having the least. Analysis of incremental views of intelligence demonstrated a main effect. Students in the tenth grade level demonstrated the most incremental views while twelfth grade students had the least. The greatest growth-mindset views were observed among the 10th graders and the greatest fixed-mindset perceptions were among the 12th graders who have been in their respective programs the longest. The results were that twelfth grade students were more likely to endorse entity views of intelligence and least likely to endorse incremental views of ability.

Predicting implicit beliefs about intelligence as related to educational level was examined in middle and high school levels in the Diseth et al. (2014) and Jonsson and Beach (2017) studies. Strengths of the studies were that differences in implicit beliefs about intelligence when comparing grade levels of students were reported. Diseth et al., reported that 8th graders, compared to 6th graders, were more likely to understand the difference between views of stable and malleable intelligence. Jonsson and Beach observed variations in implicit beliefs about intelligence when comparing tenth and twelfth graders; the seniors were more likely to endorse an entity view of intelligence. As a further strength, Diseth et al., and Jonsson and Beach had large sample sizes. A less than ideal concern about the research methodology was the primary use of self-reporting tools, which may be skewed because of socially desirable responses. Additionally, participants were from Norway (Diseth et al.) and Sweden (Jonsson & Beach), which are more progressive countries, making generalizability limited. Future studies should examine students at various educational levels in other countries, including the United States, to investigate predictability for implicit beliefs about intelligence. In addition, researchers should consider comparing more than two educational levels at a time. The following section examines the predictability of academic domains for implicit beliefs about intelligence.

Academic Domains and Implicit Beliefs About Intelligence

The study of implicit beliefs about intelligence and the relationship with academic domains is reviewed here. Several studies investigated implicit beliefs about intelligence and their associations with academic domains. The studies include those of Jonsson and

Beach (2010), Jonsson et al. (2012), Mascaret et al. (2015), Patterson et al, (2016), Jonsson and Beach (2017), and Fang (2017).

Mascaret, et al. (2015) investigated implicit theories of intelligence among sixty-one French high school teachers using an ST-IAT, which measures word-attribute relationships. The teachers were categorized by subject area: sciences or liberal arts. Teachers volunteered from mathematics and biology disciplines. Liberal arts teachers were from history, language arts, and language courses. Students ranged in age from 11 to 15 years. A 15-word list of vocabulary stimuli was developed and tested, including categories of “stable,” “modifiable,” and “intelligence.” The stable words were “consistent, balanced, stationary, immobile, and permanent.” The modifiable words were “mutable, convertible, malleable, progressive, and adaptable.” The intelligence words were “understanding, capacity, skill, aptitude, and discernment.” The stable and modifiable words were the distinguishing concepts, while intelligence was the focus concept. Participants were tested individually on a computer and asked to categorize the intelligence words as stable (left key) or modifiable (right key). Each person was started with a training session. When an intelligence term appeared on the monitor, the participants were to press the stable or modifiable key; the response time was measured. Response times were averaged, noting delays in responses, and matched with the stable or modifiable categories. The study revealed that science teachers (mathematics and biology) and liberal arts teachers (French and history) had no significant difference in associations between intelligence and the matched qualities. The teachers were classified within their corresponding disciplines “science teacher scores” and “liberal arts teacher scores.”

A study by Jonsson and Beach (2010) investigated beliefs of 177 Swedish preservice teachers, enrolled in secondary ($n = 13$), elementary ($n = 45$), and preschool ($n = 110$) programs. The preservice teachers completed a 10-point, full version of TIS, translated, in the context of mathematics and social sciences. The students were divided into control and experimental groups. The experimental group read a passage about the g -factor scientific intelligence theory. ANOVA was used to compare incremental beliefs about intelligence in the mathematics context of the control group.

Comparing incremental and entity beliefs in the control group with beliefs in the social science context revealed a strong preference for incremental beliefs versus entity beliefs about intelligence. Preservice teachers strongly preferred the incremental beliefs in TIS within the context of social studies. Univariate analyses revealed that in the social science comparison, entity beliefs were more likely to be demonstrated in the experimental group versus the control group. Also, incremental beliefs were more likely to be found in the control group compared to the experimental group. However, low effect sizes raise reservations as to the degree of real-world influence, strength, and trust in the results (Jonsson and Beach, 2010).

Jonsson et al. (2012) sampled 226 Swedish high school teachers from the following academic domains: science and mathematics (30), language (57), social sciences (62), physical education (13), special education (6), and practical (54). (High school programs in Sweden were either practical or theoretical which affects the teacher groupings.) Participants were given the TIS, the eight-item format (Dweck, 2000), translated. The Likert scale measured from 1 (*very strongly disagree*) to 10 (*very strongly agree*) for entity and incremental items.

The participants then read short summaries of the following intelligence theories: CHC, Sternberg's triarchic theory of intelligence, Gardner's MI theory, and Vygotsky's Soviet sociocultural theory. Using a 2 x 4 ANOVA with entity or incremental theory and the academic areas of mathematics, science, language, social science/humanities, and practical, Johnson et al. (2012) found these teachers demonstrated a preference for incremental theory over entity theory. Science and mathematics teachers were not different in choosing incremental theory when compared to entity theory. Teachers from language, social science, and practical academic domains were more likely to have an incremental theory of intelligence compared to the science and mathematics teachers. Science teachers were more likely to consider ability as a constant and inborn factor, which is an entity belief about intelligence. They found no significant difference between science and mathematics teacher preferences for entity theories; however, compared to teachers from the other academic domains, science and mathematics teachers were more likely to have strong entity views of intelligence (Jonsson et al.).

Patterson's group (2016) investigated undergraduate and graduate education students, including 73 preservice teachers and 53 inservice teachers. The participants completed a survey with which included Dweck's (2000) TIS and domain specific views of effort and ability. The five domains examined were basic skills, arts, humanities, STEM, and physical education. The academic domain and TIS were evaluated with univariate analyses, finding that TIS constructs were related to academic domains. Further, Patterson et al., found implicit beliefs about intelligence were significant predictors for certain domains. Implicit beliefs about intelligence predicted the academic domains of basic skills, humanities, and STEM, but not art and physical education.

Moreover, individuals with entity views of intelligence were more likely to view ability as a determining factor of performance in the domains of basic skills, humanities, and STEM. Individuals holding entity theories of intelligence were not found in the domains of art and physical education.

Jonsson and Beach (2017) examined implicit beliefs about intelligence among Swedish students ($n = 845$), in grades 10 to 12, with ages ranging from 16 to 19 years. The academic domains chosen were natural science, which has the most substantial instruction of mathematics and science, and social science and aesthetics subjects which were part of Sweden's vocational programs. Two measurement scales were administered, the patterns of adaptive learning scale and a 10-item Swedish version of Dweck's TIS (2000). Prior to administration of the TIS, to prime them, participants were asked to think about social science ($n = 300$) or think about mathematics ($n = 538$).

Using ANOVA, analyses of academic domain, grade level, and implicit theory of intelligence was conducted. The exploration found a main effect between the length of time in the program and entity theories of intelligence. Only the participants in the natural science program demonstrated differences in entity views of intelligence among the grades. Jonsson and Beach (2017) found that seniors in the science program were most likely to endorse an entity view of intelligence compared to their younger classmates. The students in the vocational aesthetic program were also observed to have higher entity endorsements, however not as great as in the science program. Students in the social science programs did not vary in their implicit beliefs about intelligence among the grades.

Fang (2017) conducted a doctoral study using individuals from the general population ($n = 60$), inservice teachers ($n = 23$), and preservice teachers ($n = 21$); evaluating implicit beliefs about intelligence among academic domains. The participants completed three scales within a 30-item questionnaire using a Likert scale with 1 (*strongly disagree*) to 5 (*strongly agree*). The survey included three items of the TIS (Blackwell, et al., 2007), which was created with three academic domain items for mathematics, three items for language arts, and three for science, for a total of 9 items. The participants also completed six self-efficacy items about mathematics, language arts, and general intelligence such as “I consider myself to be a mathematics person” and “I consider myself to be a good writer.” Furthermore the participants completed twelve items of the epistemological beliefs questionnaire. The participants were given three open-ended scenarios in which they could measure teacher behavior. Each scenario described a student who excelled in certain academic domains, but struggled in one academic domain (mathematics, writing, or science). The participants were asked to read the scenarios and recommend a strategy for approaching the struggling student and explain their reason for selecting that strategy.

Using MANOVA analysis of implicit beliefs about intelligence (Dweck, 2000) for fixed general, fixed mathematics, and fixed language Fang (2017) observed different views among the groups of participants. Compared to the general population, preservice and inservice teachers’ implicit beliefs about intelligence were more growth oriented when compared to implicit beliefs about intelligence in an academic domain such as mathematics and language arts. Fang observed that preservice and inservice teachers were more likely to have an entity belief about intelligence in mathematics than in

language arts. Depending on the academic domain, implicit beliefs about intelligence varied.

The reviewed studies of Jonsson and Beach (2010), Jonsson et al. (2012), Jonsson and Beach (2017), Mascaret et al. (2015), Patterson et al. (2016), and Fang (2017) exposed interactions between academic domains and implicit beliefs about intelligence. A consistent strength among these studies was that individuals in the science or STEM domain were more likely to endorse an entity view of intelligence (Jonsson & Beach, 2017; Jonsson et al.; Fang; Patterson et al.). No differences were observed in individuals' implicit beliefs about intelligence between the mathematics and science domains (Jonsson et al.). Individuals in the science domain were less likely to associate intelligence with modifiable words (Mascaret et al.). In a mathematics context, exposure of individuals to the *g*-factor intelligence theory increased the likelihood they would prefer an entity view of intelligence (Jonsson & Beach, 2010; Jonsson et al.). While individuals in the art and physical education domains were less likely to endorse an entity view of intelligence (Patterson et al.), other studies found individuals in language arts were more likely to have an incremental view of intelligence (Jonsson et al. 2012; Fang). This was also true in social science domains (Jonsson & Beach, 2010).

Some limitations of the studies include the use of self-reports where bias may exist (Fang, 2017; Jonsson and Beach, 2017; Jonsson et al., 2012; Patterson et al., 2016) and small sample sizes (Fang; Mascaret et al., 2015; Patterson et al.). The effect size for identification of modifiable and stable words using an ST-IAT method was small, but this does not negate real world significance for the classroom. Future studies should consider larger sample sizes to investigate the reliability of academic domains as predictors of

implicit beliefs about intelligence. Further, the use of regression and similar analyses to examine academic domains as predictors of implicit beliefs about intelligence would be revealing. The following section was intended to review educational psychology coursework as a predictor of implicit beliefs about intelligence; however, there are no studies currently available.

In summary, the findings of the above sections about age, gender, educational level, academic domain, and educational psychology coursework suggest the possibility that they could be predictors of implicit beliefs about intelligence. The variables of age and gender appeared to be predictive of implicit beliefs about intelligence. Older inservice teachers (Lynott & Woolfolk, 1994; Georgiou, 2008; Jonsson et al., 2012) and older students (Diseth et al., 2014) were more likely to endorse a fixed view of intelligence. The variable of academic domain was associated with implicit beliefs about intelligence; however lack of predictability is not evidence. However, the science domain was more likely to have teachers possessing an entity view of intelligence (Jonsson & Beach, 2017; Jonsson et al., 2012; Fang, 2017; Patterson et al., 2016) in contrast to teachers in language arts and social sciences (Jonsson & Beach, 2010; Jonsson et al.; Fang). Comparing two studies at differing educational levels finds the higher grade level to be more predictive of an entity view of intelligence (Diseth et al.; Jonsson & Beach, 2017).

There was no evidence or any studies about educational psychology coursework being predictive of implicit beliefs about intelligence. The following section reviews the assessment of preservice teacher's definitions of intelligence and demographic variables.

Assessment of Preservice Teachers' Definitions of Intelligence Related to Demographic Variables

Preservice teachers' definitions of intelligence as related to age, gender, educational level, academic domains, and educational psychology coursework will be examined. There were two studies which investigate definitions of intelligence among preservice teachers. Jones et al. (2012) and Jonsson and Beach (2010) will be considered.

Jonsson and Beach (2010) examined over 100 preservice teachers in an education program in Sweden. Of the participants studied, the majority were female ($n = 89$). Ages of the participants ranged from 19 to 48 years, with a mean of 26 years of age. The Swedish education programs last three to four years, depending on the age-related focus chosen. The preservice teachers were in one of three programs, the preschool program ($n = 63$), elementary ($n = 28$), or secondary ($n = 10$). There was a strong emphasis on early elementary education in Sweden and the numbers demonstrated this.

The students in their first semester ($n = 52$) were matched with preservice teachers ($n = 52$) in the last semester of their program; experimental and control groups were established. During the first, middle, and last semesters of the Sweden education program students were instructed on the professional aspects of education, such as educational psychology. The participants all completed Dweck's (2000) TIS adult full version, which was translated into Swedish. Only preservice teachers in the experimental group received an initial priming summary of an entity theory of intelligence: the CHC general intelligence theory. Then all of the participants received a one-page summary of four theories of intelligence including the CHC theory, Sternberg's triarchic theory, Gardner's MI theory, and Vygotsky's Soviet sociocultural theory. The triarchic and MI

theories are neither entity nor incremental views of intelligence. The sociocultural theory is an incremental theory of intelligence. The participants were asked to rate the credibility of all the theories of intelligence (Jonsson and Beach, 2010).

Independent variables of age group, gender, and choice of program had no significant interaction or relationship with preservice teachers' implicit beliefs about intelligence. There was no analysis of academic domains or educational psychology coursework. The results showed a significant relationship among the different theories of intelligence on the preservice teachers' credibility ratings prior to exposure to any entity theory of intelligence. Further, prior to any priming with the entity theory of intelligence the most credible definition was the Soviet sociocultural theory, followed by the MI theory, then the triarchic theory, with the least credible being the CHC entity theory (Jonsson and Beach, 2010).

Following the priming exposure to the CHC entity theory the results of the credibility ratings changed. The results found a significant interaction between the preservice teachers' ratings of credibility of the various theories of intelligence. For the experimental group, results contrasted to the pretest, showing that credibility of all the theories of intelligence decreased in comparison to the control group except for the CHC entity theory of intelligence, which increased (Jonsson and Beach, 2010).

Jones et al. (2012) examined beliefs about the implicit theories of intelligence and definitions of intelligence among preservice teachers. The sample was comprised of 237 preservice teachers with no teaching experience who were enrolled in six different educational psychology courses in three universities. The majority were female (80%) with a mean age of 35.8 years. In the sample, there were a few ($n = 33$) inservice

teachers, but the analyses showed no differing views from the preservice teachers so the results were combined, because this study was not a comparison between the two groups. The preservice teachers completed Dweck's (2000) TIS self-form for adults. The results found that the majority (77.9%) held a malleable view of intelligence.

An open-ended question asked the preservice teacher to imagine two friends and what would make one more intelligent than the other. The preservice teachers' definition of intelligence was comprised of seven themes including "academic achievement," "declarative knowledge," "procedural knowledge," "self-regulation," "thinking processes," "motivation," and "personality traits" within 42 categories. Major responses for each theme include the following:

- Achievement theme: Is a higher achiever in school."
- Declarative theme: "has knowledge of a variety of subjects" and "has in-depth knowledge of one subject."
- Procedural skills theme: "has better social/emotional intelligence" and "speaks well."
- Self-regulation theme: "is more metacognitive or self-aware."
- Cognitive processes theme: "has more common sense," "has more general cognitive ability," "is better at higher-order thinking and reasoning," and "has a better memory."
- Motivation theme: "is more enthusiastic about learning, inquisitive."
- Personal theme: "is more open-minded to new ideas and possibilities."

The two most common themes identified in the open-ended item were knowledge, both declarative and procedural (158 responses) and cognitive processes (151 responses) (Jones et al., 2012).

This review of literature relating preservice teachers' demographic variables and definitions of intelligence demonstrates strengths and weaknesses of the studies. Jones et al. (2012) and Jonsson and Beach (2010) investigated preservice teachers' implicit beliefs about intelligence and their definitions of intelligence. Strengths of these studies include use of a mixed methodology (Jones et al.) and a quasi-experimental (Jonsson & Beach, 2010) approach. Both studies included the 2000 version of Dweck's TIS. The qualitative and quantitative methodologies improve understanding of preservice teachers' theories about the malleability of intelligence. Comparing the studies, both found that preservice teachers tend to believe that intelligence can be developed. For definitions of intelligence, the studies found that the incremental theory of intelligence was more credible to participants (Jonsson & Beach, 2010) and the major themes regarding differences in intelligence were cognitive processing and knowledge (Jones et al.).

A weakness in this review was the limited number of studies about preservice teachers' implicit beliefs about intelligence and their definitions of intelligence. Weak points of the existing studies were that the samples from both studies were composed of mostly females (Jones et al., 2012; Jonsson & Beach, 2010) rendering generalization limited. Further, the sample sizes were relatively small, 237 for Jones et al., and 102 for Jonsson and Beach (2010). Finally, the Jonsson and Beach (2010) study investigated Swedish preservice teachers from an education program that was unique when compared to other countries. In addition, Sweden is a country where Marxism theory is more

common when compared to other western countries, making any comparisons or generalizations narrow. Future studies should consider larger sample sizes from across countries and across the United States. Structured interviews should be considered using open-ended questions and quasi-experiments to provide better understanding of responses. Further, increased investigation of preservice teachers' implicit beliefs about intelligence and their definitions of intelligence were merited.

CHAPTER 3

METHODOLOGY

Introduction

The purpose of this study was to investigate preservice teachers' preferred definitions of intelligence, demographic variables, academic domains, and course variables as predictors of their implicit beliefs of intelligence. The content of this chapter explains the type of research implemented, the sample studied, a description of the sample, the hypotheses of the study, the definitions of target variables, instruments used in this research, the data collection involved, and the data analyses performed.

Type of Study

This was a quantitative study which was designed to minimize subjectivity by using numbers and measurements (Creswell, 2014). Non-experimental methods of descriptive, correlational, and survey research were implemented to study relationships, with no manipulation of the sample. Descriptive analysis involves organizing and describing numerical information about a sample, often using means, range of scores, and standard deviations. The descriptive design evaluated current situations or conditions. The correlational methods used statistical values to assess relationships between variables (Howell, 2007). High values indicated strong relationships; low values indicated weak relationships. Lastly, the survey gathered information from a sample (Creswell), which was a cross-sectional survey of the target sample. Quantitative, non-experimental, descriptive, correlational, and cross-sectional survey methods were used to explore

whether preservice teacher's implicit beliefs of intelligence and their knowledge about definitions of intelligence have a relationship. The following sections provide a description of the sample, hypotheses, variable definitions, instruments, collection method, and analysis of data. The schedule and budget are shown in Appendix A.

Population and Sample

The focus was on preservice teachers from the Midwestern region of the United States. Participants were reached with an electronic emailed survey to students in traditional and alternative programs in IHE. Preservice teachers were surveyed using QuestionPro survey tool services

After data screening, the sample included 262 preservice teachers having less than two years of teaching experience. The sample was a convenience and volunteer sample from the Midwestern United States. The Midwestern states are comprised of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, South Dakota, Ohio, and Wisconsin.

Data on preservice teachers is collected by the Title II Higher Education Act website (<https://title2.ed.gov/Public/Home.aspx>). Current information on preservice teachers is from the report for the 2015-2016 year (NCTQ, 2016). A total of 77,781 preservice teachers completed education programs in the United States, with 29,526 individuals from the Midwestern states. Over three-quarters of preservice teachers were female, 58,174 women versus 19,762 men. The racial composition of preservice teachers in the Midwest was primarily White/Caucasian (68,285); the next most common group was Hispanic (3,556), followed by Black/African American (3,072). Other ethnicities

include American Indian, Asian, Native Hawaiian, and individuals reporting two or more races.

Within states, teacher preparation programs typically offer three types of programs: traditional at IHEs, alternative at IHEs, and alternative not at IHEs. Almost 90% of enrolled preservice teachers attend traditional programs at IHEs; around 10 percent attend alternative-based education programs. Data regarding preservice teacher's demographics and program determined the number of preservice teachers to survey to reflect the Midwestern population accurately.

Table 2

Title II 2015-2016 Preservice Teacher Demographic Data from the Midwestern States (Enrollment, Gender, and Race)

State	Enrolled	Male	Female	White	African American	Hispanic	Asian
Illinois (IL)	12,763	3,145	9,615	9,178	766	1,424	460
Indiana (IN)	6,813	1,795	5,062	5,588	302	282	93
Iowa (IA)	6,697	1,700	4,996	5,968	98	200	74
Kansas (KS)	5,148	1,336	3,802	4,365	149	316	50
Michigan (MI)	7,868	1,857	6,004	6,741	376	230	120
Minnesota (MN)	9,065	2,807	6,390	7,526	320	236	257
South Dakota (SD)	1,631	384	1,247	1,484	10	27	11
Nebraska (NE)	3,616	891	2,725	3,291	69	184	46
Ohio (OH)	14,715	3,580	11,135	12,726	805	346	152
Wisconsin (WI)	7,952	1,838	6,114	7,057	167	290	154
Total Midwest	77,781	19,762	58,174	65,285	3,072	3,556	1,421

Hypotheses

Hypothesis 1:

Null Ho: There will be no significant difference in the implicit beliefs of intelligence held by the preservice teachers.

Research Ho: There will be a significant difference in the implicit beliefs of intelligence held by the preservice teachers.

Hypothesis 2:

Null Ho: There will be no significant difference in preservice teachers' preference of definitions of intelligence, given a list of four choices.

Research Ho: There will be a significant difference in preservice teachers' preference for definitions of intelligence, given a list of four choices.

Hypothesis 3:

Null Ho: The implicit beliefs of intelligence of preservice teachers will not predict their preferred definition of intelligence.

Research Ho: The implicit beliefs of intelligence of preservice teachers will predict their preferred definition of intelligence.

Hypothesis 4:

Null Ho: The age, gender, education level, academic domain, and educational psychology coursework of preservice teachers will not predict implicit beliefs of intelligence.

Research Ho: The age, gender, education level, academic domain, and educational psychology coursework of preservice teacher will predict implicit beliefs of intelligence.

Variable Definitions

The variables studied were implicit beliefs of intelligence, personal preference of definition of intelligence, and demographic variables of gender, age, educational level, subject area, teaching experience, and whether participants had taken an educational psychology course. A brief description of the variables will follow; complete operational explanations are found in Appendix B.

Implicit Beliefs about Intelligence

Implicit beliefs were those regarding whether or not intelligence or abilities can change (Dweck et al, 1995a, 1995b); this variable was measured by the TIS, an 8-item instrument developed to measure an individual's belief regarding intelligence as either incremental or entity. The continuous variable (1-7) was transformed into a categorical variable (incremental, mixed, entity) to identify preservice teachers' implicit beliefs about intelligence. The items were scored on a 7-point Likert scale with 1 (*strongly agree*) to 7 (*strongly disagree*), and 4 (*neither agree nor disagree*). The 7-point Likert scale was recommended by Ablard and Mills (1996) to assess a range of beliefs. The four entity items were reverse scored; Dweck et al., found that almost all those who disagree with the entity items endorsed an incremental view. The eight items were averaged for a total TIS score. The range of total scores was from 1.00 to 7.00, indicating either strong entity or strong incremental outlooks respectively. Individuals with a score in the 1.00 to 3.40 range were classified as entity believers (= 1). Individuals with a score of 4.6 to 7.00 were classified as incremental theorists (= 3). Individuals with a score from 3.41 to 4.59 were classified as neither or mixed believers (=2) (Dweck, 2000). These ranges were adopted from Nudd (2015) who used the TIS with a 7-point Likert scale.

Personal Preference of Definition of Intelligence

This variable is the definition of intelligence which an individual relates to or prefers. The definitions of intelligence options were studied, then based on those most commonly used in Western society. To observe this item, the survey requested that participants choose among four choices (definitions). Choice 1 = entity, choices 2 and 3 = neither or mixed, Choice 4 = incremental. This was a categorical variable.

The definitions of intelligence chosen for this study came from well-researched and validated intelligence theories. The development of the definition statements used for this study were personal understandings and summaries. Choice 1 was “entity,” from the CHC general intelligence definition: “Intelligence is made of heredity and environment.” Choice 2 was “neither or mixed,” from Gardner’s MI theory: “Intelligence is a style of learning.” Styles include logical, linguistic, musical, interpersonal, and spatial. Choice 3 was “neither or mixed,” from Sternberg’s triarchic theory: “Intelligence is made up of three types of thinking: critical thinking, creative thinking, and analytical thinking.” And Choice 4, “incremental,” was developed from Vygotsky’s sociocultural theory: “Intelligence is something that is inside all humans and can be developed.” These personally summarized definition statements were valid and dependable because of years of validated research and study of these intelligence theories (Carroll, 1997; Cattell, 1963; Gardner, 1983; Grigorenko, 2004; Sternberg, 1985).

Demographic Variables

Gender was sexual orientation as indicated by participant selection of male (0) or female (1). This was a categorical “dummy” variable.

Race was the participant's ethnicity, chosen from the options of white or Caucasian (1), black or African American (2), Hispanic (3), American Native Indian (4), Asian (5), and other (6). This was a categorical variable.

Age was the participant's current lifetime in years in response to the question "what is your age in years." This was a metric variable.

First year of field experience item asked whether the first-year participant had an opportunity to observe a classroom and to choose options during the years 2016 (1), 2017 (2), 2018 (3), or other time (4). This was a categorical ordinal variable.

Educational level was the participant's current academic status, selected from the options of freshman (0), sophomore (1), junior (2), senior (3), graduate student (4), or alternative student (5) in an education program. This was a categorical ordinal variable.

Academic domains were the participant's chosen area of study in an education program, choosing from options STEM = 0, Liberal Arts = 1, Fine Arts = 2, Social Sciences = 3, and other = 5. This variable was used in two ways: a categorical variable and variable transformed through dummy coding into separate and independent variables in order to be used in MLR of testing and hypothesis 4.

Taken a course in educational psychology was the response to whether participants had taken a course in educational psychology, indicated by (no = 0) and (yes =1). This was a categorical variable.

Demographic variables such as age, gender, education level, and academic domain will assist in describing the sample of preservice teachers. Specific operational definitions are found in Appendix B.

Instruments

Dweck et al. (1995a, 1995b) reviewed six studies assessing the implicit theory of intelligence and the intelligence measure, a questionnaire using three entity items: “You only have a certain amount of intelligence and you really can’t do much to change it;” “Your intelligence is something about you that you can’t change very much;” and “You can learn new things, but you can’t really change your basic intelligence.” On a six-point scale, the responses ranged from strongly agree (1) to strongly disagree (6). They found that approximately 85% of participants were evenly split between entity theory and incremental theory with the remainder of individuals, 15% held mixed views.

Dweck, et al. (1995a, 1995b) also reviewed the studies for reliability and validation of the implicit theory of intelligence questionnaire. Assessing internal reliability across six studies using the implicit theory for intelligence, the kind of person, and their morality, they found internal reliability for the theory of intelligence. The Cronbach’s alpha for the six studies, measuring internal reliability, was 0.96, 0.98, 0.94, 0.96, 0.96 and 0.97, followed by a test-retest measure of $\alpha = 0.80$. Dweck et al., did validation studies on the implicit theory of intelligence across these studies. They conducted factor analysis for validity, finding that the intelligence theory measured properties of human nature distinct and different from the morality theory and world theory. In studies four, five, and six of Dweck et al., the intelligence and moral theories were evaluated in relation to age, sex, religion, church attendance, church importance, or political orientation; they found the theory of intelligence to be unrelated to the other theories. Construct validity was further assessed, finding no relatedness of intelligence theory to cognitive ability assessments, self-presentation concerns, optimism, or social-

political attitudes. Recently, Zhu, Garcia, and Alonzo (2019), when investigating ninth graders, found the survey instrument valid and reliable.

The second question on one's personal preference definition of intelligence was developed by the researcher from studies of implicit theories of intelligence and definitions of intelligence, in order to obtain a better understanding of individual views about ability (Jones et al., 2012; Sternberg, 1985). Four definitions were chosen because of the reliability demonstrated by duration and common usage. In addition, these definitions were commonly used in research in education and academic settings. The definitions of intelligence chosen were based on studies by Jonsson et al. (2012) and Jonsson and Beach (2010). Both studies investigated implicit beliefs of intelligence and definitions of intelligence, using four definitions. The definitions were the CHC g theory (Carroll, 1997; Cattell, 1963), the triarchic theory by Sternberg (1985), the MI theory by Gardner (1983), and sociocultural theory by Vygotsky (Grigorenko, 2004). The CHC definition was based on general intelligence and has been shown to be an entity-based trending view. Sternberg's triarchic theory was neither an entity nor an incremental view of intelligence; the same was true for Gardner's MI theory. The fourth definition of intelligence was Vygotsky's SC theory of ability, an incremental view of intelligence.

Data Collection

Prior authorization was requested from the Internal Review Board (Appendix C) for the research project, including the use of QuestionPro services for the use of surveys to collect data. QuestionPro teams located a minimum sample of 300 preservice teachers in the Midwestern region of the United States who were participating in traditional and alternative IHEs. The survey had two qualifying questions, years of teaching experience,

and “are you a preservice teacher?” Only participants with zero to two years of experience who answered affirmatively to being a preservice teacher were surveyed. They were surveyed on their preferred definition of intelligence with a short scenario and their demographic data collected. QuestionPro sent the following to the potential participants: a letter, stating that the duration of the survey was less than 10 minutes, and providing the opportunity to give informed consent or to decline the survey, and giving assurances that all data would be handled confidentially by the researcher and QuestionPro. The collected data was downloaded from QuestionPro by the researcher and kept secure in a locked office within the School of Education. The data was evaluated using SPSS. The data was reviewed by the researcher and committee members. Upon completion of the study the data will be deleted.

Data Analysis

Analysis of the data included the following statistical processes. Data were screened for missing cases and whether they met the assumptions required for statistical analysis. Descriptive analysis was performed for Hypotheses 1 and 2. The data were analyzed for participants’ preferred definition of intelligence. The definitions were important, relevant, and based on theory. The preferred definition variable was a nominal variable with ranking from lowest to highest. Chi-square cross tabs were implemented for Hypothesis 3 testing. Because the variables were categorical, Chi square was used to determine the existence of independence or dependence between implicit beliefs of intelligence and the definitions of intelligence variables. Also, linear regression was used for Hypothesis 3 with an implicit belief of intelligence as an independent variable to determine relatedness with the preferred definition of intelligence. Multiple linear

regression was used for Hypothesis 4 to ascertain which demographic variable predictors were associated with implicit beliefs of intelligence as a continuous variable. Further, the academic domains variable was transformed into a “dummy” variable, separately and independently, to be used in multiple linear regression testing. The study used descriptive statistics, Chi-square cross tabulation, linear regression, and multiple linear regression to analyze the data and evaluate the hypotheses.

CHAPTER 4

RESULTS

Overview

The following chapter reports findings from data collected using an electronic survey, distributed to preservice teachers in the Midwestern United States. Descriptive analysis was used to evaluate the percentages and frequencies of participant demographics, including gender, location (state), age category, race, first year of field experience, type of educational institution, educational level, academic domain, and completion of an educational psychology course. Data were analyzed to discover preservice teachers' implicit beliefs about intelligence and preferred definitions of intelligence. Linear and multiple linear regression were used to report associations between preservice teachers' implicit beliefs about intelligence and their preferred definitions of intelligence, and to observe any relationships between participants' demographic data and their implicit beliefs about intelligence.

The data collected was screened to ensure that participants were preservice teachers (no teaching experience) and that they were from one of ten Midwestern states (Iowa, Illinois, Indiana, Kansas, Michigan, Minnesota, Missouri, Ohio, South Dakota, and Wisconsin). Following the screening, thirty-eight participants were not from Midwestern states and were removed. A new sample was created; analyses were performed on the remaining preservice teachers ($n = 262$).

Participant Demographic Data

The following section reports the demographic data of the participants including state, gender, age, race, educational level, academic domain, first year of field experience, and enrollment in educational psychology course as shown in Tables 1 and 2.

Midwestern States

The TIS survey was completed by 262 Midwestern preservice teachers who had zero to two years teaching experience. The participants were comprised of preservice teachers from the following Midwestern states: Illinois (26.0%), Indiana (11.1%), Iowa (3.1%), Kansas (5%), Michigan (14.5%), Minnesota (9.2%), Missouri (4.2%), South Dakota (1.5%), Ohio (18.7%), and Wisconsin (6.9%). A majority of the participants, 184 (70.3%), came from Illinois, Indiana, Michigan, and Ohio, followed by 66 (25.3%) from Kansas, Minnesota, Missouri, and Wisconsin; the smallest number of participants, 12 (4.6%) were from Iowa and South Dakota. The Title II 2015-2016 (NCTQ, 2016) data about preservice teachers, described in chapter 3 can be considered in comparison to the participants of this study.

Gender, Age, and Race

The sample was 85.9% female and 14.1% male; participants ranged in age from 19-59 years, 29% were less than 25 years; 39.7% fell between 25-34; 21.8% fell between 34-44 years; 7.6% fell between 45-54 years; and 1.5% were more than 55 years of age. Regarding race, the participants reported they were White-Caucasian (81.7%), Black-African American (7.6%), Hispanic (4.7%), American Indian-Native American (1.0%), Asian (3%), and other (1.3%).

Table 3*Preservice Teacher Participant Demographic Data (n = 262)*

Item	Description	Frequency	Percent
Gender	Male	37	14.1
	Female	225	85.9
States	IA	8	3.1
	IL	68	26.0
	IN	29	11.1
	KS	13	5.0
	MI	38	14.5
	MN	24	9.2
	MO	11	4.2
	OH	49	18.7
	SD	4	1.5
	WI	18	6.9
Age Categories	< 25	77	29.4
	25-34	104	39.7
	35-44	57	21.8
	45-54	20	7.6
	55+	4	1.5
Race	White Caucasian	214	81.7
	African American	20	7.6
	Hispanic	14	5.3
	Indian Native Am	3	1.1
	Asian	8	3.1
	Other	3	1.1
First Year of Field Experience	2016	76	29.0
	2017	93	35.5
	2018	72	27.5
	Other	21	8.0

Table 3, continued*Preservice Teacher Participant Demographic Data (n = 262)*

Item	Description	Frequency	Percent
Type of Educational Institution	Public university	173	66.0
	Private university	64	24.4
	Parochial university	8	3.1
	Alternative	17	6.5
Educational Level	Freshman	3	1.1
	Sophomore	13	5.0
	Junior	18	6.9
	Senior	62	23.7
	Graduate	136	51.9
	Other	30	11.5
Academic domains	STEM	52	19.8
	Liberal Arts	71	27.1
	Fine Arts	31	11.8
	Social Sciences	56	21.4
	Other	52	19.8
Educational Psychology	Yes	216	82.4
	No	46	17.6

First Year of Field Experience, Educational Level,
and Type of Educational Institution

Participants ($n = 262$) reported their first year of field experience, educational level, and type of EPI attended. Preservice teachers were asked in what year they had their first field experience; there were four options: 2016, 2017, 2018, or other. The analysis found 29% of the participants had their first field experience in 2016, 35.5% in 2017, 27.5% in 2018, and 8% chose other.

The sample was comprised of graduate students (51.9%), seniors (23.7%), juniors (6.9%), sophomores (5%), freshman (1.1%), and students from alternative programs (11.5%). Seniors and graduate students made up most of the survey participants. They came from public universities (66%), private universities (24.4%), parochial universities (3.1%), and alternative programs (6.5%)

Academic Domains and Educational Psychology Enrollment

Preservice teachers chose an academic domain for their certification. In this study the preservice teachers' academic domain options included STEM (science, technology, engineering, and mathematics), liberal arts (English, foreign languages, and English as a second language), fine arts (music, art, performance), social studies (history, psychology, economics), and other. The descriptive analysis showed these preservice teachers' choices to be stem (19%), liberal arts (27.1%), fine arts (11.8%), social sciences (21.4%), and other (19.8%).

The majority (82.4%) of the preservice teachers had taken educational psychology. The educational psychology course is typically taken in the first two years of an educational program and is often a prerequisite for acceptance into a teacher preparation program.

Implicit Beliefs about Intelligence

Implicit beliefs about intelligence are beliefs regarding whether or not intelligence or abilities can change (Dweck & Leggett, 1988). The following section reports preservice teacher responses on implicit beliefs about intelligence.

The preservice teachers were asked to complete the TIS as a 7-point Likert Scale ranging including 1 (*strongly agree*), 2 (*agree*), 3 (*mostly agree*), 4 (*neither agree nor*

disagree), 5 (*mostly disagree*), 6 (*disagree*), and 7 (*strongly disagree*). The 7-point Likert scale included the neither agree nor disagree option, considered neutral, to allow for a continuum of responses; this format was strongly recommended by Albard and Mills (1996) and utilized in Nudd's (2015) dissertation.

In the analysis some of the items needed to be recoded. Items 1, 2, 4 and 6 were analyzed with 1 (strongly agree) to 7 (strongly disagree) so that individuals with scores in the 1.00 to 3.40 range were classified as entity endorsing. A high score in these four items indicated incremental beliefs. The items 3, 5, 7 and 8 were coded in the other direction where 1 (strongly disagree) to 7 (strongly agree). Incremental items were recoded so that a high score indicated an incremental belief. In essence we were measuring incremental beliefs; after recoding we reported the incremental views of intelligence of preservice teachers.

Table 4 reports the responses for the eight items. The first item "Everyone has a certain amount of intelligence and they really can't do much to change it." found that 6.5% strongly agree, 17.6% agree, 11.5% mostly agree, 10.3% neither agree nor disagree, 29.8% mostly disagree, 13.4% disagree, and 11.1% strongly disagree. The mean for the first item was 4.24, SD was 1.78. Preservice teacher participants (35.6%) agreed that everyone has a certain amount of intelligence and they really can't do much to change it, while (54.3%) of participants disagreed with that statement. The second item "Everyone's intelligence is something about them that they can't change very much." found that 4.2% strongly agree, 14.9% agree, 11.8% mostly agree, 10.7% neither agree nor disagree, 29.8% mostly disagree, 18.3% disagree, and 10.3% strongly disagree. The mean for the second item was 4.43; SD was 1.69. Preservice teacher participants (30.9%)

agreed that everyone's intelligence is something about them that they can't change very much while (58.4%) of participants disagree.

The third item "No matter who someone is, they can significantly change their intelligence." found that 9.5% strongly agree, 22.9% agree, 35.9% mostly agree, 14.1% neither agree or disagree, 12.2% mostly disagree, 4.2% disagree, 1.1% strongly disagree. The mean for the third item was 4.86 and SD was 1.34. Preservice teacher participants (68.3%) agree that no matter who someone is, they can significantly change their intelligence while (17.5%) of participants disagree. The fourth item "To be honest, people can't really change how intelligent they are." results found the 1.9% strongly agree, 9.5% agree, 12.2% mostly agree, 11.8% neither agree nor disagree, 32.4% mostly disagree, 19.8% disagree, 12.2% strongly disagree. The mean for the fourth item was 4.72 and the SD was 1.55. Preservice teachers' participants (23.6%) agree that honestly, people can't really change how intelligent they are while (64.4%) of participants disagree.

The fifth item "People can always substantially change how intelligent they are." results found 10.3% strongly agree, 16.4% agree, 35.5% mostly agree, 20.2% neither agree nor disagree, 12.2% mostly disagree, 4.2% disagree, 1.1% strongly disagree. The mean for the fifth item was 4.75 and SD was 1.33. Preservice teachers' participants (62.2%) agree that people can always substantially change how intelligence they are while (17.5%) of participants disagree. The sixth item "Everyone can learn new things, but they can't really change their basic intelligence." results found 5.7% strongly agree, 15.3% agree, 18.7% mostly agree, 20.6% neither agree or disagree, 23.3% mostly disagree, 9.5% disagree, 6.9% strongly disagree. The mean for the sixth item was 3.97

Table 4*Implicit Beliefs of Intelligence Items: Percentage, Mean, and Standard Deviation*

Item	1	2	3	4	5	6	7	χ^2	SD
Everyone has a certain amount of intelligence and they really can't do much to change it.	6.5	17.6	11.5	10.3	29.8	13.4	11.1	4.24	1.78
Everyone's intelligence is something about them that they can't change very much.	4.2	14.9	11.8	10.7	29.8	18.3	10.3	4.43	1.69
No matter who someone is, they can significantly change their intelligence level.	1.1	4.2	12.2	14.1	35.9	22.9	9.5	4.86	1.34
To be honest, people can't really change how intelligent they are.	1.9	9.5	12.2	11.8	32.4	19.8	12.2	4.72	1.55
People can always substantially change how intelligent they are.	1.1	4.2	12.2	20.2	35.5	16.4	10.3	4.75	1.33
Everyone can learn new things, but they can't really change their basic intelligence.	5.7	15.3	18.7	20.6	23.3	9.5	6.9	3.97	1.59
No matter how much intelligence someone has, they can always change it quite a bit.	1.5	3.8	15.3	17.2	35.1	16.4	10.7	4.73	1.38
People can change even their basic intelligence level considerably.	1.9	4.6	13.0	22.1	29.0	19.5	9.9	4.70	1.40

Note: Items 1, 2, 4, and 6 were rated 1(strongly agree) to 7(strongly disagree). Items 3, 5, 7, and 8 were rated 1 (strongly disagree) to 7 (strongly agree).

and the SD was 1.59. Preservice teachers' participants (39.7%) agree that everyone can learn new things, but they can't really change their basic intelligence while (39.7%) of participants disagree. The results of the seventh item "No matter how much intelligence someone has, they can always change it quite a bit." found the 10.7% strongly agree, 16.4% agree, 35.1% mostly agree, 17.2% neither agree nor disagree, 15.3% mostly disagree, 3.8% disagree, 1.5% strongly disagree. The mean for the seventh item was 4.73 and SD was 1.38. Preservice teachers' participants (62.2%) agree that no matter how much intelligence someone has can always change quite a bit while 20.6% of preservice teachers disagree. The mean for the eighth item "People can change even their basic intelligent level considerably." found that 9.9% strongly agree, 19.5% agree, 29.0% mostly agree, 22.1% neither agree nor disagree, 13.0% mostly disagree, 4.6% disagree, and 1.9% strongly disagree. The mean of the eighth item was 4.70 and SD was 1.40. Preservice teachers' participants (58.4%) agree that people can change even their basic intelligence level considerably while (19.5%) of participants disagree. The following section will report the findings of categorical implicit beliefs of intelligence and the preferred definition of intelligence by preservice teacher participants.

Preferred Definition of Intelligence

From a list of four choices, the survey requested preservice teachers' preferred definitions regarding intelligence. The most preferred definition was intelligence was a style of learning (43.9%), then intelligence was something inside all humans and can be developed (21%), followed by intelligence was made up of critical, creative and self-regulated thinking (20.2%) and finally that intelligence was made of heredity and environment (14.9%).

Hypothesis Testing

Some of the inferences of the sample from hypothesis testing were discussed. Each hypothesis of this study had a null statement to reject if the Chi square or the F value probability was significant at < 0.05 .

Hypothesis 1

The first hypothesis of this study was to identify the implicit beliefs about intelligence held by the preservice teachers, using a survey instrument. Using descriptive analysis of the TIS question items, three categories of beliefs and the associated percentages holding them were determined. The implicit theory of intelligence variable was a metric, or continuous variable from 1 (*strongly agree*) to 7 (*strongly disagree*). The three categories were entity, mixed, and incremental. Of the 262 participants, 133 (50.8%) held incremental beliefs, 91 (34.7%) held mixed beliefs, and 38 (14.5%) were entity believers.

The null hypothesis tested (H_01) states “There will be no significant difference in preference of three implicit beliefs of intelligence held by the preservice teachers. The non-parametric chi-square test for the three categories shows a significant preference ($\chi^2 = 51.901$, $df = 2$, $p = .000$) for incremental beliefs in 50% of the sample.

The majority of preservice teachers in this Midwestern sample hold an incremental belief about intelligence (50.8%), with a little over a third (34.7%) holding a mixed view of intelligence, and less than twenty percent holding an entity view of intelligence (14.5%).

Hypothesis 2

Participants were asked to choose a preferred definition of intelligence from four choices. Choice one, “Intelligence is made of heredity and environment.” was an entity belief definition. The second choice, “Intelligence is made up of many styles of learning.” was neither an entity nor an incremental view of intelligence. The third choice, “Intelligence is made up of three types of thinking.” was also neither an entity nor an incremental view of intelligence. The fourth choice, “Intelligence is something that is inside all humans and can be developed.” was an incremental view of intelligence.

The null hypothesis (H_{02}) stated there would be no significant difference in preference for definitions of intelligence, given a list of four options. There were four categories and three degrees of freedom for the Chi-square value. The non-parametric Chi-square test demonstrated significant preferences ($\chi = 52.198$, $df = 3$, $p = 0.000$).

The first definition, “Intelligence made up of heredity and environment.” was preferred by 39 participants (14.8%). The second definition, “Intelligence is made up of different styles of learning.” was preferred by 115 (43.9%) participants. The third definition, “Intelligence is made up of three types of thinking: critical thinking, creative thinking, and analytical thinking.” was preferred by 53 (20.2%) participants. Lastly, 55 (21%) of the participants preferred the “Intelligence is something that is inside all humans and can be developed.” definition.

Hypothesis 3

Linear regression was used to test the null hypothesis: The implicit beliefs about intelligence of preservice teachers will not predict their preferred definitions of intelligence; the definitions were an ordinal variable and assumed the definitions can be

ranked according to the incremental beliefs of the participants. The regression results show a predictor role for implicit beliefs of intelligence ($R = .421$, $R^2 = .177$, $R^2 \text{ adj.} = .174$, $F(1, 260) = 55.893$, $p = .000$), and explains the variance among implicit beliefs of intelligence. An $R = 0.421$ and $R^2 = 0.177$ finding explains 17.7% of the variance found for the predictor implicit beliefs about intelligence. These results support the rejection of the null hypothesis and retention of the research hypothesis which states that the implicit beliefs about intelligence of preservice teachers ($b = .378$, $SE = .050$, $\beta = .421$, $t = 7.476$, $p = .000$) will predict their preferred definitions of intelligence.

Hypothesis 4

Multiple linear regression was used to test the Null Ho: age, gender, education level, academic domain, and an educational psychology course of preservice teachers will not predict implicit beliefs of intelligence. The collinearity assumptions were tested for these predictors, finding that tolerance was between .565 and .94 and the VIF range was from 1.063 to 1.771, making it evident that there were not collinearity problems. Regression results indicated an overall model of two predictors, gender and age, which predict implicit beliefs [$R = .328$, $R^2 = .108$, $R^2 \text{ adj.} = .079$, $F(8, 253) = 3.810$, $p = .000$]. Age was negatively correlated with implicit beliefs of intelligence and females were more likely to have an incremental view of intelligence. These findings account for 11% of the variance in implicit beliefs, supporting the rejection of the null hypothesis and partially retaining the research hypothesis that age and gender of preservice teachers will predict implicit beliefs of intelligence; see Table 5.

Table 5.*Preservice Teacher's Age and Gender Coefficients*

	B	β	t	p <	SE
Female	4.04	0.129	2.094	0.037	0.188
Age	-0.31	-0.253	-3.996	0.000	0.007

Summary and Conclusions

Preservice teachers ($n = 262$) from the Midwestern states of the United States were surveyed for their demographic data, implicit beliefs about intelligence, and preferred definitions of intelligence. The data collected from the sample reports the general characteristics of the participants and predicts the relationship between their implicit beliefs about intelligence and their preferred definition of intelligence, and whether the demographic data predicts their implicit beliefs.

Participant demographic data showed that the majority of the preservice teachers were female (85.9%) with only 37 male participants. The participants were surveyed in the Midwestern states; the greatest number were from the states of Illinois (26%), Indiana (11%), Michigan (14.5%), and Ohio (18.7%). The race of the preservice teachers was over three-quarters white or Caucasian (81.7%); with almost 40% found in the group aged 25-34, and the least number in the over 55 years of age group.

More than a third of the preservice teachers had their first field experience in 2018. These preservice teachers were primarily from public and private institutions

(80.4%), and were mostly seniors and graduate students (85.6%). The academic domains of the preservice teachers were distributed among STEM (19.8%), Liberal Arts (27.1%), Social Science (21.4%), and other (19.8), with the least from Fine Arts (11.8%). In this sample more than three-quarters of the preservice teachers had enrolled in an educational psychology course. Because a large portion of the participants were graduate students and seniors, it is logical that the percentage reporting educational psychology course completion was high. The topic of intelligence is addressed in educational psychology courses which are part of teacher preparation programs.

The preservice teacher sample completed the TIS (Dweck, 2000) and answered the first hypothesis about identifying the implicit beliefs about intelligence of preservice teachers. The majority of the preservice teachers (50%) endorsed an incremental or growth view of intelligence. The least endorsed view of intelligence among the sample was an entity or fixed view (14.5%) of intelligence. A mixed view of intelligence was endorsed by over a third of the preservice sample.

For the second hypothesis, participants reported their preferred definition of intelligence preference when given a list of options. Analysis demonstrated that the majority of the preservice teachers preferred a Gardner's MI definition which was neither entity nor incremental. Over half the preservice teachers preferred definitions which included styles of learning or types of thinking. Comparing just the entity and incremental definitions, preservice teachers preferred an incremental definition (21%) as compared to the entity definition (14%).

The third hypothesis of the study was to observe whether preservice teachers' implicit beliefs of intelligence have a relationship with their preferred definition of

intelligence. The findings show a significant relationship between the two variables; a preservice teacher's implicit belief about intelligence predicts a moderate correlation ($\beta = 0.421$) with the preferred definition of intelligence.

For the fourth hypothesis of the study, the predictive quality of the participants' demographic data for implicit beliefs about intelligence was analyzed to answer the research question "Do age, gender, educational level, academic domain, and educational psychology course enrollment" have any relationship to preservice teachers' beliefs? Multiple linear regression demonstrated that only gender (female) and age of the preservice teacher were predictive of implicit beliefs about intelligence. The other demographic variables were not associated with any predictive value. The gender of female ($\beta = 0.129$) was positively correlated to implicit beliefs about intelligence. Age of preservice teachers (Standardized Coefficients $\beta = -0.253$) was inversely associated with implicit beliefs of intelligence.

Chapter 5 provides an interpretation of the findings and their implications for preservice teachers' implicit beliefs, their preferred definition of intelligence and the influence of demographic predictors of age, gender, educational level, academic domain, and educational psychology coursework. As a result of these findings, recommendations for further research and improvement in teacher preparation programs and the quality of instruction are discussed in the concluding chapter.

CHAPTER 5

SUMMARY, FINDINGS, DISCUSSION, AND RECOMMENDATIONS

Introduction

This chapter presents the summary, conclusions, implications, and recommendations of the study, based on the analysis of data documented in Chapter 4. The purpose of this study was to investigate preservice teachers' preferred definitions of intelligence and related demographic variables (age, gender, educational level, academic domains, and educational psychology course enrollment), as predictors of their implicit beliefs about intelligence.

Preservice teachers' implicit beliefs about intelligence have implications for teacher preparation programs, for development and planning of curricula and for recognition of areas for improvement. These implications were revealed by an examination of the implicit beliefs of preservice teachers, definitions of intelligence they preferred, and any associations with age, gender, educational level, academic domains, and educational psychology coursework. This study concluded that implicit beliefs about intelligence were important to the success of teacher preparation programs. As with inservice teachers in their classrooms, implicit beliefs about intelligence influenced the judgment and behavior of the teacher and the classroom climate. Further, assessment of preferred definitions of intelligence was a way to develop strategies for improvement of teacher preparation programs.

Summary of the Literature Review

The literature review included landmark articles investigating Dweck's implicit beliefs about intelligence, which included Dweck and Leggett (1988), Hong et al. (1995), and Blackwell et al. (2007). Further, literature about preservice teachers' implicit beliefs about intelligence, definitions of intelligence (Jonsson & Beach, 2010), and related demographic variables of age, gender, educational level, academic domains, and educational psychology coursework was included (Romero et al., 2014; Mascaret et al., 2015; Jonsson & Beach, 2017).

Dweck's implicit beliefs about intelligence theory was the conceptual foundation of this study, based on assumptions about entity and incremental beliefs about intelligence. A person with entity beliefs about intelligence focuses on performance and demonstration of ability. This individual has a fixed mindset. An individual with incremental beliefs about intelligence uses effort to learn and to develop new knowledge and understanding. This individual has a growth mindset. A person with both entity and incremental views of intelligence has mixed views of intelligence.

Preservice teachers' implicit beliefs about intelligence and the corresponding associations with preferred definitions of intelligence were of specific interest in this study. The four definitions of intelligence utilized were the CHC theory, Gardner's (1983) MI theory, Sternberg's types of cognitive processing (1985, 2005), and Vygotsky's sociocultural (SC) theory (Grigorenko, 2004). Multiple studies found that preservice teachers' implicit beliefs were related to definitions of intelligence (Jones et al., 2012).

In addition to definitions of intelligence, the variables of age, gender, educational level, academic domains, and educational psychology coursework as related to implicit beliefs about intelligence were studied. Implicit beliefs about the intelligence of various ages of individuals has been examined, including adolescents, college students, and adults (Blackwell et al., 2007; Dupeyrat & Marine, 2005; Hong et al., 1995). The review of implicit beliefs about intelligence and gender found no significant differences between males and females (Romero et al., 2014); entity environments in mathematics courses decreased females' feelings of belonging when compared to males (Good et al., 2012). Educational levels and implicit beliefs about intelligence were investigated in middle schoolers, university students, and adults returning to school (Blackwell et al., 2007; Dupeyrat & Marine, 2005; Hong et al., 1995) which found that implicit beliefs about intelligence influenced how they explained outcomes such as tests or grades. The research related to implicit beliefs about intelligence and academic domains revealed that students with an entity view of intelligence were more likely to view mathematics as an innate and stable ability (Rattan et al., 2012). The educational psychology enrollment variable relationship to implicit beliefs about intelligence was not investigated explicitly in any literature, but preservice teachers were participants in studies while enrolled in educational psychology courses (Jones et al., 2012; Lynott & Woolfolk, 1994).

The variables of age, gender, educational level, academic domains, and educational psychology coursework were reviewed for the ability to predict implicit beliefs about intelligence. Older teachers, compared to younger teachers, were more likely to have an entity belief about intelligence (Lynott & Woolfolk, 1994; Spinath et al., 2003). Further, older teachers with more experience, when compared to older teachers

with less experience, were more likely to have a fixed view of intelligence (Jonsson et al., 2012). In reviewing implicit beliefs about intelligence and gender, male science teachers were more likely than female science teachers to have a negative view of the relationship between intelligence and malleable concepts (Mascret et al., 2015). Twelfth graders were more likely to have an entity view of intelligence when compared to tenth graders (Jonsson & Beach, 2017). The review of academic domains as related to implicit beliefs about intelligence demonstrated a positive relationship between social science teachers and incremental beliefs about intelligence, while science teachers were more likely to endorse an entity belief of intelligence when compared to non-science teachers (Jonsson & Beach, 2010; Jonsson et al, 2012). Lastly, assessment of preservice teachers' definitions of intelligence and demographic variables found that preservice teachers primed with an additional exposure to the explicit general intelligence theory CHC were more likely to find this theory of intelligence credible as compared to other theories; this demonstrated the possibility of influencing beliefs about intelligence (Jonsson and Beach, 2010).

Summary of the Methodology

A quantitative, non-experimental, descriptive, correlational, and cross-sectional survey procedure was used to investigate preservice teachers' implicit beliefs about intelligence, age, gender, educational level, academic domains, and enrollment in an educational psychology course, as predictors of their implicit beliefs about intelligence and preferred definitions of intelligence. Further, the study examined the relationship between implicit beliefs about intelligence and demographic variables and preferred definitions of intelligence.

Section one of the survey instrument was comprised of two qualifying questions and demographics variables, where the participants were asked to indicate their age, gender, race, first year of field experience in the classroom, educational level, academic domains, and enrollment in educational psychology.

Section two of the survey instrument consisted of the Implicit Theory of Intelligence Scale (TIS) (Dweck, 2000), with eight items for evaluating adults' implicit beliefs about intelligence of which four items were classified as entity items and four as incremental. In this section of the questionnaire, participants were asked about their beliefs regarding the ability of an individual to change one's intelligence using a 7-point Likert scale with the following options: 1 (*strongly agree*), 2 (*agree*), 3 (*mostly agree*) 4 (*neither agree or disagree*), 5 (*mostly disagree*), 6 (*disagree*) and 7 (*strongly disagree*). For the analysis, the four incremental items were recoded as 1 (strongly disagree) to 7 (strongly agree), yielding scores of 4.60 to 7.00. Entity views ranged from 1.00 to 3.40. These ranges were chosen from Nudd (2015) who used the TIS with a 7-point Likert scale. This yielded assessment of participant views on a continuum of implicit beliefs about intelligence. Moreover, an increase in entity beliefs demonstrated a decrease in incremental beliefs. According to Dweck, Chiu, and Hong (1995a, 1995b), the internal reliability of the TIS, using Cronbach's alpha, ranged from 0.96 to 0.98, with a test-retest of $\alpha = 0.80$. The Cronbach's alpha is a measure of the internal consistency of the constructs measured by the instrument (Taber, 2018).

Da Fonseca et al. (2007) evaluated these subscales and found reliabilities of 0.78 for entity beliefs and 0.81 for incremental beliefs. Further, they found reliability was strong using a test-retest analysis of entity ($r = 0.74$) and incremental ($r = 0.70$) beliefs.

The use of the TIS was found to be reliable in other studies (Butler, 2000; Dweck, 2017; Epler, 2011, Zhu et al., 2019), which found inservice teacher's response to students was related with their implicit beliefs about intelligence.

The second section of the survey included a *preferred definition of intelligence* item. The four response options were "Intelligence is made of heredity and environment;" "Intelligence is made up of many styles of learning. Some styles are logical, linguistic, musical, interpersonal, and spatial;" "Intelligence is made up of three types of thinking: critical thinking, creative thinking, and analytical thinking;" and "Intelligence is something that is inside all humans and can be developed." The preferred definition scenario and the list of options were chosen based on research from Jonsson and Beach (2010) and Jones et al. (2012).

The population was comprised of preservice teachers in education programs with zero to two years of teaching experience from the Midwestern states of Iowa, Illinois, Indiana, Kansas, Michigan, Minnesota, Missouri, Ohio, South Dakota, and Wisconsin. Sample participants represented public, private, and parochial universities, and alternative education programs. The survey was disseminated electronically using QuestionPro services. The data were collected anonymously, downloaded, and analyzed using the SPSS program (version 24.0). Descriptive, correlational, and regression analyses were implemented.

Summary of Major Findings

The purpose of this study was to investigate preservice teachers' implicit beliefs about intelligence, their preferred definitions of intelligence, and related demographic variables including age, gender, educational level, academic domains, and enrollment in

an educational psychology course. The following section is a summary of the findings, and a discussion of the findings.

Research Question 1

What implicit beliefs about intelligence do preservice teachers endorse or hold?

Hypothesis 1

Null Ho: There will be no significant difference in the implicit beliefs of intelligence held by preservice teachers.

Research Ho: There will be a significant difference in the implicit beliefs of intelligence held by preservice teachers.

Summary of Findings

Using percentages, means, and standard deviations, the items of the TIS were analyzed, identifying the categories of views: entity, mixed, and incremental. Among the participants ($n = 262$), 14.5% endorsed entity views, 34.7% chose mixed views and 50.8% selected incremental views. Overall, less than fifteen percent endorsed an entity view of intelligence while half of preservice teachers endorsed an incremental mindset. Interestingly, a third of the participants endorse a mixed view of ability. The findings of the analysis supported the first research hypothesis, that preservice teachers endorse different implicit beliefs about intelligence.

Discussion of Findings

An unusual finding was that only 50.8% of participants endorsed an incremental belief of intelligence. As strongly recommended by Albard and Mills (1994), this study used the TIS (Dweck, 2000) with a 7-point Likert scale allowing for a continuum of implicit views of intelligence and found that half of the participants endorsed an

incremental view of intelligence. A possible explanation for the lower percentage of incremental participants was the inclusion of a neutral option in the Likert scale.

In prior studies of preservice teachers' implicit beliefs about intelligence, higher percentage of participants were found to have incremental views of intelligence. Jones et al. (2012) studied preservice teachers ($n = 270$) from three Midwestern universities, using a 3-item, 6-point Likert scale TIS (Dweck, 2000), finding that approximately 75% of the participants endorsed an incremental view of intelligence ($M = 2.54$, $SD = 1.07$). Gutshall (2014) investigated preservice teachers ($n = 113$) at the beginning and end of their education programs, also using a 3-item, 6-point TIS by Dweck and Henderson (1989), and found that the majority of the students endorsed incremental views of intelligence at both times. Palazzolo (2016) conducted a study of Canadian preservice teachers ($n = 89$) who completed the TIS (Dweck, 2000) at the beginning and end of the first year of their practicum. They demonstrated that the preservice teachers held incremental views of intelligence before and after their practicum experience. Smith (2014) examined preservice teachers ($n = 235$) only in Kentucky and administered Dweck's (2000) 8-item, 6-point Likert scale version of the TIS to future teachers, and found an incremental view of intelligence ($M = 4.71$, $SD = 0.27$; $\alpha = 0.91$) with only a small variability among participants responses.

A possible explanation why my results differed from the propensity of available research may be due to the structure of the Likert scales. That is that the TIS with a 7-point Likert scale allowed for a continuum of responses. Another explanation could be the varied regions in which the prior studies took place. The Midwest is more conservative than Canada and less conservative than the southern region of the United

States. Further the explanation for varied results may be due to teacher preparation programs emphasizing different things. Further, differences were seen in smaller sample sizes as in Palazzolo (2016) and Gutshall (2014) as they might not have represented the studied population accurately due to some degree of variability. In addition, small sample sizes may have had higher levels of bias as a result of non-responses as well as voluntary responses which influenced accuracy of survey results.

These findings encourage teacher preparation programs to consider instruction in implicit beliefs about intelligence. This study may result in teacher educators analyzing their own beliefs regarding the nature of intelligence how these beliefs influence their instruction and behavior toward students. Teacher educators in EPIs could use survey research methods to assess students' conceptions about teaching and learning. The implementation of Dweck's theory of intelligence scale may be used to evaluate and track implicit beliefs about intelligence of preservice teachers.

Research Question 2

Which definitions of intelligence do preservice teachers prefer given a list of four choices?

Hypothesis 2

Null Ho: There will be no significant difference in preservice teachers' preference of definitions of intelligence, given a list of four choices.

Research Ho: There will be a significant difference in preservice teachers' preference for definitions of intelligence, give a list of four choices.

Summary of Findings

From the following four choices of definitions of intelligence, respondents were asked to indicate the one which best reflected their preferred definition:

Choice 1	Intelligence is made of heredity, and environment.
Choice 2	Intelligence is made of many styles of learning. Some styles are logical, linguistic, musical, interpersonal and spacial.
Choice 3	Intelligence made up of three types of thinking: critical thinking, creative thinking and analytical thinking.
Choice 4	Intelligence is something that is inside all humans and can be developed.

The respondents were asked to indicate their choices based on the following scenario.

Imagine that you are in the classroom and students are having a discussion on what makes one student more intelligent than another. Students propose reasons for different intelligences.

The findings revealed that the most preferred definition of intelligence was “Intelligence is made up of many styles of learning. Some styles are logical, linguistic, musical, interpersonal, and spatial” (43.9%) with the second most preferred definition was “Intelligence is something that is inside all humans and can be developed” (21%). These were followed by “Intelligence is made up of three types of thinking: critical, creative, and self-regulation” (20.2%) and finally “Intelligence is made up of heredity and environment” (14.9%). The analysis supported the second hypothesis, that preservice teachers’ have a significant difference in their preference for various definitions of intelligence.

Discussion of Findings

Research Question 2 examined preservice teachers preferred definitions of intelligence. The question was intended to determine how preservice teachers defined intelligence. The item provided options of preferred definitions of intelligence making it possible to examine the partiality of the participants. The most preferred definition was the multiple intelligence theory (43.9%), followed by the sociocultural theory (21.0%), then the Triarchic theory (20.2%), and lastly the Cattell-Horn-Carroll general intelligence theory (14.9%).

These results confirmed that the participants' most preferred definition of intelligence was the MI theory. A possible explanation for this is that Gardner's MI theory is adopted frequently in the curricula of teacher education programs in the United States. Multiple intelligences allow teacher educators to model diverse instructional activities using the various learning styles, such as logical-mathematical or spatial-kinesthetic, when teaching declarative or procedural knowledge in the academic setting.

Preservice teachers next most preferred definition of intelligence was the incremental definition of intelligence, while the least preferred definition was the entity definition. These results were consistent with the research of Jonsson and Beach (2010), who developed an experiment where Swedish preservice teachers were randomly grouped in control and experimental groups with the experimental group receiving increased exposure to the CHC general intelligence theory of intelligence. They found that for the non-experimental groups the sociocultural ($M = 6.93$) was the most preferred theory, followed by the MI ($M = 6.3$) and the triarchic theory ($M = 5.7$), and the CHC

general intelligence theory was preferred the least. The experimental group preferred the CHC theory the most.

The Swedish culture and form of governance differs from that of the United States. Sweden is a progressive country with a socialist style of government. This is a more sociocultural viewpoint of government, which may have influenced ideas about intelligence and education. The United States is a republic with a capitalistic economy. This is a more general intelligence viewpoint of government and may influence conceptions of intelligence. Explicit theories of intelligence, general intelligence, and IQ assessment in the U.S. all influence ideas about intelligence and education, and were different when compared to Sweden. This may explain the disparate results of this study when compared to Jonsson and Beach (2010).

Research Question

Do the implicit beliefs of preservice teachers have any relationship to their preferred definition of intelligence?

Hypothesis 3

Null Ho: The implicit beliefs of intelligence of preservice teachers will not predict their preferred definition of intelligence.

Research Ho: The implicit beliefs of intelligence of preservice teachers will predict their preferred definition of intelligence.

Summary of Findings

Using linear regression based on the hierarchical ranking of definitions discussed above in Research Question 2, implicit beliefs about intelligence were found to predict their preferred definitions of intelligence.

Discussion of Findings

In order to determine any relationship between the variables, linear regression was used with correlational analysis. The linear regression results indicated an overall model which predicted that preferred definitions of intelligence were related to implicit beliefs about intelligence [$R = 0.421$, $R^2 = 0.177$, $F(1,260) = 55.893$, $p < 0.002$]. This model accounted for 17.7% of the variance of implicit beliefs about intelligence, meaning the relationship was statistically significant and the strength of the relationship, in the social sciences, is considered moderate (0.42). The positive correlation between preferred definitions of intelligence and implicit beliefs about intelligence shows that how a preservice teacher defines intelligence was moderately related to their beliefs about the malleability of intelligence. This was a salient understanding which can influence future teachers' behavior in the classroom.

Jonsson and Beach (2010) investigated Swedish preservice teachers' credibility of theories of intelligence. The participants in the control group found the sociocultural theory to be most credible while the least credible was the CHC general intelligence theory. Jones et al. (2012) also investigated the implicit beliefs of intelligence of preservice teachers and included an open-ended question as to why they believed one person was more intelligent than another. Seven themes were identified, which included achievement, declarative and procedural knowledge, self-regulation, cognitive processes, motivation, and personal characteristics. However, neither of these studies examined the relationship between implicit beliefs of intelligence and their preferred definitions of intelligence.

Research Question 4

Do demographic variables of age, gender, educational level, academic domains, and educational psychology course enrollment have a relationship with preservice teachers' implicit beliefs about intelligence?

Hypothesis 4

Null Ho: The age, gender, education level, academic domain, and educational psychology coursework of preservice teachers will not predict implicit beliefs of intelligence.

Research Ho: The age, gender, education level, academic domain, and educational psychology coursework of preservice teacher will predict implicit beliefs of intelligence.

Summary of Findings

Research Question 4 posited that age, gender, education level, academic domains, and educational psychology coursework of preservice teachers would predict their implicit beliefs about intelligence, a continuous variable. Use of multiple linear regression methods found that, of all the independent variables, only gender and age of preservice teachers predicted implicit beliefs [$R=.328$, $R^2 = .108$, $R^2 \text{ adj}=.079$, $F(8,253) = 3.810$, $p = .000$]. This accounted for a small (11%) percentage of the variance or correlation, whereas the other demographic variables of educational level, academic domains, and psychology coursework did not predict implicit beliefs about intelligence. Consequently, the fourth hypothesis was partly significant in that age and gender were predictive of implicit beliefs about intelligence.

Interpretation and Discussion of Findings

Research Question 4 examined the relationship between demographic variables and implicit beliefs about intelligence. In order to establish the relationship, multiple regression and correlation analysis were used to determine the relatedness between variables. The regression results indicated that the overall model predicted implicit beliefs using gender and age. Weak and small correlations with age and gender predicted implicit beliefs about intelligence. The other demographic variables did not predict implicit beliefs about intelligence. The association between implicit beliefs and the variables age and gender was linear. Further, in the model gender, specifically female, positively predicted implicit beliefs about intelligence, and age negatively predicted implicit beliefs. Age of a preservice teacher was inversely related to implicit beliefs about intelligence.

Possible explanations may be found in previously reviewed studies. Lynott and Woolfolk (1994) and Spinath et al, (2003) discovered that older teachers were more likely to have entity beliefs about intelligence and less likely to have an incremental belief about intelligence. Jonsson et al. (2012) elucidated findings that older teachers with more experience, when compared to older teachers with less experience, preferred an entity belief about intelligence. Jonsson and colleagues also revealed that younger teachers with less experience were more likely than younger teachers with more experience to hold entity beliefs about intelligence. Further, Georgiou (2008) found that older inservice teachers believe that stable attributes such as ability, family background, and gender play a role in achievement, which is a more entity view about intelligence. Conversely, younger preservice teachers were more likely to believe that dynamic traits

of the teacher play a role in student achievement, that is, a more incremental view of intelligence. The findings in this study were consistent with the other studies for age, being inversely related to a view of implicit beliefs about intelligence.

In considering gender, Spinath et al. (2003) conducted a study with twins in Germany, finding a relationship between implicit beliefs and gender, in that females were more likely to have an incremental belief about intelligence. Diseth et al. (2014) performed a study of Norwegian middle schoolers, finding that boys' achievement was less likely to be associated with their incremental beliefs about intelligence. The researchers Mascaret et al. (2015) found that male science teachers, when compared to female science teachers, had a more negative relationship with intelligence and with modifiable words indicating malleability. This study was consistent with other research findings that females were more likely to have a malleable view of intelligence when compared to males.

Limitations of the Study

The study had potential limitations which were as follows: the use of a self-survey, the preferred definition of intelligence variable, and the ability to generalize the findings.

A self-survey had potential limitations. The responses were dependent on the reading skills and personal context of the participant. Further, the participants were preservice teachers from the Midwest who had access to the internet and were willing to participate in the study. Participation was voluntary and participant belief in anonymity was ensured.

The design of the study was correlational. The findings of the study were limited to association and were not cause and effect. The *preferred definition of intelligence* variable in the survey was developed for the purposes of this study and was not intended to create a standard for the research community. In some way, each of the four statements represented some stage of a continuum, involving an implicit belief of intelligence, with overlap between stages. The limitation of this particular item was that it represented the participants' interpretations of the statements and how they perceived the differences among the statements.

The Delimitations of the Study

This study was delimited to preservice teachers who confirmed that they were students in a teacher education program. This study was delimited to those preservice teachers with zero to two years of teaching experience. These results should not be generalized to preservice teachers in other geographic regions in the United States.

Recommendations for Practice

Pajares (1992) makes assertions regarding preservice teachers:

. . . beliefs are often well established by the time a student starts their educational program... the investigation of teacher's beliefs is a necessary and valuable avenue of educational inquiry...a strong relationship exists between educational beliefs and planning, instructional decisions and classroom practices (p. 326).

Educator Preparation Institutions (EPI) should be more concerned about preservice teachers' implicit beliefs about intelligence. There is a need for faculty diversity and unique styles of teaching. Since preservice teachers are the only resource for much needed future teachers, education programs at universities, colleges, and

alternative institutions need to focus on quantitative and qualitative research methodologies that lend themselves to the study of implicit beliefs about intelligence of future teachers to improve understanding of the impact of these beliefs.

The use of means, percentages, and standard deviations confirmed that preservice teachers, for the most part, somewhat agreed, agreed, or strongly agreed with incremental beliefs about intelligence. Preservice teachers did not all agree on the definition of intelligence. Most preferred the MI theory while, the second most preferred definition was sociocultural theory. The least preferred definition of intelligence was the general intelligence definition. The study found that a relationship existed between implicit beliefs about intelligence and preferred definitions of intelligence, but that it lacked magnitude; larger samples better detect an effect better. Lastly, using multiple regression, this study found weakly positive linear relationships with the variables of age and gender when predicting implicit beliefs about intelligence.

This study suggested that preservice teachers' implicit beliefs about intelligence may exist prior to enrollment in a teacher preparation program and were related to preferred definitions of intelligence. The findings of this study constitute the basis for the recommendations for Educator Preparation Institution training of future teachers:

1. Preservice teachers need to know themselves, to reflect on how they view intelligence, and consider how that will affect their behavior in the classroom. The recommendation is that the construct of implicit beliefs about intelligence be integrated into educational interventions (Gonzalez & Skultety, 2018; Guido, 2016; Kennedy, 2016; Kraker-Pauw, Wesel, Krabberndam &

Atteveldt, 2017; Makel, Snyder, Thomas, Malone; Putallaz, 2015 and Yeager, et al., 2016).

2. EPIs should include the instruction of explicit and implicit theories of intelligence and specifically, incremental, growth minded beliefs about intelligence, importance of effort, attention to errors and the plasticity of the brain (Myers, Wang, Black, Bugescu, & Hoeft, 2016; Sarrasin, Nenciovici, Foisy, Allaire-Duquette, Riopel, & Masson, 2018; Schroder, Fisher, Lin, Lo, Danovitch, & Moser, 2017; and Tempelaar, Rienties, Giesbers, & Gijsselaers, 2015).
3. Meaningful, continuous tracking of preservice teacher's implicit beliefs about intelligence and their personal definitions of intelligence upon entrance into the program through to the end of the program, and as they become new teachers in the field, can facilitate needed curriculum adjustments. Effective intervention in the curriculum promoting a growth mindset alongside neuroscience findings can communicate to preservice teachers that intelligence and ability are malleable, can aid academic underachievement, can assist students in low-income brackets, and increase brain activity (Beaubien, 2018; Claro, Paunesku & Dweck 2016; Ng, 2018 and Paunesku, Walton, Romero, Smith, Yeager, & Dweck, 2015; Sarrasin et al., 2018).
4. EPIs need to recognize that implicit beliefs about intelligence must be connected with planning, instruction, and behavior; thus, they should be taught concurrently in methodology courses.

Implications for Future Research

This correlational study aimed to study preservice teachers' implicit beliefs of intelligence and the relationship of preservice teachers preferred definitions of intelligence and their implicit beliefs of intelligence. The study also aimed to evaluate any relationships between preservice teacher's implicit beliefs of intelligence and demographic variables of age, gender, educational level, academic domains and educational psychology coursework.

The sample of 262 preservice teachers was collected and a low to moderate relationship was observed between implicit beliefs of intelligence and preferred definitions of intelligence. Since effects are observed better with larger samples, a bigger sample of over 300 participants would be beneficial. The participants were selected from ten midwestern states. A selection of preservice teachers from various regions of the United States would allow a comparison of findings. The participants of the study were mainly females. Therefore, future studies should sample male preservice teachers and examine their implicit beliefs of intelligence and relationship between their mindset and preferred definitions of intelligence. Further, given the sample of participants in the study was a Caucasian majority, it would be interesting to study a more diverse racial demographic sample. Further, the majority of the participants in this study were from public universities. A study of preservice teachers from parochial institutes, examining their implicit beliefs of intelligence and preferred definitions of intelligence would be helpful. In addition, this study utilized a self-survey to collect preservice teacher responses regarding implicit beliefs of intelligence and preferred definitions of intelligence. Including a quantitative and an open-ended qualitative question should be

studied. Finally, future research could experiment with manipulating preservice teachers' mindsets and then examine their preferred definitions of intelligence.

APPENDICES

APPENDIX A
SCHEDULE AND BUDGET

Schedule

Stage	Task	Date	Resources/ Materials	Responsible
Authorization	Proposal approval IRB approval	Feb 2019	Forms	M.K.B.
Recruitment	QuestionPro Send out survey	Feb 2019		M.K.B.
Data Collection	Week 1	Feb 2019	Survey QuestionPro Website Services	M.K.B.
Data Analysis		Mar 2019	SPSS software	M.K.B.
First draft		Aug 2019		M.K.B.
Editing		Oct 2019		M.K.B.
Pre-defense		Dec 2019		M.K.B.
Review/editing		Dec 2019		M.K.B.
Defense		Apr 2020		M.K.B.
Final Edition		Apr 2020		M.K.B.

Budget

Human Resources	\$0.00
Equipment	
Dell Computer	\$0.00
Pro Quest Services	\$2,499.00
Materials	\$0.00
Transportation	
Fuel	\$0.00

APPENDIX B

Variables

Operational Definitions of Variables

Variable	Conceptual	Instrumental	Operational
Implicit beliefs about intelligence		Indicate extent you agree or disagree with each of the following statements: (1-7 Likert scale, strongly agree to strongly disagree)	To calculate the total score for responses on the 8 items.
The beliefs regarding whether or not intelligence or abilities can change, (Carol Dweck and colleagues)		<ol style="list-style-type: none"> 1. Everyone has a certain amount of intelligence and they really can't do much to change it.(E) 2. Everyone's intelligence is something about them that they can't change very much. (E) 3. No matter who someone is, they can significantly change their intelligence level. (I) 4. To be honest, people can't really change how intelligence they are. (E) 5. People can always substantially change how intelligent they are. (I) 6. Everyone can learn new things, but they can't really change their basic intelligence. (E) 7. No matter how much intelligence someone has, they can always change it quite a bit. (I) 8. People can change even their basic intelligent level considerably. (I) 	<p>A score of 3.4 or less = Entity beliefs.</p> <p>Score of 4.6 or more = incremental beliefs.</p> <p>Score of 3.41 to 4.59 will be classified as neither or mixed beliefs.</p>
The entity theory of intelligence refers to an individual's belief that intelligence and ability are fixed traits.			

Variable	Conceptual	Instrumental	Operational
	<p>Variable #1, Level 1</p> <p>Entity beliefs An individual's belief that intelligence and ability are unchanging.</p>	<p>Indicate extent you agree or disagree with each of the following statements: (1-7 Likert scale, strongly agree to strongly disagree, and neutral</p> <p>1. Everyone has a certain amount of intelligence and they really can't do much to change it.(E)</p> <p>2. Everyone's intelligence is something about them that they can't change very much. (E)</p> <p>4. To be honest, people can't really change how intelligence they are. (E)</p> <p>6. Everyone can learn new things, but they can't really change their basic intelligence. (E)</p>	<p>Items 1, 2, 4, and 6 will be calculated from the total average of scores from items 1-8. The range of this scale will be from 1.00 to 7.00.</p> <p>Individuals with a score in the 1.00 to 3.40 range will be classified as having entity beliefs.</p>
	<p>Variable #1, Level 2</p> <p>Neither or Mixed Beliefs</p> <p>An individual's belief is neither entity nor incremental.</p>		<p>Individuals with a score from 3.41 to 4.59 will be classified as neutral or undecided.</p>
	<p>Variable #1, level 3</p> <p>Incremental belief An individual's belief that intelligence and ability can change with effort.</p>	<p>Indicate extent you agree or disagree with each of the following statements: (1-7 Likert scale, strongly agree to strongly disagree, and neutral</p> <p>3. No matter who someone is, they can significantly change their intelligence level. (I)</p> <p>5. People can always substantially change how intelligent they are. (I)</p> <p>7. No matter how much intelligence someone has, they can always change it quite a bit. (I)</p> <p>8. People can change even their basic intelligent level considerably. (I)</p>	<p>Items 3, 5, 7. and 8 will be recoded. Individuals with a score of 4.6 to 7.00 will be classified as incremental.</p> <p>For this categorical variable 1= entity, 2= neutral, 3 = incremental</p>

Variable	Conceptual	Instrumental	Operational
Variable #2 preferred definition of intelligence	Individual concept of what is intelligence as it is perceived.	<p>Based on this situation given, choose the option which best reflects your definition of intelligence.</p> <p><i>Imagine that you are in the classroom and students are having a discussion on what makes one students more intelligent than another. Students propose reasons for different intelligences. Choose one option that best describes your definition of intelligence.</i></p> <p>1. Intelligence is made of heredity, and environment (Carroll, 1997). 2. Intelligence is made up of many styles of learning. Some styles are logical, linguistic, musical, interpersonal and spatial. (Gardner, 1983). 3. Intelligence is made up of three types of thinking: critical thinking, creative thinking and analytical thinking. (Sternberg, 1985) 4. Intelligence is something that is inside all humans and can be developed. (Grigorenko, 2004)</p>	<p>This is a three categories variable:</p> <p>Definition 1 = entity =1 Definitions 2 & 3= neither or mixed Definition 4 = incremental =</p>
Preservice status	In a preparation program	Are you a preservice teacher?	<p>1 = yes 2 = no</p>
Preservice status	Teaching experience	How many years of teaching experience do you have?	<p>1 = 0-2 years 2 = more than two years</p>
Age	Preservice teachers current age	What is your age?	Number in Years
Gender	Sexual Orientation	Indicate your sex.	<p>0= female 1 = male</p>
Race	Ethnicity	Indicate your race.	<p>1 =White Caucasian 2 = Black African American 3 = Hispanic 4 = American Native Indian 5 = Asian 6 = Other</p>

Variable	Conceptual	Instrumental	Operational
Field experience	First year of field experience	In what year did you have your first field experience?	1 = 2016 2 = 2017 3 = 2018 4 = other
Educational institution	Type of Institution	What type of educational institution did you attend?	1 = public 2 = private 3 = parochial 4 = alternative
Educational level	College Educational Level	What is your educational level? Options include: freshman, sophomore, junior, senior, graduate student, or alternate program student.	0 = Freshman 1 = Sophomore 2 = Junior 3 = Senior 4 = Graduate Student 5 = Alternate student program
Academic Domain	Preservice teachers' academic domain of study for certification	What is your academic domain? Options include: STEM (Science, Technology, Engineering, Math), Liberal Arts (English, Foreign languages, English as Second Language (ESL), Fine Arts (music, art, performance), Social Sciences (history, psychology, economics), and Other.	0 = STEM 1 = Liberal arts 2 = Fine Arts 3 = Social Sciences 4 = Other
Taken Educational Psychology Course	Did the preservice teacher take a course in educational psychology?	Did you take a course in educational psychology?	0 = No 1 = Yes

APPENDIX C

IRB DOCUMENTS

Andrews University
Office of Research and Creative Scholarship
Institutional Review Board
(269) 471-6361 Fax: (269) 471-6246 E-mail: irb@andrews.edu
Andrews University, Berrien Springs, MI 49104-0355

APPLICATION FOR APPROVAL OF HUMAN SUBJECTS RESEARCH

Please complete the following application:

1. Research Project

Title PRESERVICE TEACHERS' PREFERRED DEFINITIONS OF INTELLIGENCE, AND RELATED DEMOGRAPHICS (AGE, GENDER, EDUCATIONAL LEVEL AND ACADEMIC

DOMAIN), AS PREDICTORS OF THEIR IMPLICIT BELIEFS OF INTELLIGENCE

Will the research be conducted on the AU campus? ☐ Yes ☒ No

If no, please indicate the location(s) of the study and attach an institutional consent letter that references the researcher's study.

ON-LINE SURVEY

a) What is the source of funding (please check all that apply)

☒ Unfunded

☐ Internal Funding Source:

☐ External Funding Sponsor/Source:

Grant title: Award # / Charging String:

If you do not know the funding/grant information, please obtain it from your department

2. Principal Investigator (PI)

First Name: Michelle Last Name: Bacchiocchi Telephone: (269)208-5290 E-mail: michellb@andrews.edu

☒ Yes I am a student. If so, please provide information about your faculty advisor below.

First Name: Elvin Last Name: Gabriel Telephone: (269)471- E-mail: gabriel@andrews.edu

Advisor's signature:

Department: Education—Educational Psychology Program:Ph.D

3. Co-investigators (Please list their names and contact information below)

None

4. Cooperating Institutions

Is this research being done in cooperation with any institutions, individuals or organizations not affiliated with AU?

☐ Yes ☒ No If yes, please provide the names and contact information of authorized officials below.

Have you received IRB approval from another institution for this study? ☐ Yes ☒ No

If yes, please attach a copy of the IRB approval.

5. Participant Recruitment

Describe how participant recruitment will be performed. Include how and by whom potential participants are introduced to the study (please check all below that apply)

☐ AU directory ☐ Postings, Flyers ☐ Radio, TV

☒ E-mail solicitation. Indicate how the email addresses are obtained:

☐ Web-based solicitation. Specify sites:

☐ Participant Pool. Specify what pool:

☒ Other, please specify:

Please attach any recruiting materials you plan to use and the text of e-mail or web-based solicitations you will use.

6. Participant Compensation and Costs

Are participants to be compensated for the study? Yes ☐ No ☒ If yes, what is the amount, type and source of funds?

Amount: Source: Type:

Will participants who are students be offered class credit? ☐ Yes ☒ No ☐ NA

Are other inducements planned to recruit participants? ☐ Yes ☒ No If yes, please describe.

Are there any costs to participants? ☐ Yes ☒ No If yes, please explain.

7. Confidentiality and Data Security

Will personal identifiers be collected? ☐ Yes ☒ No Will identifiers be translated to a code? ☐ Yes ☐ No

Will recordings be made (audio, video)? ☐ Yes ☒ No If yes, please describe.

Who will have access to data (survey, questionnaires, recordings, interview records, etc.)? Please list below.

Principal investigator: Michelle Bacchiocchi; Dissertation committee members: Dr. Elvin Gabriel (chair), Dr. Tevni Grajales, and Dr. Jeannie Montagano

8. Conflict of Interest

Do you (or any individual who is associated with or responsible for the design, the conduct of or the reporting of this research) have an economic or financial interest in, or act as an officer or director for, any outside entity

Whose interests could reasonably appear to be affected by this research project: ☐ Yes ☒ No

If yes, please provide detailed information to permit the IRB to determine if such involvement should be disclosed to potential research subjects.

9. Results

To whom will you present results (highlight all that apply)

☐ Class ☐ Conference ☒ Published Article ☐ Other If other, please specify:
Dissertation

10. Description of Research Subjects

If human subjects are involved, please highlight all that apply:

☐ Minors (under 18 years) ☐ Prison inmates ☐ Mentally impaired ☐ Physically disabled

☐ Institutionalized residents ☐ Anyone unable to make informed decisions about participation

☐ Vulnerable or at-risk groups, e.g., poverty, pregnant women, substance abuse population

11. Risks

Are there any potential damage or adverse consequences to researcher, participants, or environment? These include physical, psychological, social, or spiritual risks whether as part of the protocol or a remote possibility. NO

Please highlight all that apply (Type of risk): Definitions of risks can be found at the end of the application form.

☐ Physical harm ☐ Psychological harm ☐ Social harm ☐ Spiritual harm

12. Content Sensitivity

Does your research address culturally or morally sensitive issues? ☐ Yes ☒ No If yes, please describe:

13. Please provide (type in or copy - paste or attach) the following documentation in the boxes below:

Protocol: Survey will be sent out to preservice teachers in Michigan, Ohio and Indiana. Students will be tested using the AIMS-Web R-CBM and Maze benchmark probes and a multi-dimensional fluency rubric. See attached document for samples of these probes.

Survey instrument or interview protocol:

Institutional approval letter (if off AU campus): See attached document.

Consent form (for interviews and focus groups):

Participants' recruitment documents: See attached Email Text

Principal Investigator's Assurance Statement for Using Human Subjects in Research

☒ I certify that the information provided in this IRB application is complete and accurate.

☒ I understand that as Principal Investigator, I have ultimate responsibility for the conduct of IRB approved studies, the ethical performance of protocols, the protection of the rights and welfare of human subjects, and strict adherence to the study's protocol and any stipulation imposed by Andrews University Institutional Review Board.

☒ I will submit modifications and / or changes to the IRB as necessary prior to implementation.

☒ I agree to comply with all Andrews University's policies and procedures, as well as with all applicable federal, state, and local laws, regarding the protection of human participants in research.

☒ My advisor has reviewed and approved my proposal. (Email to IRB)

IRB letter of approval:

February 11, 2019

Michelle Bacchiocchi Tel. 269-208-5290 Email: michellb@andrews.edu

RE: APPLICATION FOR APPROVAL OF RESEARCH INVOLVING HUMAN SUBJECTS IRB Protocol #:19-020 Application Type: Original Dept.: Graduate Psychology & Counseling Review Category: Exempt Action Taken: Approved Advisor: Elvin Gabriel Title: Preservice teachers' preferred definitions of intelligence, and related demographics (Age, gender, educational level and academic domain) as predictors of their implicit beliefs of intelligence.

Your IRB application for approval of research involving human subjects entitled: "Preservice teachers' preferred definitions of intelligence, and related demographics (Age, gender, educational level and academic domain) as predictors of their implicit beliefs of intelligence" IRB protocol # 19-020 has been evaluated and determined Exempt from IRB review under regulation CFR 46.101 (b) (2). You may now proceed with your research. Please note that any future changes made to the study design and/or informed consent form require prior approval from the IRB before such changes can be implemented. In case you need to make changes please use the attached report form.

While there appears to be no more than minimum risks with your study, should an incidence occur that results in a research-related adverse reaction and/or physical injury, this must be reported immediately in writing to the IRB. Any research-related physical injury must also be reported immediately to the University Physician, Dr. Katherine, by calling (269) 473-2222.

We ask that you reference the protocol number in any future correspondence regarding this study for easy retrieval of information.

Best wishes in your research.

Sincerely,

Mordekai Ongo

Research Integrity and Compliance Officer

Institutional Review Board – 8488 E Campus Circle Dr Room 234 - Berrien Springs, MI 49104-0355 Tel: (269) 471-6361 E-mail: irb@andrews.edu

APPENDIX D
SURVEY AND LETTER

Dear Preservice Teacher,

My name is Michelle Bacchiocchi, a student in the educational psychology doctoral program and an assistant professor of student teaching at Andrews University. I would like to ask you to complete a short online questionnaire to investigate implicit beliefs and definitions of intelligence among student teachers. This research is being performed as partial fulfillment of my doctoral program and degree. The questionnaire should take no more than 10 minutes to complete. Participating in this study is entirely voluntary and poses no known risks. By completing and submitting your response you are providing implied consent. You may choose to withdraw at any time. Your participation is confidential and you will not be identified with your responses in any way. Please note that absolute confidentiality cannot be guaranteed due to the limited protections of internet access. However, Question Pro, the online survey host, will not record any IP addresses or identifying information to help ensure confidentiality between the participant and the survey host. Upon finishing of the survey, please be sure to click the “next” button which will close your browser and maximize confidentiality. As a professor of student teachers I understand your schedules are busy balancing academic requirements and field experiences. I very much appreciate your time and involvement in the study. This research provides more understanding into preservice teachers' belief structures. If you have any questions about the questionnaire please contact Andrews University Internal Review Board, Andrews University, at 269-471-6361 and irb@andrews.edu. If you have read and understood the above statements, please click “next” button below to indicate your consent to participate in this study. Thank you very much for your time and support.

Are you a pre-service teacher?

1. Yes
2. No

How many years of teaching experience do you have?

1. 0-2 years
2. More than 2 years

In what year did you have your first field experience?

1. 2016
2. 2017
3. 2018
4. Other

Indicate your sex.

1. Male
2. Female

What is your age? (in years)

Indicate your race.

1. White-Caucasian
2. Black-African American
3. Hispanic
4. American Indian-Native Alaskan
5. Asian
6. Other

What is your educational level?

1. Freshman
2. Sophomore
3. Junior
4. Senior
5. Graduate Student
6. Alternate student program

What type of Educational Preparation Institution are you enrolled?

1. Public University/College
2. Private University/College
3. Parochial University/College
4. Alternative Education Program

What is your academic domain? Options include: STEM (Science, Technology, Engineering, Math), Liberal Arts (English, Foreign languages, English as Second Language (ESL), Fine Arts (music, art, performance), Social Sciences (history, psychology, economics), and Other.

1. STEM
2. Liberal arts
3. Fine Arts
4. Social Sciences
5. Other

Did you take a course in educational psychology?

1. Yes
2. No

Indicate extent you agree or disagree with each of the following statements:

	Strongly agree	Agree	Mostly agree	Neither agree or disagree	Mostly disagree	Disagree	Strongly disagree
Everyone has a certain amount of intelligence and they really can't do much to change it.	☐	☐	☐	☐	☐	☐	☐
Everyone's intelligence is something about them that they can't change very much.	☐	☐	☐	☐	☐	☐	☐
No matter who someone is, they can significantly change their intelligence level.	☐	☐	☐	☐	☐	☐	☐
To be honest, people can't really change how intelligent they are.	☐	☐	☐	☐	☐	☐	☐
People can always substantially change how intelligent they are.	☐	☐	☐	☐	☐	☐	☐
Everyone can learn new things, but they can't really change their basic intelligence.	☐	☐	☐	☐	☐	☐	☐

	Strongly agree	Agree	Mostly agree	Neither agree or disagree	Mostly disagree	Disagree	Strongly disagree
No matter how much intelligence someone has, they can always change it quite a bit.	☐	☐	☐	☐	☐	☐	☐
People can change even their basic intelligent level considerably.	☐	☐	☐	☐	☐	☐	☐

Based on this situation given, choose the option which best reflects your definition of intelligence. Imagine that you are in the classroom and students are having a discussion on what makes one student more intelligent than another. Students propose reasons for differences in intelligence. Choose one option that best describes your definition of intelligence.

1. Intelligence is made of heredity, and environment.
2. Intelligence is made up of many styles of learning. Some styles are logical, linguistic, musical, interpersonal and spatial.
3. Intelligence is made up of three types of thinking: critical thinking, creative thinking and analytical thinking.
4. Intelligence is something that is inside all humans and can be developed.

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