University of Nevada, Reno

An Exploratory Factor Analysis of Teachers' Beliefs, Attitudes, and Perceptions Utilizing the *1998-99 ECLS-K Spring 2004 Fifth Grade Teacher Questionnaire* as a Secondary Data Source

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Abstract

As public school teachers in the United States today confront unparalleled standards of accountability for student achievement and increasingly challenging working conditions, there is a need for a clear understanding of those factors that have the potential to impact teachers' effectiveness and influence teachers' decisions to remain in the workforce. Large national surveys such as the MetLife Survey of the American teacher (Met Life Foundation, 2013) have traditionally provided to professional educators highly accessible demographic, descriptive, and trend information about teaching from the teacher's perspective. Results from these are accessible to the public by means of print and online media. This study posited that national datasets hold additional value as a secondary data source for educational researchers. The advantages of utilization of secondary data sources have been explicated in the literature (Crossman, 2014; Elder, Jr., Pavalko, & Clipp, 1993). With the application of exploratory analysis techniques, this study explored the potential to impute additional significance to an existing national education dataset.

The purpose of this quantitative study was to seek empirically-determined factors associated with upper elementary teachers' beliefs, attitudes, and perceptions about their work. Exploratory factor analysis procedures were conducted with selected elements of the existing dataset provided in the public-use file of the *1998-99 ECLS-K Spring 2004 Fifth Grade Teacher Questionnaire (ECLS-K 5th Grade).* Data pre-screening established a sample size of 1,314 teachers who met the study delimiters. Implementation of principal components analysis and exploratory factor analysis procedures resulted in 26 questionnaire items constituting a five-factor solution. Chronbach's Alpha ($\alpha > .70$) was conducted and established internal consistency among all items and among items related to the factors. The five factors were labeled Leadership and Professional Learning Community (PLC), Student and Parent Effects, Student Evaluation, Teacher Efficacy, and Teacher Collaboration Time. A follow-up MANOVA procedure was conducted to analyze responses based on the established demographic groups of Race, Age, Years of Teaching Experience, and Highest Education Level. Significant mean differences among the demographic groups were identified based on computed factor scores. Where applicable, post hoc analysis was conducted. Results indicated the existence of significant mean differences for all five factors with regard to the various demographic groups; however all significant effect sizes and pairwise differences for means were small.

This study resulted in two key findings. The first key finding was the appropriateness of the use of the *ECLS-K 5th Grade* teacher survey instrument as a secondary data source with which to apply exploratory procedures to empirically identify underlying constructs (factors) of the teacher experience. Capitalizing on the large sample size afforded by the data set (N = 1,314), five factors were identified. The second key finding was the empirical identification of differences among selected demographic groups in relation to the identified factors. The data provided by this study, taken as a whole, provides educational policymakers and school leaders a multi-dimensional look at the interplay between research-based teacher factors and the implementation of activities associated with these factors by the diverse individuals that comprise a teacher workforce.

Dedication

This work is dedicated to my parents, Tommy and Cindy Vela, my sisters, Terry and Linda, and my grandparents, Bill and Fritzi Brand…in memory of all of the Sunday dinners around the table on Agnes Avenue and all that I learned there about love, life, and the joy of learning.

Acknowledgments

Along this journey I came to realize that committee is everything; I am extremely indebted to my committee. I am deeply appreciative of Dr. Bill Thornton, my committee chair, for his unwavering optimism and guidance. My ability to complete this work is entirely due to his belief in me. I cannot thank him enough for the extra care he took in answering all my questions and honoring my concerns along the way.

I am extremely thankful for Dr. Gus Hill who, with Dr. Thornton, assisted me in structuring my study. I appreciate Dr. Hill not only for his expertise, but also for his energy and curiosity about the data – he was a great role model. I also appreciate his readiness to continue to serve on my committee even after his move to New Mexico.

If I ever have the honor of serving as an advisor on a dissertation committee, I will aspire to provide the depth of feedback that committee member, Dr. Janet Usinger, provided to me. Her meticulously insightful guidance was invaluable in my completion of this work. I appreciate that, as she held my work to high standards, she also provided me collegial support that enabled me to proceed with confidence.

I am indebted to Dr. Mary Sedgwick for her willingness to join my committee, as we had not met beforehand. Dr. Sedgwick was instrumental in asking the questions that guided me to maintain a focus on the hard work of teachers. Due to her guidance, my work is more thoughtful and accurate.

Completing my committee was Dr. Patricia Miltenberger, whom I have known since the early 1990's. As I have reminded her, she was my professor for one of my first Master's level classes in Educational Leadership. She inspired me then, and continues to inspire. I appreciate her willingness to serve on my committee over the many years.

When a work takes a period of time, there is plenty of opportunity to ponder how things are going and what has led to certain accomplishments. I have had much time to consider all who have enabled me to reach this point of completion. I would like to thank Dr. Ricky Medina for his assistance in the initial organization of my dataset. I would like to acknowledge Sue and Jeff Brand, my aunt and uncle, who thought I could do this and encouraged me to keep moving forward. This work is a tribute to the students I have been fortunate to teach and the teachers I have been fortunate to know. I would like to acknowledge my first students in the Oxnard Elementary School District whose trust and optimism propelled me forward into a lifelong career in public education. I appreciate all that I came to learn about the honor of leading teachers in the Carson City School District and would like to express my gratitude to those teachers who were my colleagues.

I would like to acknowledge my family. Over the many years that I was completing my work, my three children, Matthew, Annie, and Alysse, grew up and have accomplished so much. In addition, they are incredible people who each see the world through an independent lens, which I so admire. They are an inspiration and a motivation to me to do my best. In closing, I would like to thank my husband, Bill. He is adamant that he not be mentioned. Sorry, Bill, that's just not possible because, without you, nothing else is possible. With all my love.

Table of Contents

List of Tables

Chapter 1: Introduction

Teachers in the United States today face pressures and teaching conditions unparalleled in the history of the nation. Low salaries (Met Life Foundation, 2013), decreasing retirement benefits (Doherty, Jacobs, & Madden, 2012), weakening of collective bargaining (Moore, 2012; Toppo, 2012), and school violence (Met Life Foundation, 2013) are all conditions that inform teachers' sense of job satisfaction, influence teachers' decisions to remain in the workforce, and impact teacher effectiveness.

The factors that affect teacher satisfaction, teacher retention, and teacher effectiveness are dynamic and need to be well understood (Ingersoll, 2003). Results from large national teacher surveys such as the MetLife Survey of the American Teacher (Met Life Foundation, 2013) and the 2011 - 2012 Schools and Staffing Survey (SASS) (National Center for Education Statistics, 2014) have been commonly used by both researchers and the general public to gain an understanding of the teaching experience. National datasets such as these have long provided demographic, descriptive, and trend information about teaching from the teacher's perspective. The information from such national datasets is often summarized in a format that is easily understood by both the lay person and the professional educator.

This study posited that national datasets hold value as a secondary data source for educational researchers. With the application of exploratory analysis techniques to an existing dataset, there is the potential to impute additional significance to existing data collected during national surveys. Specifically, this study applied exploratory factor analysis procedures to selected elements of the existing dataset provided by the *1998-99*

ECLS-K Spring 2004 Fifth Grade Teacher Questionnaire (ECLS-K 5th Grade), a component of the Early Childhood Longitudinal Study (*ECLS-K)* national dataset made available by the National Center for Educational Statistics (U.S. Department of Education, 2013). With the utilization of an exploratory study analysis, a study of the existing data from this national survey provided insight into fundamental underlying constructs, or factors.

Crossman (2014) described secondary data analysis as the researcher's use of data that he or she did not collect for the purpose of answering questions that the data was not designed to answer. Crossman stated several advantages to secondary data analysis, particularly as related to national datasets: (1) monetary, the costs associated with the collection of the data are avoided; (2) time/quality, the researcher can dedicate more time to the analysis of the data because the secondary dataset is in a viable, "cleaned" (p.1), highly reliable format; (3) breadth, individual researchers most likely could not collect data on as large of a scale as the secondary datasets provided in studies conducted by the federal government; and (4) expertise, individual researchers are likely to find it difficult to employ the work of highly trained professionals for each facet of the research process as is the case with large national studies. Disadvantages inherent in secondary data analysis, include the need for the secondary researcher to become thoroughly familiar with another's dataset and the possibility of a mismatch between the data necessary to meet the secondary researcher's investigative needs and the existing dataset (Crossman, 2014; Koziol & Arthur, 2011).

The *ECLS-K* study in its entirety follows a cohort of students from their kindergarten through 8th grade school years. Throughout the years of the national longitudinal study, data were collected at the student, parent, administrator, and teacher levels in the form of interviews, questionnaires, and (student) academic assessments. The longitudinal *ECLS-K* study, initiated in 1998, included four teacher questionnaires administered at the Kindergarten, 3rd, 5th , and 8th grade data collection junctures. This study will utilize data provided in the 5th grade school year by means of the *1998-99 ECLS-K Spring 2004 Fifth Grade Teacher Questionnaire (ECLS-K 5th Grade).*

The advantages of the *ECLS-K 5th Grade* as a secondary data source for research are consistent with those enumerated by Crossman: savings in terms of time and cost, data quality, breadth of sample, and staff expertise. The complete teacher dataset is readily available online in a public-use format (U.S. Department of Education, 2013). Teacher data via the questionnaires was collected on a large scale, with over 10,000 teachers participating in each of the administrations at the K, 3rd, 5th, and 8th grade levels. Technical manuals available from NCES provide substantiation of the level of staff expertise provided in the form of technical and content advisory committees, psychometricians, and test administration trainers (Tourangeau, Le, & Nord, 2005).

The *ECLS-K 5th Grade* is comprised of 121 survey items. The survey items are organized into seven categories: Instructional Activities and Focus; Classroom Resources; Student Evaluation; School and Staff Activities; Views on Teaching, School Climate and Environment; Teacher Background; and Teaching Assignment. As a primary data source, the purpose of the 5th grade questionnaire was to “[collect] information from teachers of children who are in the study to investigate the relationship between children’s achievement and various school, teacher, and home factors” (U.S. Department of Education, 2013, p. ii). As a secondary data analysis source, the *ECLS-K 5th Grade* was utilized in this study to apply exploratory factor analysis techniques to selected questionnaire items in an effort to identify salient, underlying constructs of the upper elementary teacher experience.

Statement of the Problem

Educational leaders are under increasing pressures to improve student achievement. Studies that consider large datasets related to teachers' beliefs, attitudes, and perceptions about their work is limited. National datasets in the field of education are underutilized as a secondary data analysis source, thereby creating a missed opportunity for the individual researcher to carry out research facilitated by the advantages that national datasets as secondary data sources afford. Specifically, the *ECLS-K 5th Grade* provides a comprehensive dataset related to many issues associated with teachers' beliefs, attitudes, and perceptions on a variety of topics; however, an empirical exploration of the dataset to possibly identify underlying constructs of the upper elementary teacher's experience has not been undertaken. Such a use of the dataset would contribute to the body of quantitative research of teacher job satisfaction and teacher retention.

Purpose of the Study

This study applied exploratory factor analysis methodology to existing data available from a national teacher survey, the *ECLS-K 5th Grade* from the Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (*ECLS-K*) (U.S. Department of Education, 2013). The purpose of this study was to attempt to identify empirically-determined factors that are associated with upper elementary school teachers' beliefs, attitudes, and perceptions about their work. Analysis of this comprehensive dataset sought to empirically identify underlying constructs of the upper elementary teacher experience.

Theoretical Perspective

This study was based on the tenets of factor analytic theory as they apply to the field of human psychology, whereby attributes of a human phenomenon can be characterized as internal or external attributes. Tucker and McCallum (1997) defined an internal attribute as “an unobservable characteristic of people on which people differ in extent or degree” (p. 2). Factor analytic theory is predicated on the notion that there is a relationship between internal and external (or surface) attributes. Internal attributes are not able to be observed, their existence is only known due to the existence of the external. Tucker and McCallum explained that internal attributes “can be thought of as hypothetical constructs…not necessarily taken to be real or concrete. Rather they are constructs that can be used to understand and account for observed phenomena” (p. 2). For the purposes of this study, internal attributes were considered underlying constructs.

Research Questions

The *ECLS-K 5th Grade* provides a wealth of perceptual, environmental, and demographic information about teachers in the workplace. This study utilized the *ECLS-K 5th Grade* data set of teacher responses provided in the *1998-99 ECLS-K, K-8 Full Sample Public Use Data Files* (U.S. Department of Education, 2013). Teacher factors from the dataset had not been previously empirically determined. A primary purpose of this study was to establish possible constructs in the dataset related to teachers’ beliefs, attitudes, and perceptions about their work based on analysis of selected items from the national survey. Phase 1 of this study sought to answer the following question:

Research question 1. Will a factor analysis of selected items from the *ECLS-K 5th Grade* reveal factors related to underlying constructs about upper elementary teachers' beliefs, attitudes, and perceptions regarding their work?

With the establishment of factors in Phase 1, Phase 2 of the study proceeded. Phase 2 explored differences based upon the factors across groups established by selected demographic variables. The following question was considered:

Research question 2. When groups are established using selective demographic variables, are there differences between these groups based upon the factors established in Phase I?

The demographic variables for this study were: Race (White / Non-White), Age, Years of Teaching Experience, and Highest Education Level.

Significance of the Study

This factor analysis study using a national teacher survey as a secondary data source sought to determine underlying constructs of the multi-faceted upper elementary teacher variable. The study also sought to determine how these constructs vary across identifiable demographic groups. A description of these underlying teacher constructs and their representation across demographic groups will be useful to future researchers as well as practitioners who seek to carry out procedures and policies that maximize teacher job satisfaction and retention. Results from this exploratory analysis using the ECLS-K may serve as a model for future quantitative studies in the field of education that seek to use a secondary data source research design based on a national dataset.

Assumptions

The assumption was made in this study that *ECLS-K 5th Grade* survey respondents self-reported with accuracy. Research supports the finding that data from such surveys is most accurate when respondents have a good understanding of the questions and when there is no concern of personal reprisal resulting from responding to the survey. The assumption was made in this study that teachers had sufficient understanding and sufficient confidence in the data collection process to respond to all survey questions accurately (Sergiovanni, 1966).

Methodology

This quantitative study sought to identify factors from an existing set of attitudinal and perceptual data provided by the *ECLS-K 5th Grade*. In Phase 1 of this study, a set of 39 items reflecting beliefs, attitudes, and perceptions of upper elementary teachers about their work was selected for analysis from the *ECLS-K 5th Grade* with the input of an advisory panel of experts. (See Appendix B.) Panel members had demonstrated expertise in the areas of educational leadership and educational research methodology. The exploratory analysis of this study focused on the responses of 1,314 teachers to the selected survey items. Principal components analysis was carried out to identify sources of variability for each observed variable. Factor analysis was used as a data reduction tool. Selected demographic variables were used to establish groups for Phase 2 of the study. The second phase of the study utilized multivariate analysis to consider possible differences across various groups based on the factors established in Phase 1.

Limitations of the Study

By design, the *ECLS-K 5th Grade* is limited in its scope of participants due to the fact that the only teachers surveyed were those who were identified with a case student in the longitudinal study. For this reason, the results of the survey must be regarded carefully; results do not represent the population of 5th grade teachers as a whole. With that said, the exploratory approach of this study was a valid use of the comprehensive dataset. Future researchers will be able to apply knowledge of the factors defined in this study to other survey populations.

Delimitations of the Study

This study was limited to the 5th grade teachers who participated in the administration of the *ECLS-K 5th Grade.* This limitation to participants of this secondary data source was appropriate due to the richness and specificity of the questionnaire's dataset and its large sample size (*N* = 10,872). The 5th grade teacher experience was chosen as a focus for this study in recognition of the upper elementary grades as "increasingly challenging and important to children's futures" (Finnan, 2009, p.2).

Data from the *ECLS-K 5th Grade* included responses from teachers in public and private schools. In an effort to focus on teachers whose teaching lives had been most impacted by the federal regulatory sanctions and political climate of the current era of accountability, participants in this study were limited to public school teachers. The intent of this study was to add to the body of research on the factors related to upper elementary teachers' beliefs, attitudes, and perceptions about their work. Therefore, use of the *ECLS-K 5th Grade* was limited to teachers who taught in self-contained classrooms, as this is the typical elementary school classroom organization. Teachers must also have indicated that they held a regular or standard state teaching certificate and were certified in Elementary Education. Of the 10,872 teacher-level questionnaires completed, 1,314 met the requirements for this study. Lastly, not all questionnaire items from the *ECLS-K 5th Grade* were utilized in the exploratory analysis. An advisory panel of educational experts assisted in the identification of the questionnaire items that were included in the analysis.

Definition of Terms

For the purposes of this study, the following definitions of terms were utilized:

Communalities. An index provided in the results of a factor analysis which expresses the proportion of variability for a given variable that is explained by the factors (Mertler & Vannatta, 2010).

Common variance. Variance shared by two or more variables (Field, 2009).

Confirmatory factor analysis. – a form of factor analysis that tests specific hypotheses about structure and relations between the latent variables in a dataset (Field, 2009).

Correlation matrix. A specialized form of correlation table that presents all the possible combinations of correlations between a certain number of variables (Huck, Cormier, & Bounds, Jr., 1974).

ECLS-K. Acronym for the Early Childhood Longitudinal Study, Kindergarten Class 1998-99 developed under the sponsorship of the U.S. Department of Education, National Center for Education Statistics (NCES) in the Institute of Education Sciences (IES).

ECLS-K 5th Grade. Acronym for the *1998-99 ECLS-K Spring 2004 Fifth Grade Teacher Questionnaire* developed by the U.S. Department of Education, National Center for Education Statistics in the Institute of Education Sciences as part of the Early Childhood Longitudinal Study, Kindergarten Class, 1998-99 (ECLS-K).

Equamax Rotation. - a combination of the Varimax method (simplification of factors) and the Quartimax method (simplification of variables) of factor rotation.

Exploratory Factor Analysis. The most common form of factor analysis used to identify latent factors influencing a set of responses (Ryan, 2013).

Extraction. The process by which factors are determined from a larger set of variables (Mertler & Vannatta, 2010).

Face Validity. The extent to which a measure appears to be measuring what it is expected to measure (Field, 2009).

Factor. - Groupings of variables that are measuring some common entity or construct (Mertler & Vannatta, 2010).

Factor Analysis. A data reduction technique used to describe the underlying structure that explains a set of variables with a focus on shared variability (Mertler & Vannatta, 2010).

Factor Loading. – The correlation coefficients between the variables (rows) and factors (columns) in a correlation matrix (Mertler & Vannatta, 2010).

Goodness of Fit. – statistical modeling, e.g. test of normality, used to compare an anticipated frequency to an actual frequency (Hair, Jr., Black, Babin, & Anderson (2010).

Latent Construct. – A factor that cannot be measured directly but is suggested by clusters of large correlation coefficients between subsets of variables (Field, 2009).

Oblique Rotation. – A method of rotation in factor analysis that allows the underlying factors to be correlated (Field, 2009).

Orthogonal Rotation. – A method of rotation in factor analysis that keeps the underlying factors independent (not correlated) (Field, 2009).

Principal Components Analysis. - A multivariate technique for identifying the linear components of a set of variables. Original variables are transformed into a new set of linear combinations by extracting the maximum variance from the dataset with each component (Field, 2009; Mertler & Vanatta, 2010).

Respondents. – For the purposes of this study, individuals who completed the *1998-99 ECLS-K Spring 2004 Fifth Grade Teacher Questionnaire*. This study utilized the national database and did not directly collect data from the teacher individuals.

Rotation of Factors. – The process by which the solution of a factor analysis is made more interpretable without altering the underlying mathematical structure (Mertler & Vanatta, 2010).

Self-Contained Classroom. – The elementary classroom organizational structure whereby one teacher teaches the majority of academic subjects in one day to one group of students (Tourangeau, Le, & Nord, 2005).

Variance. – An estimate of average variability (spread) of a set of data (Field, 2009).

Variable. – Anything that can be measured and can differ across entities or time (Field, 2009).

Summary and Organization of the Study

The use of a national dataset as a secondary data source can enhance educational research. The individual researcher can take advantage of the time and resources spent by large entities, such as the federal government, to design large scale, high quality studies that produce accessible and highly reliable datasets. This study employed a secondary data analysis utilizing the *ECLS-K Spring 2004 5th Grade Teacher Questionnaire* (*ECLS-K 5th Grade*) to identify underlying constructs pertinent to the teacher variable. A better understanding of these underlying constructs could serve to inform educational leaders who seek to optimize teacher retention and teacher effectiveness. This study was divided into two phases. In Phase 1, exploratory factor analysis was utilized to examine selected items from a national survey, the *ECLS-K* 5^{th} *Grade*. Underlying constructs of the teacher variable were identified. In Phase 2 of this study, demographic variables provided in the *ECLS-K* 5^{th} *Grade* dataset were examined in light of the identified underlying factors in an effort to confirm the existence of any differences in upper elementary teacher beliefs, attitudes, and perceptions about their work based on membership among selected demographic groups.

This research study is presented in five chapters. Chapter 1 summarizes the background information, statement of the problem, research questions, and methodology of the study. The chapter also provides the underlying theoretical perspective of the study, as well as the assumptions, limitations, delimitations, and a definition of terms. Chapter 2 provides a review of the literature. The chapter is divided into three parts. Part one provides background information regarding the ECLS-K survey instrument, including previous educational research studies that have utilized its data. Part two provides a brief survey of the literature regarding the educational significance of teachers' beliefs, attitudes, and perceptions about their work. Part three provides a review of the literature concerning the development of factor analysis as a data analysis tool utilized to identify and quantify underlying constructs. The elements of a factor analysis procedure are outlined. Chapter 3 describes the methodology implemented in this study, including a description of the instrument, the existing data set, and the data analysis techniques employed to address the research questions. Chapter 4 presents a summary of the significant data analysis results to address the two research questions.

Chapter 5 presents a discussion of the key findings of the study and recommendations for future research based on these findings.

Chapter 2: Review of Related Literature

The Early Childhood Longitudinal Study (ECLS) Program and Survey Instrument

The Early Childhood Longitudinal Study, Kindergarten Class of 1998–1999 (*ECLS-K*) is a national database that was developed under the sponsorship of the U.S. Department of Education, National Center for Education Statistics (NCES) in the Institute of Education Sciences (IES) with the purpose of supporting research on the effect of a breadth of environmental factors on children's performance in school. The NCES describes the longitudinal *ECLS-K* study as follows:

> The ECLS program provides national data on children's status at birth and various points thereafter; children's transitions to nonparental care, early education programs, and school; and children's experiences and growth through the eighth grade. The ECLS program also provides data to analyze the relationships among a wide range of family, school, community, and individual variables with children's development, early learning, and performance in school. (U.S. Department of Education, 2013, para. 2)

The breadth of the *ECLS-K* study makes it a rich source of educational data that lends itself to an analysis of the significance of its components. Longitudinal data began to be collected at the student, parent, teacher, and administrator levels for 22,782 kindergarten children in 944 schools during the 1998-99 school year. Data were collected in fall 1998 (kindergarten); spring 2000 (most children were in 1st grade); spring 2002 (most were in 3rd grade); and spring 2004 (most children were in 5th grade). Sample refreshening was carried out in the 1st grade year only. The refreshening process allowed for the inclusion of students in the 1st grade year who had not attended kindergarten. At the student level, diverse racial, ethnic, and socioeconomic groups were well-represented in the sample, with limited English Proficient students oversampled in comparison to other subgroups (Princiotta, Flanagan, & Hausken, 2006).

The only parents, teachers, and administrators who were participants in the longitudinal study were those associated with the child participants. Rich survey data for these educational stakeholders is available from each year of data collection. At each of the data collection junctures, the teachers of the cohort students completed a teacher questionnaire. The teacher questionnaire data archives teacher responses regarding beliefs, attitudes, and perceptions about their schools and their students. Questionnaire items were divided into the following categories: Instructional Activities and Focus; Classroom Resources; Student Evaluation; School and Staff Activities; Views on Teaching, School Climate, and Environment; Teacher Background; and Teaching Assignment.

Assessment instruments for the *ECLS-K* study were similarly constructed for each year. Study instruments included computer-based and self-administered paper and pencil instruments. The teacher questionnaires were of the latter category. In each phase of the study the *ECLS-K* Technical Review Panel (TRP) and Content Review Panel (CRP) provided advice on both content and design. Members of both panels included non-federal and federal experts from the fields of elementary education and family policy. Meta-studies were conducted to assess the effects of any changes made to the instruments. Tourangeau, Le, and Nord (2005) described the care taken in the design of the study instruments:

In the design phase of the *ECLS-K* kindergarten, 1st grade, 3rd grade, and

> 5th grade waves of data collection, policymakers, teachers, and researchers were consulted, and relevant literature was reviewed to ascertain the specific areas within each of the topical components for which national data were needed. Information gathered from these activities guided the formulation of research questions deemed most important for the *ECLS-K* to address. Extant surveys were reviewed to identify surveys that had been fielded to answer similar questions. (p. 2-1)

The kindergarten, 1st grade, and 3rd grade teacher questionnaires followed the same structure. The 5th grade teacher questionnaire, however, was drafted to reflect the fact that a large portion of 5th grade students had more than one teacher. Reading, math, and science teachers were asked to complete self-administered questionnaires, thereby ensuring that teachers who knew the child best in relation to the various academic content areas were providing data. The 5th grade teacher questionnaire included items from the Social Rating Scale (SRS) which was adapted from the Social Skills Rating Scale (Gresham & Elliott, cited in U.S. Dept. of Education, 2013) and the Academic Rating Scale (ARS) which was developed for the *ECLS-K* to obtain teachers' evaluations of children's academic achievement in three domains: language and literacy, science, and mathematical thinking (U.S. Department of Education, 2013). The ARS surveyed the same construct at each grade level, increasing in complexity commensurate with each grade level assessed; thus, teacher survey items based on the ARS differed with each grade level.

The contributions of the teacher questionnaire to the *ECLS-K* study were described by Tourangeau et al. (2005):

> Teachers…represent a valuable source of information on themselves, the children in their classrooms, and the children's learning environment... Teachers are not only asked to provide information about their own backgrounds, teaching practices, and experience, they are also called on to provide information on the classroom setting for the sampled children they teach and to evaluate each sampled child on a number of critical cognitive and noncognitive dimensions. (p. 1-6)

Recommended uses of the *ECLS-K*. Support materials provided in the *ECLS-K* User's Manual (Tourangeau, Le, Nord, Pollack, & Atkins-Burnett, 2006) included exemplars of possible research questions that can be applied to the longitudinal dataset. For example, comparisons between student conditions in the kindergarten year could be examined as predictors of "students' later school outcomes" (p. 9-3). Other suggestions included an examination of the dataset to study school or classroom characteristics and their influence on students' learning outcomes and attitudes toward school.

Tourangeau et al. (2005) noted that the *ECLS-K 5th Grade* is useful to researchers who are interested in describing the post-primary classrooms and schools with children from diverse backgrounds. The 5th grade data could provide insight into the children's post-primary academic gains in the context of the learning environments in which the academic progress occurs. The 5th grade teacher questionnaires, specifically, provide researchers the opportunity to explore teacher factors associated with students' school experience.

Beyond the recommended uses of the *ECLS-K*, however, Elder, Pavalko, and Clipp (1993) supported the use of archival data to answer new research questions.

Recognizing the inherent complexities of using old data to answer new questions, the researchers stated:

> In working with archival data the investigator seeks to maximize the fit between the research question and the data. In one version of this process life-record data are sought to fit a particular question then modified or recast in some way to achieve a better fit. An improved fit may also be achieved by modifying the research question and its analytical model. In other cases, the question is put aside to enable study of a researchable problem that has relevant data at hand. Most uses of archival data involve a mix of such changes in a sequential process that eventually produces an acceptable goodness of fit. (p. 5)

According to the ERIC and Web of Science databases, citations of the 1998-99 *ECLS-K* longitudinal dataset, through 2014, numbered 167 and 126, respectively. Topics ranged from the study of gifted education to the wearing of school uniforms, from the achievement of language and ethnic minorities to childhood obesity.

Studies utilizing the *ECLS-K*. Researchers have utilized the *ECLS-K* dataset to examine factors of children's learning. Xu, Kushner Benson, Mudrey-Camino, and Steiner (2010) studied the 5th grade dataset in terms of one environmental component: parent involvement – its relationship to self-regulated learning and its effect on 5th grade student achievement. Principal component analysis (PCA) was employed as a data reduction technique for 28 items on the 5th grade parent survey in an effort to see which items grouped together to formulate dimensions of parent involvement. Orthogonal (varimax) and oblique (promax) rotations were performed to reduce the chance of multicollinearity. The researchers carried out path analysis with three regression models and were able to identify seven dimensions of parent involvement that positively affected learning outcomes: School Involvement, TV Rules, Homework Help, Homework Frequency, Parental Education Expectations, Parent-Child Communication, and Extracurricular Activities.

Downey, von Hippel, and Broh (2004), Fryer and Levitt (2004), Chatterji (2005), and Desimone and Long (2010) utilized the *ECLS-K* to study the socio-demographic academic achievement gap. Desimone and Long focused on the math item response theory (IRT) scores from the *ECLS-K* in their study of differential school effects on kindergarten and 1st grade academic achievement for Black and White students from high and low socioeconomic status (SES) groups. Desimone and Long sought clarification on the influence of the teacher on two fronts: teacher quality and quantity of instruction. Using hierarchical linear modeling (HLM), nesting tests within students and students within classrooms, the researchers estimated the growth in math achievement between the kindergarten and 1st grade years. Their data concluded that less time on task was a factor of lower student achievement for Black children and students from lower SES groups. The researchers were able to quantify the extent to which "low achievers tend to get worse teachers" (p. 3061) in terms of time spent on instruction. As grave as the findings were regarding teacher quality and teacher practices, the researchers noted that these underlying causes of the achievement gap could readily be addressed by the schools.

Claessens, Duncan, and Engel (2009) and Lubienski, Robinson, Crane, and Ganley (2013) also used the rich *ECLS-K* dataset to analyze students' success in mathematics. Claessens et al. (2009) ran regression models to relate socio-emotional characteristics, early learning readiness, and 5th grade math achievement. The researchers found no ties between socio-emotional characteristics in the early school years to 5th grade math achievement. The researchers did find a strong relationship between early learning math skills and later math achievement, causing the researchers to conclude that early intervention for at-risk students was imperative in assuring high achievement in math in later school years. Lubienski et al. (2013) examined gender as a factor in math achievement. The study results were inconclusive; however, the *ECLS-K* dataset revealed stereotypical differences between boys' and girls' treatment in the home environment and inconclusive differences in teacher perception between boys and girls. The researchers suggested that teacher perception may have a bearing on a persistent math achievement gap between males (higher) and females.

Philips (2010) utilized the 1998-99 *ECLS-K* 1st grade data to ascertain the effectiveness of the No Child Left Behind "Highly Qualified Teacher" requirement. Even though the data studied were collected 4-5 years preceding the advent of the federal law, Philips was able to draw relevant conclusions about specific components of the law. Philips cited the law's focus on at-risk students (a major part of the study sample) and the data the *ECLS-K* provided regarding characteristics supported in the literature as central to teacher quality: certification, education, competency, and experience. Philips also noted the importance of using a national study such as the *ECLS-K* to conduct research with the underlying goal to better understand the impact of a national educational policy. The research study concluded that the NCLB requirement for a highly qualified teacher in every classroom did not sufficiently ensure that at-risk students would have a teacher who positively impacted their academic achievement to an extent sufficient to narrow the achievement gap.

Hair, Halle, Terry-Humen, Lavelle, and Calkins (2006) carried out two studies utilizing kindergarten *ECLS-K* data to identify student profiles, and predict 1st grade outcomes. Using cluster analysis, the researchers studied the interaction of "multiple dimensions" (p. 432) of children's development to identify student profiles based on child characteristics (e.g. gender, ethnicity, home language), as well as socioeconomic, socio-emotional, and health characteristics. These profiles were then applied to the students' 1st grade school performance measures. Results affirmed findings of previous studies that students with higher socieconomic status were more likely to be healthier, demonstrate higher levels of kindergarten readiness, and perform better in school in later years. The researchers advocated that child-find programs carried out by school districts in accordance with the Individuals with Disabilities Education Act (IDEA) to identify, locate, and evaluate children between the ages of birth and 21 years for possible special education needs were of the utmost importance for at-risk children in order to mitigate the effects of the profile characteristics.

Leak and Farkas (2011) analyzed the *ECLS-K* dataset to determine if kindergarten teacher characteristics had an effect on kindergarten student achievement. Specifically, the researchers considered three areas of teacher background: (1) whether or not the teacher possessed a master's degree; (2) number of courses the teacher had taken in math, reading, and child development; and (3) type of teacher certification: regular versus alternative; no certification versus highest certification. Findings on impact of teacher preparation were mixed, with neither teacher degree/credentialing nor teacher course preparation showed measures of any definitive impact on student reading and math achievement.

The *ECLS-K* Teacher Survey and Exploratory Factor Analysis

Teacher Beliefs, Attitudes, and Perceptions. Harman (1976) noted that factor analysis can be an exploratory tool "used to verify or modify theories through new experiments and new data subject to fresh analyses for purposes of clarifying or polishing previous formulations" (p. 6). The ECLS-K 5th Grade provides an unusual opportunity to explore data derived from teacher self-reporting. In order to fully understand the import of all that the ECLS-K 5th Grade data may offer, it is useful to review the literature regarding the significance of teacher factors. Such a review serves to provide research-based context for findings resulting from the exploratory factor analysis conducted in this study. Below is a brief review of the literature regarding teachers' beliefs, attitudes, and perceptions regarding their work.

Teacher beliefs. The importance of belief systems and the bearing that they have on the individual's real life experience have been well documented in the literature (e.g. Dewey, 1938/1997; Rotter, 1960; Bandura, 1986; Hoy & Miskel, 2013). Pajares (1992) made the case that teacher belief systems shape teachers' knowledge of their craft and, therefore, are a legitimate and necessary subject of educational research. Pajares stated:

> Researchers have learned enough about specific types of beliefs to make their exploration feasible and useful to education. Self-efficacy, for example, is a cornerstone of social cognitive theory. Self-concept and self-esteem are the essence of phenomenological and humanistic theories. (p. 308)

Nespor (1985) was one of the first researchers to study the dialectical relationship between teachers' beliefs and teaching practices. Nespor posited that teachers' practices should be considered in the light of the teachers' own goals, not the a priori goals most often set for them by school leadership. Nespor further maintained that these goals were a manifestation of the teachers' beliefs. A better understanding of teachers' belief and knowledge systems, Nespor explained, enabled school leaders to build upon or replace existing belief and knowledge systems in an effort to improve teacher effectiveness. Nespor carried out case studies of eight teachers with the goal of ferreting out their beliefs about teaching, students, school administration, and community. Written as narratives, the case studies detailed the teachers' classroom practices. Regular interviews with the teachers enabled the researcher to describe in detail the teachers' rationale for those practices. Through the course of the interviews, the teachers were also forthright in identifying their motivators, as well as strengths and limitations regarding their teaching abilities. Utilizing a complex griding and interview process, Nespor identified Subject Matter Conceptions, Career Path, and Teaching Experience as three categories of teacher beliefs that were central to teaching practice.

Yilmaz, Altinkurt, and Cokluk (2011) developed the *Educational Belief Scale* to determine the educational beliefs of current and prospective teachers. In the pilot phase, the researchers administered the scale to 480 teachers and prospective teachers. Ultimately, 459 cases were analyzed using exploratory factor analysis. The researchers carried out validity and reliability studies which supported the use of the scale. The researchers maintained that use of the scale would serve to fill a void in an important aspect of educational research: teachers' and prospective teachers' belief systems.

Teacher job satisfaction. Sergiovanni's (1966) study of teacher job satisfaction consisted of interviews with 71 elementary and secondary teachers who were asked to provide information about their most memorable and the most recent high and low point experiences in the workplace. Data were analyzed utilizing Herzberg's a priori approach (Herzberg, Mausner, & Snyderman, 1959/2008). The results of Sergiovanni's study supported Herzberg's finding that job factors are either satisfiers or dissatisfiers. For teachers, Sergiovanni concluded, factors relating to the work itself led to job satisfaction. Factors related to the conditions of work were found to be dissatisfiers. The methodology of the Herzberg and Sergiovanni studies were based on the assumptions that research participants could self-report accurately their level of feelings about an incident, they could recall events accurately, and they could be truthful (Hoppock, 1935/1970; Sergiovanni, 1966).

Components and predictors of job satisfaction. Numerous studies have demonstrated a significant and negative relationship between job satisfaction and employee turnover (e.g., Harrison, Newman, & Roth, 2006; Judge, Bono, Thoresen, & Patton, 2001; Liu & Ramsey, 2008; Mueller, Boyer, Price, & Iverson, 1994). Therefore, in order to institute practices and policies that positively impact teacher retention, it is useful to analyze the components and predictors of job satisfaction as they are revealed through the research.

Butt, Fielding, Gunter, Rayner, and Thomas (2005) found in a review of the literature that the "main contributors to high levels of teacher job satisfaction are working with children… intellectual challenge…and employee autonomy and independence. Dissatisfaction with teaching was often linked to high workload, low levels of pay, and poor job status" (p.456). Based on the results of their two-year study regarding teacher workload, Butt et al. recommended reform measures. In seeking to find answers, Butt et al. noted that many more questions were raised regarding satisfiers and dissatisfiers. Finding no clear relationship between lessening work load and increased teacher job satisfaction, Butt et al. acknowledged that addressing the hygiene issue of workload was not enough. The researchers posited that unclear results may have been partially due to the fact that educators participating in the study demonstrated differences in the ability to problem solve and the ability to respond to the need for change. The complexity of the findings spoke to the continued need for a research-based consideration of teacher job satisfaction in order to better determine predictors.

More recently, results from the 2012 MetLife Survey of the American Teacher (Met Life Foundation, 2013) revealed a 23-point drop in teacher job satisfaction since the last survey was administered in 2008. Factors attributed to the decline included low salary, less time for collaboration, and less resources due to declining school budgets. Dissatisfied teachers were more often working in high-need schools and reported high levels of stress.

Teacher attitudes and demographic variables. Teacher roles, demographic traits, and environmental aspects of teachers' work have been of interest to researchers when studying conditions of the workplace. Ellis and Bernhardt (1992) reported a gender discrepancy, with female teachers attributing more significance to their chosen career than male teachers. Female teachers were also more satisfied than their male counterparts with the level of feedback received regarding the effectiveness of their teaching. Ma and MacMillan (1999) investigated teacher job satisfaction in light of teacher background. Their findings on the gender gap were consistent with previous studies in that female teachers were more satisfied with their profession than male teachers. Job satisfaction of male teachers was much more influenced by the organizational culture of the school than that of female teachers.

Demographic research by Bolin (2007) also supported the finding that male educators demonstrated less job satisfaction than female educators. Additionally, Bolin found that a survey of the literature “largely concluded that the degree of job satisfaction increases with age” (p. 50). In their study of over 2000 elementary school teachers, however, Ma and MacMillan (1999) found a negative relationship between job satisfaction and years of teaching experience; teachers who were in the profession longer found less professional satisfaction in their jobs. The qualification for these contradictory findings may be in the observation made by Huberman, Grounauer, and Marti (1993) that experienced teachers follow one of two paths: either proactive and comfortable in the profession or immersed in self-doubt and restrained within the profession.

Using national data from the 1999 - 2000 Schools and Staffing Survey (SASS) (Gruber, Wiley, Broughman, Strizek, & Burian-Fitzgerald, 1999-2000), Strunk and Robinson (2006) found that teachers in specialized subject areas were more likely to be dissatisfied. The working conditions and stress level of special education teachers were the focus of a job satisfaction study by Stempian and Loeb (2002). They found that the retention rate among new teachers was significantly lower for special education teachers than general education teachers, 89% compared to 94% respectively.

Shann (1998) found that student progress was a factor in determining job satisfaction or dissatisfaction among general education teachers, specifically urban middle school teachers. Ellis and Bernhardt (1992) noted that teachers who worked in lower socioeconomic districts were “significantly less satisfied with the challenge of their jobs than were their colleagues in both high and average socioeconomic districts” (Findings section, para. 3). Loeb, Darling-Hammond, and Luczak (2005) reported, however, that the effect of student characteristics on job satisfaction was sharply reduced when poor working conditions (e.g., condition of facility, class size, overcrowding, lack of textbooks, access to technology and salary) were factored into their study.

Zhang, Verstegen, and Kim (2008) researched the relationship between teacher salary, job satisfaction, and teacher retention using SASS data. Consistent with results regarding other aspects of teacher work conditions, years of teaching experience was found to be a consideration when examining the results of the study. Earlier research by Kelly (2004) demonstrated that salary had a temporal effect on retention, the effect being stronger in the early years of a teacher’s career. Zhang et al. found that teacher salary was the second best predictor of teacher job satisfaction. The strength of the relationship varied depending on years of teaching experience: comparatively, teachers with 5 or less years of teaching experience were less likely to regard low teacher salary as a dissatisfier. For teachers 50 years or older the association between job satisfaction and salary was weaker than for those younger than 50. For all teachers, salary and job satisfaction maintained a significant degree of association.

Efficacy. An individual’s belief about his or her ability to accomplish specific tasks or responsibilities is the basic definition of perceived self-efficacy; this perception influences how one thinks and acts (Bandura, 1998). Indeed, the work of social theorist, Albert Bandura, has proven valuable in the study of the variables of teacher satisfaction, specifically teacher efficacy and response to the work environment (e.g., Caprara, Barbaranelli, Vorgogni, & Steca, 2003; Hoy & Woolfolk, 1993; Taylor & Tashakkori, 1995). Building on Rotter's (1960) constructs of locus of control and expectancy is Bandura's social cognitive theory which examines the importance of the cognitive self-regulative process. Social cognitive theory is predicated on the idea that people are "producers as well as products of social systems" (Bandura, 2001, p.1). Bandura developed the concept of *human agency* and its characteristics of *intentionality, self-regulation, self-reflection*, and *forethought.*

Intentionality, Bandura (2001) explained, is "grounded in self-motivators affecting the likelihood of actions at a future point in time" (p.6). As the defining characteristic of human agency, Bandura pointed out that the concept of intentionality does not prevent unforeseen consequences resulting from intentional actions at the expense of desired outcomes. Bandura's theoretical construct of self-regulation sheds light on an important aspect of the human condition: goal setting. Of goals, Bandura (2001) stated:

> Goals rooted in a value system and a sense of personal identity, invest activities with meaning and purpose…By making self-evaluation conditional on matching personal standards, people give direction to their pursuits and create self-incentives to sustain their efforts for goal attainment. (p. 8)

The construct of forethought is a temporal aspect of goal setting in that determining a future desirable state serves as a motivator of current actions. When the individual's thinking and actions are corroborated by the realization of desired results, feelings of self- efficacy are developed and reinforced.

Collective efficacy. Acknowledging the power of human interdependency, Bandura (2000) extended his concept of efficacy to include collective efficacy, of which he stated:

> Perceived collective efficacy is not simply the sum of the efficacy beliefs of individual members. Rather, it is an emergent group property. People's shared beliefs in their collective efficacy influence the types of futures they seek to achieve through collective action, how well they use their resources, how much effort they put into their group endeavor, and their staying power when discouragement that can beset people taking on tough social problems. (p. 76)

Lee, Zhang, and Lin (2011) explained that collective efficacy is associated with self-efficacy, though collective efficacy is a school level variable, not an individual variable. The concepts of self-efficacy and collective efficacy become useful in better understanding the relationship between teacher belief systems and teacher effectiveness. Collective efficacy, according to Bandura (1999), is guided by the school's leadership. His studies measured collective efficacy using two methods, aggregating teachers' level of efficacy in their own classrooms and measuring teachers' beliefs in the schools capability as a whole. Bandura found that school demographics affect teachers' sense of collective efficacy. His research revealed a weaker sense of collective efficacy in schools plagued by poverty, absenteeism, and high transient rate.

Teacher autonomy. Teacher autonomy is defined as the "degree to which (teachers) can make autonomous decisions regarding what they teach to students and how they teach it" (Glossary and Great Schools Partnership, 2015, para. 1). Kreis and Brockopp (1986) found that there is a significant relationship between teachers' perception of autonomy and job satisfaction. They qualified the conclusion noting that teachers, for the most part, limit expectations of autonomy to the classroom level, deferring to administrative autonomy at the school level. Kim and Loadman (1994) identified professional autonomy and challenge as necessary components of teacher job satisfaction. Pearson and Moomaw (2005) surveyed 300 teachers to gather data regarding the relationship between curriculum autonomy and general autonomy to teacher job stress, job satisfaction, and professionalism. Curriculum autonomy was defined as the ability to make one's own decisions regarding the selection of teaching materials and instructional planning. General autonomy was defined as the ability to set one's own standards for classroom conduct and the ability to engage in independent decision making regarding the work of teachers. The Teaching Autonomy Scale (TAS) was utilized as the study instrument. Investigation results affirmed the hypotheses that curriculum autonomy was correlated with a decrease in job stress, and general autonomy was positively correlated with professionalism and empowerment.

Factor Analysis

Factor analysis is commonly used in social science research to study and define constructs. As Tucker and McCallum (1997) explained, constructs are considered to be internal attributes that assist in describing observed phenomena. Rummel (1970) elaborated on the usefulness of factor analysis for social science research and the study of complex human behavior. He noted the flexibility of factor analysis as demonstrated by the varied types of research design and data that it could accommodate. Additionally, he explained the utility of factor analysis across many types of research designs. Factor analysis provides a mathematical basis to support both deductive and predictive conclusions. Rummel explained the significance of the mathematical foundation:

> Factor analysis has a geometrical representation that allows for the visual portrayal of behavioral relationships. It allows for building physical models of social reality that can be studied in abstraction from the equations underlying them…These geometric representations make it feasible to discuss and perceive relations and theory in a way not possible with equations alone. (p. 4)

As a mathematical, analytical tool, factor analysis is used to identify social constructs based on assessment results. Factor analysis can provide empirical data to support constructs, to identify concepts, and to reduce large datasets to answer the question, *What are the factors that underlie the items under consideration?*

The social science researcher must make decisions related to methodology that include instrumentation, subjects, and analysis. Factor analysis is a powerful method to establish a well-grounded assessment instrument. Mertler and Vannatta (2010) provided a working definition of factor analysis:

> Factor analysis is a procedure used to determine the extent to which…shared variance – exists among a set of variables. Its underlying purpose is to determine if measures for different variables are, in fact, measuring something in common…[it] is essentially a process by which the number of variables is reduced by determining which variables cluster together, and factors are the groupings of variables that are measuring some common entity or construct. (p. 233)

Mertler and Vannatta (2010) addressed the lexicon of factor analysis; they noted that there are many types of factoring (rotation of factors), with principal component analysis and common factor analysis being the most often used methods for analyzing relationships among the variables (factors). Factor analysis also denotes the "*general* process of variable reduction, regardless of the actual method of extraction utilized" (Mertler & Vannatta, 2010, p. 233).

The genesis of factor analysis as a data reduction tool is generally considered to begin with the work of Spearman in 1904 (Harman, 1976); Spearman, the "father of factor analysis" (p. 3), developed a method for mathematic modeling of the underlying psychological theories of the phenomenon of intelligence. Initially, Spearman posited the existence of a single common factor that evolved into a two-factor theory. However, over time, the two-factor theory came to be regarded as limited in the analysis of the results of psychological testing as researchers began to understand that an instrument often had multiple dimensions.

Over the next few decades, concepts related to factor analysis were developed and expanded to many applications. In 1947 the social scientist L. L. Thurstone developed the concept of a matrix of correlational factors that could be used "as a basis for determining the number of common factors" (Harman, 1976, p. 4). Harman noted, "The matrix formulation of the problem has greatly facilitated further advances in factor analysis" (p. 4). This approach has enabled researchers to study multiple dimensions within instruments. Thurstone conceptualized the construct of *simple structure* that led to a universally accepted objective of factor analysis as that of "a parsimonious description of observed data" (Harman, 1976, p. 5).

Rummel (1970) explained the role of parsimony in the construct of simple structure conceived by Thurstone:

One major goal underlying the use of simple structure is to make our

> model of reality as simple as possible. If phenomena can be described equally well using fewer factors, then the principle of *parsimony* is that we should do so. Simple structure maximizes parsimony by transforming from a solution accounting for the variance of a variable by several factors to a solution accounting for this variance by one, or at most two, factors. (p. 381)

Another major contribution by Thurstone was his refinement of the concept of rotation of factors. He developed the construct of invariant factors which are defined by marker variables across multiple groups of subjects. Such factors, emerging from simple structure rotation, enable social science researchers to make comparisons across various groups.

A review of the literature emphasizes the complexity of the decisions that must must be made during the factor analysis process and the methodological issues that arise when poor decisions are made (Fabrigar, Wegener, MacCallum, & Strahan, 1999; Henson & Roberts, 2006; Schmitt, 2011). Citing Reise, Waller, and Comrey (2000), Ryan (2013) noted that the literature clearly established five components of factor analysis that must be responsibly addressed in the planning and reporting of factor analysis procedures in order to counterbalance the subjectivity inherent in the factor analysis process: (1) factor model and estimation method; (2) sample size; (3) factor extraction; (4) rotation criteria; and (5) factor retention. Each component is discussed in further detail below.

Factor models and estimation methods. Varied approaches to factor analysis are available and easily accessible with modern computers. However, for the purpose of this discussion only principal components analysis and common factor analysis are presented. At a fundamental level, both analyze correlations among the variables.

Principal components analysis. Principal components analysis (PCA) is a commonly used method of factor extraction which considers both common variance and error variance, analyzing unique, shared, and error variability. Principal components analysis provides one or more uncorrelated variables (factors) that account the largest part of the variance in the original items (Joliffe, 2002). The PCA process provides weighted values for various items in an attempt to maximize the amount of variance that can be accounted by those factors. Thus, the resulting factors are linear transformations of the original variables. Mathematically, these factors are based on the actual items and, thus, can be mapped back to specific items.

Mertler and Vannatta (2010) cited three uses of PCA: (1) to determine the underlying constructs that account for the preponderance of variability within a set of variables; (2) as a precursor to multiple regression to reduce the number of predictors; and (3) to reduce the number of variables for a MANOVA. Factor analysis is a data reduction technique; specifically, factor analysis provides a method to move from a large number of items to a set of subscales (factors). Williams, Brown, and Onsman (2010) stated that PCA is the analysis of choice when “no priori theory or model exists” (p. 6). Tabachnik and Fiddell (1989) explained that PCA is commonly used as a “preliminary extraction technique” (p. 623), which is then followed by the use of other factor extraction procedures.

Common factor analysis. Common factor analysis (CFA) provides one or more variables (factors) that account for the variance in the original set of items. However, CFA attempts to relate the items to underlying theoretical concepts. This approach considers only common variance without error variance. Error variance is defined as the variance that exists due to chance factors, such as sampling error (Mertler & Vannatta, 2010). An assumption is made with CFA that relationships among variables reflect both shared and unique underlying factors (DeCoster, 1998). The results are not linear combinations of the original variable; the results are generally curvilinear (quadratic functions of the original variable).

There are two general purposes for common factor analysis: exploratory and confirmatory. According to Tabachnick and Fiddell (1989), exploratory factor analysis (EFA) is a procedure used to organize a set of data by grouping correlated variables without a predetermined set of underlying structures. Underlying structures are determined by the groupings that empirically emerge from the data analysis. The use of EFA is most purposeful at the outset of a research process where the findings can be used "for generating hypotheses about underlying processes" (Tabachnick & Fiddell, 1989, p. 599). Gorsuch (1974) clarified the usefulness of EFA, noting that the value of exploratory research is only realized if results are followed by subsequent research to test the validity of formulated hypotheses.

Confirmatory factor analysis (CFA) is a more refined process than EFA in that CFA requires carefully crafted predictions for the purpose ofhypothesis testing. Unlike EFA, CFA is used during the latter stages of research in order to test a posited theory regarding latent processes; CFA can also be used to test a hypothesis of latent processes between groups of subjects (Harman, 1976; Tabachnick & Fiddell, 1989). Confirmatory factor analysis is useful in establishing the validity of a factor model or a specific factor loading (DeCoster, 1998). Williams, Brown, and Onsman (2010) summarized the differences between EFA and CFA:

> Broadly speaking EFA is heuristic. In EFA, the investigator has no expectations of the number or nature of the variables…(it) is exploratory in nature…it allows the researcher to generate a theory…in CFA the research uses this approach to ***test*** a proposed theory…(p. 3, para. 1)

Sample size. In an examination of the similarities and differences between principal component analysis and exploratory factor analysis, Suhr (2005) explained the nature of each as a variable reduction technique. Principal components analysis "is used when variables are highly correlated" and "reduces the number of observed variables to a smaller number of principal components which account for most of the variance of the observed variables" (Suhr, 2005, p. 1). In contrast, exploratory factor analysis, according to Suhr, seeks to measure latent (unobserved) constructs (components) and hypothesizes underlying constructs that are not measured directly. Suhr noted that the PCA and EFA reduction procedures are similar in that the factors derived from each increase in stability with a large sample size.

Loo (1983) noted that the advent of computerized statistical analysis and packaged computer programs has resulted in an increased number of poorly designed factor analysis studies. A common weakness of such studies, according to Loo, was the lack of consideration for adequate sample size to ensure reliable factors. A larger sample size, Loo explained, was necessary to minimize the effect of outliers and produce a more stable factor structure. Loo indicated that a sample size of 200 was reasonable to optimize results.

Guadagnoli and Velicer (1988) conducted research to establish the effect of sample size on the reliability of the factor loadings. They found that components with four or more items with factor loadings of .60 were reliable without regard to sample size; components with 10 or more loadings of .40 could be considered reliable with a sample size greater than 150. Components with only low loadings could only be considered with a sample size of 300. Though such specificity is helpful, Hetzel (cited in Stapleton, 1997) warned against strict adherence to such guidelines as the decision to retain factors ultimately requires careful consideration and judgment:

> Regardless of the rules eventually used, when considering the number of factors to retain, it is important for the researcher to remember the advantages and limitations of the various decision rules and to make a subsequent decision in a thoughtful and well-reasoned manner, based on the nature of the analysis. (p. 6)

De Winter, Dodou, and Weiringa (2009) pointed out that exploratory factor analysis requires a large sample size, with $N = 50$ as a minimum. The researchers posited that absolute norms for sample size needed to be established and followed. Tabachnik and Fiddell (1989) argued that larger sample sizes are more reliable; a sample size of 300 is considered good and a sample size of 1,000 considered excellent. Osborne and Fitzpatrick (2012) emphasized that EFA results can be unstable even with datasets that are characterized by a strong factor structure; they posited that a large sample size, combined with strong factor loading and communalities, enhances the integrity of the EFA.

Fabriger et al. (1999), however, posited that guidelines for sample size are not as useful as consideration of the number of measured variables representing each common factor and the presence of high communalities. With three to four variables for each factor and communalities with an average of .70 or higher, sample sizes could be as low as 100. Thus, there is some disagreement among researchers regarding the relationship between sample size and the number of variables.

Factor extraction. Factor extraction serves to remove variance found among clusters of variables from the original matrix of association. Numerous approaches to factor extraction have been developed over the years. Typically, a step-wise procedure is used; this is commonly associated with the correlation matrix of the variables. Once the common variance for the first cluster of variables (factor one) is removed, the process is repeated until there are no longer factors remaining to explain the variance among the residual variables (Henson & Roberts, 2006). The most commonly employed methods for factor extraction are principal components, principal axis factoring, image factoring, maximum likelihood factoring, alpha factoring, unweighted least squares, and generalized least squares (Tabachnik & Fiddell, 1989). With the exception of principal components, the following extraction methods seek to ascribe additional meaning to a set of factors through the application of transformation processes. Characteristics of each method are briefly discussed below.

Principal component, principal axis factoring, and image factoring. Some researchers have argued that principal components analysis (PCA) is not a factor extraction technique. Henson and Roberts (2006) stated, "…PCA is intended to simply summarize many variables into fewer components, and the latent constructs (i.e., factors) are not the focus of the analysis" (p. 398). However, Thompson and Daniel (1996) cited instances when it is a useful alternative. Field (2009) advised that the choice of extraction method for EFA is dependent on whether the data will be utilized in a descriptive or inferential manner. Principal axis factoring (PAF) is the most common extraction method in exploratory factor analysis. PAF is characterized by a correlation matrix that produces communalities on the diagonal. The communalities are used as an estimate of the reliability of variables in relation to a specific factor solution (Clark, 2015). Image factoring focuses on common parts of the data in contrast to variance among the data. This commonality is visualized as a vector space. Rummel (1970) explains, “The common parts of the data are defined as the regression estimates of each variable regressed on all the others…What is factor analyzed is the covariance matrix of the regression estimates. These estimates form a a delimitable vector space for which the image factors can be determined” (p. 114). Principal components analysis, principal axis factoring and image factoring assume that the sample is the population; therefore, interpretation of results is limited to a description of the given sample unless analysis is carried out with different samples and provides the same factor organization (Field, 2009). According to Field (2009), principal components analysis and principal axis factoring are the most desirable extraction methods and provide similar solutions. Fabrigar et al. (1999) recommended principal components factoring in cases where the assumption of normality of the dataset (normal distribution of the variables) was in question, and the determination of component structure was sought.

Maximum likelihood and alpha factoring. Maximum likelihood and alpha factoring are two additional methods for factor extraction. Maximum likelihood is a statistical-based method of factor analysis that utilizes the formulation of a hypothesis regarding the number of common factors. Differences between the correlations among the observed variables and the hypothetical values of the sample are considered (Harman, 1976). Maximum likelihood utilizes a goodness of fit model with a variety of indices while also providing for significance testing of factor loadings and correlations among the factors. Additionally, maximum likelihood provides confidence intervals for these loadings and factors (parameters). Fabrigar et al. (1999) stated of maximum likelihood, "A limitation…is the assumption of multivariate normality. When this assumption is severely violated, this procedure can produce distorted results" (p. 277).

Alpha factoring, developed by Kaiser and Caffrey (1965), is a psychometric-based method of factor analysis that assumes randomly sampled variables. Alpha factoring maximizes the generalizability of non-correlated factors, but is likely to produce communalities larger than 1. Maximum likelihood and alpha factoring are based on the premise that participant selection has been randomized, but each method assumes that the variables of interest constitute the full population of possible variables. For this reason, results can only be considered applicable to the variables present in the study (Field, 2009).

Generalized least squares and unweighted least squares. Two final methods for factor extraction are generalized least squares and unweighted least squares. Both are regression processes. Generalized least squares (GLS) is a factor extraction method whereby the inclusion of *prior information* regarding components of interest sets up a hypothesis testing (weighted) approach to determine model parameters (Menke, 2015). Unweighted least squares (ULS) is a factor extraction method that minimizes the squared residual correlations and provides communalities in the solution. With ULS there are no *a priori* assumptions made about the data except for equality of variance (Tellinghuisen, 2014).

Factor rotation. Factor rotation is a procedure which enables researchers to strategically consider all the solution alternatives suggested by the factor analysis process in order to identify the best solution. Factor rotation is based upon the mathematical representation of factors as axes upon which variables are plotted. A cluster of variables in proximity to an axis indicates the loading. Axes are rotated to maximize their association with groups of variables. There are two types of factor rotation: orthogonal and oblique. Orthogonal factor rotation extracts factors such that their axes are maintained mathematically independent at 90 degrees. Orthogonal rotation results in no correlation among the factors. In contrast, oblique rotation is not contingent upon mathematical independence by means of axes at 90 degree angles, thereby allowing the extent of factor correlation to be determined. Oblique rotation results in correlated factors.

The computer programs for both types of factor rotation produce a loading matrix of which Hair, Jr., Black, Babin, and Anderson (2010) stated, “The objective of all methods of rotations is to simplify the rows and columns of the factor matrix to facilitate interpretation” (p. 115). Simplification is achieved when as many of the loadings as possible are close to 0, limiting the number of high loadings.

There are three methods of orthogonal rotation: varimax, quartimax and equamax. Varimax is a rotation of the factor axes to maximize the variance of the squared loading of a factor on all the variables in a factor matrix. Varimax simplifies the interpretation of the factors (Stenson & Wilkinson, 2012). Quartimax rotation minimizes the number of factors needed to explain each variable and simplifies the interpretation of the observed variables. This approach involves the maximization of fourth powers of factor loadings; hence, the term *quartimax* (Harman, 1976). Equamax is a combination of the varimax method (simplification of factors) and the quartimax method (simplification of variables). Of the three methods, varimax is the most commonly utilized.

The two methods of oblique rotation are direct oblimin and promax. Direct oblimin rotation simplifies factors by minimizing cross products of loadings. Promax rotation, the most commonly used oblique method, rotates orthogonal factors to oblique positions. Hendrickson and White (as cited in Rummel,1970) proposed the promax technique whereby the orthogonality of the factors in a varimax solution were relaxed to fit simple structure.

Mertler and Vannatta (2010) recommended the use of orthogonal rotation over oblique rotation; they reasoned that the primary objective of factor analysis is to identify disparate factors that “represent some *unique* aspect of the underlying structure (p. 238)” which correlated factors do not provide. Van de Geer (1971) stated of the oblique system of rotation: “The…procedure tends to produce solutions with small angles between factors. This is an unfortunate result, because it tends to confuse factors and runs counter to parsimony (p. 154).” Field (2009) explained that oblique rotation should be used in cases where there is a theoretical basis for positing that there is a relationship between the factors; otherwise, an orthogonal rotation should be utilized to more easily identify and understand a factor structure.

Factor loadings. A challenge in the application of factor analysis is the identification of the factors based on the associated variables. Factor analysis provides *factor loadings*, which Gorsuch (1974) defined as, "A measure of the degree of generalizability found between each variable and each factor" (p. 2). Specifically, a factor loading is the Pearson correlation coefficient between a variable and a factor. The coefficients (factor loadings) between multiple variables and factors are represented on the factor matrix, with variables expressed in the rows and factors in the columns. Variables will load on many factors but, most commonly, will only load strongly on one factor (Mertler & Vannatta, 2010). Factor loadings range in value from -1.00, indicating a perfect negative association, through 0 to +1.00, which indicates a perfect positive association (Mertler & Vannatta, 2010). Loadings are determined to be high (strong factor association with a variable) or low (weak factor association with a variable). Tabachnick and Fiddell (1989) recommended a minimum factor loading of .32. Cross loadings were defined by Costello and Osborne (2005) as items that load at .320 or higher on more than one factor (component).

Interpretation of the significance of factor loadings is made more complex because, for the most part, variables will all load on the most important factor and least on the least important factor (Field, 2009); however, this is not always the case. For this reason, factor rotation is a valuable tool in the process of discrimination between factors and serves to improve the interpretation process by maximizing high correlations and minimizing low correlations (Tabachnick & Fiddell, 1989). Comrey and Lee (cited in Huber, Horn, & Martin, 2008) presented a scale that is commonly used to determine loading quality. Loadings of

- .71 (50% overlapping variance) are considered excellent;
- .63 (40% overlapping variance) are considered very good;

- .55 (30% overlapping variance) are considered good;
- .45 (20% overlapping variance) are considered fair;
- .32 (10% overlapping variance) are considered poor (Huber et al., 2008, p. 17).

Simple structure. Factor analysis is a complex mathematical approach for data reduction of a large dataset. Fabrigar et al. (1999) explained the enormity of the task in factor analysis:

> For any given solution with two or more factors…, there exists an infinite number of alternative orientations of the factors in multidimensional space that will explain the data equally well…a researcher must select a single solution from among the infinite number of equally fitting solutions. (p. 13)

Simple structure, first posited by Thurstone (1947), is the accepted guiding principle used during the implementation of the factor rotation process. Thurstone proposed five criteria of *simple structure*:

1. Each variable should produce at least one zero loading on some factor.
2. Each factor should have at least as many zero loadings as there are factors.
3. Each pair of factors should have variables with significant loadings on one and zero loadings on the other.
4. Each pair of factors (4 or more) should have a large proportion of zero loadings on both factors.
5. Each pair of factors should have only a few complex variables (loadings of .30 or higher on more than one factor).

The process of factor rotation facilitates the achievement of simple structure. The rotation procedure makes the pattern (loadings) more interpretable by increasing the number of loadings with Pearson correlations near -1, 0, or 1.

Factor retention. The decision-making processes of factor extraction and factor rotation are followed by establishing the number of factors to retain. The researcher must decide which of the identified factors should be brought forth for further analysis and determine the best solution. Henson and Roberts (2006) stated:

> Given that the goal of EFA is to retain the fewest possible factors while explaining the most variance of the observed variables, it is critical that the researcher [retain] the correct number of factors because this decision will affect results directly. (p. 398)

Hayton, Allen, and Scarpello (2004) emphasized that the criteria for factor retention must be carefully considered in exploratory factor analysis due to the lack of an a priori theoretical basis to assist in determining the type and number of factors to be retained. Too many or too few factors could cause serious errors, particularly in the instance of fewer factors causing false loadings.

Cattell (1952) and Kaiser (1960) studied problems associated with determining the number of relevant factors necessary to account for the variability within a set of data. Both researchers based their recommendations on the eigenvalues. Eigenvalues provide an indication of the amount of variation in the total sample accounted by each factor; it follows that the magnitude of the eigenvalue provides a method to determine the number of factors to consider (Rummel, 1970; Harman, 1976). For example, consider a set of data with 25 items and a factor with an eigenvalue of 10. This eigenvalue factor would account for 40% of the variance in the dataset (10/25=40%). The magnitude of the eigenvalue reflects the relative importance of each factor. Factors with large eigenvalues account for relatively large amounts of variance, while factors with small eigenvalues account for little explained variance. As a result, factors with small eigenvalues can be ignored.

Approaches put forth by Kaiser (1960) and Stevens (1992) provided guidelines for determining the number of factors to retain. “Kaiser’s Rule” determined that those factors with an eigenvalue higher than 1 should be considered and studied. Cattell (1952) analyzed the number of factors to be considered; he developed a plot of the eigenvalues, which he called a “scree plot.” The scree plot provides a graphic representation of the relative magnitude of eigenvalues. Cattell maintained that factors should not be considered after the plotted curve leveled off. Stevens (1992) stipulated that factors to be retained needed to account for at least 70% of the variability.

Citing a serious reliability deficit with Kaiser’s rule and concerns regarding the subjectivity of the scree plot, Fabriger et al. (1999) considered parallel analysis (PA), first formulated by Horn (as cited in Fabrigar et al., 1999), as a reliable method to determine factor retention. They prescribed a comparative process using eigenvalues of a random sample to carry out PA. In this process the largest sample eigenvalues of the reduced correlation matrix are compared with eigenvalues generated from random data based on similar sample size and similar number of variables. Only the eigenvalues larger than the random data eigenvalues are retained. Mertler and Vannatta (2010) posited that the criterion of *assessment of model fit* would serve well in establishing the number of components to retain and interpret. This model is predicated on the consideration of all other available models while maintaining the principle of parsimony (Rummel, 1970) at the forefront of decision making,

Philosophical foundations of common factor analysis. Harman (1976) referred to an era when psychologists ascribed a “mystique” (p. 5) to the exploratory nature of factor analysis. Though contemporary researchers approach common factor analysis in a purely scientific, non-mystical manner, the philosophical foundations of factor analysis are acknowledged in the literature. Mulaik (1987) posited that the researcher who employs factor analysis is exercising “fundamental philosophical assumptions” (p. 268). The interplay between observed and latent variables, the cornerstone of common factor analysis, has its basis in the development of human thought, which Mulaik detailed. The Greeks pondered the phenomenon of appearance versus the unobserved reality in their philosophy of monism, all are made of one element. Mulaik stated, “thus from the Greek rationalists and atomists we have the idea that what is real is different from what appears to us” (p. 269).

Induction, the process of formulating a theory from a series of observations, and deduction, the process of reaching a specific, logical conclusion from a formulated hypothesis, have served as the basis of philosophical reasoning for millennia. Aristotle’s scientific method established hierarchically organized systems utilizing both inductive and deductive reasoning. Bacon and Descartes reflected on a problem-solving method based on both intuition and deduction. Mulaik explained, “Intuition is the analytic operation of reason. By intuition one breaks a problem down into simpler components until one is then able to see clearly and distinctly what these components are” (p. 275). Descartes formulated the use of hypotheses into a “universal method of analysis and synthesis” (p.277) which Mulaik connected to the practice of factor analysis: “In factor analysis we seek to breakdown observed variables and their interrelations into the effects of linearly independent, latent, component variables." Modern thinking regarding analysis and synthesis, Mulaik posited, was furthered by the contributions of Locke, Berkeley, Hume, and Kant. Among many other aspects of their tenets, each lent their greatest thinking to the phenomenon of the observed and the latent, fundamental concepts of common factor analysis.

Haig (2005) advocated for common factor analysis as "a method for generating rudimentary explanatory theories" (p. 304). In addition to the preservative nature of deductive reasoning and the ampliative nature of inductive reasoning, Haig sought to bring to the fore of scientific methodology the utility of abductive reasoning, defined as "reasoning from factual premises to explanatory conclusions" (p. 304) or from hypotheses that are "worthy of further pursuit" (p. 306). Abduction, according to Haig, has its roots in Aristotle's reasoning theories, but was forwarded by the American philosopher and scientist Charles Sanders Pierce. Haig suggested that Pierce's loosely-defined, existentialist schemata of abduction could be modified such that its relevancy would be widely accepted by the modern scientific community. Haig posited that "our conceptions of the latent factors of (common factor analysis) come to us through existential abductions" (p. 308).

Practical applications of common factor analysis. There are many practical applications of factor analysis, particularly in the social sciences. Exploratory and confirmatory factor analysis are commonly used in the areas of psychology and education, especially for those researchers interested in the measurement of personality and intelligence (Rummel,1970; Tabachnick & Fiddell, 1989; Williams, Brown, & Onsman, 2010). Rummel (1970) provided an extensive categorical bibliography of social science applications which he called “the first of its kind” (p. 523). These general categories were Methodological, Political Units, Social and Economic Groups, Processes, Behavior, and Natural Sciences. Citing their ubiquity, Rummel purposely omitted a listing of psychological studies. The bibliography included the goal, data source, data slice (type of factor analysis), model and technique and study results. Social applications cited in the bibliography ran the gamut from the study of political peacekeeping efforts to ethnographic studies to mass media.

The bibliography included studies published between the years 1927 to 1967. In the Methodological section of his bibliography Rummel (1970) described 31 studies which, he noted, were “primarily concerned with the methodology of factor analysis and not with substantive results” (p. 524). Pioneers of factor analysis were present among the Methodological studies, including Spearman, Thurstone, Cattell, and Fruchter. The bibliographic section, Politicial Units, included the following subdivisions: Nations, Tribes and Cultural Groups, Intermediate Political Units, and Urban Areas. Banks (cited in Rummel, 1970) used component factor analysis and orthogonal rotation to group nations according to their political characteristics. Banks’ results indicated five nation profiles: polyarchic, elitist, centrist, personalist, and traditional. Gouldner and Peterson (cited in Rummel, 1970) utilized component factor analysis and orthogonal rotation to identify dimensions common to primitive societies: lineality, sex dominance, technology level, and norm-sending. Social applications of factor analysis included a study by Weiss and Pasmanick (cited in Rummel, 1970) which examined fifty questionnaire items to determine the dimensions of individual and group goals. The dimensions found were judgment, drive, individual versus group goals, and cooperation-conflict.

Outside of the social sciences, Raven (1994) cited the paucity of literature of the application of factor analysis in empirical research, specifically agricultural education research. He sought to determine the level of use of factor analysis in the field over a 5-year period; how was factor analysis utilized and what results were presented? Raven reviewed 402 articles in refereed agricultural journals and found 22 (5.5%) had incorporated factor analysis in the research design. He concluded that the vast majority of researchers did not use factor analysis as an analytic tool, as evidenced by the lack of specificity in the reporting of key elements of factor analysis research design, such as factor model, rotational method, and factor loading decision making. Raven conjectured that inadequate sample size might have been a reason for under use of factor analysis. He also noted that poor research reporting made replication of the agricultural studies difficult.

Williams, Onsman, and Brown (2010) published a "five-step guide for novices" (2010, p.1) in an effort to encourage the use of factor analysis in health-related professions, specifically paramedicine. According to the authors the use of factor analysis in the health profession has been on the rise. They reported a 16,000% increase in articles reporting factor analysis, from two articles in 1985 to 326 articles in 2000.

Factor analysis has been utilized in research applications at the K-12 and higher education levels. Tschannen-Moran, Bankole, Mitchell, and Moore, Jr. (2013) studied the trust relationship between teacher and student in 49 schools in a diverse K-12 urban school district. Analysis was carried out at the school level. Three instruments were used (cited in Tschannen-Moran et al., 2013): the Student Trust in Teachers Survey (Adams and Forsyth), the Identification with School Questionnaire (Voelkl), and an adaptation of Academic Press (Hoy, Hannum & Tschannen-Moran). Utilizing confirmatory factor analysis, the researchers established a three-pronged relationship among the independent variables of student trust, academic press (defined as an "academically oriented environment where goals and expectations are high" [Tschannen-Moran et al., 2013, p. 154]), and student identification with school. The effect of these variables on student achievement in math and English was analyzed. Scale scores from state math and English assessments were utilized to establish a composite scale score in both subject areas for each school. Confirmatory factor analysis resulted in the identification of the latent construct the researchers labeled *student academic optimism*. Of significance was the finding that "student academic optimism explained a significant proportion of the variance in student achievement above and beyond the effects of SES" (Tschannen-Moran et al., 2013, p. 167). Tschannen-Moran et al. (2013) acknowledged that the concept of student academic optimism was a relatively new area of K-12 research; however, they cited its potential to overcome effects of SES factors on student achievement as a rationale for prioritizing further study.

Yang and Xu (2014) carried out a psychometric evaluation of the adapted Chinese version of the Homework Management Scale (HMS) for high school students to compare its validity with that of the original United States version. The researchers utilized exploratory factor analysis with half of the study participants (n = 442) and confirmatory factor analysis with the remaining participants (n = 442). The exploratory phase of the study established the consistency of factor structure between the two versions. The confirmatory phase of the study established the HMS as a "factorially valid measure of homework management” (p. 8) at the high school level. The study findings determined that the Chinese version was psychometrically consistent with the U.S. version.

Ryan (2013) examined the reliability and validity of a 55-item survey instrument administered to 396 students at a technical high school to determine the students’ perception of 21st Century skill acquisition. Principal components analysis, carried out initially, determined eight potential factors. The factor extraction techniques applied included unweighted least squares, generalized least squares, principal axis factoring, alpha factoring and maximum likelihood. The orthogonal methods of quartimax, varimax and equamax were utilized. The factor reduction analysis determined five general areas (factors) of skill acquisition: (1) job seeking and career development skills; (2) communication skills; (3) interpersonal skills; (4) problem solving and reasoning skills; and (5) business and economic skills.

Turk-Fiecoat (2011) employed a factor analysis methodology to establish the validity of a student survey instrument that addressed student satisfaction on the college campus as it related to student value perception of a new student union. Utilizing unweighted least squares and varimax rotation, Turk-Fiecoat determined five interpretable factors: Retail Food, Student Life, Environment, Promotion, and Effectiveness. Turk-Fiecoat carried out a cluster analysis of the data to identify differences in levels of satisfaction with the student union, and the college experience in general, between student demographic groups. Though levels of satisfaction were generally high, Turk-Fiecoat determined a significant difference between racial/ethnic groups. Non-White students represented the highest satisfaction levels and White students represented the highest dissatisfaction levels.

Feldt, Graham, and Dew (2011) studied the factor structure and construct validity of the Student Adaptation to College Questionnaire (SACQ). The researchers cited the need to assure validity due to the usefulness of the instrument to measure first-year students' acclimation to the college setting. Participants in the study numbered 305 first-year students. Confirmatory factor analysis failed to establish a goodness of fit with the 4-factor structure established by previous researchers. Feldt et al. followed with exploratory factor analysis which established a 6-factor structure. The researchers recommended that items that did not load on the factors in their analysis of the SACQ nor on the factors in the analyses carried out by previous researchers should be removed from the SACQ when, and if, a revision to the survey instrument was to be made.

Summary

The Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (*ECLS-K*) is a a national database developed under the sponsorship of the U.S. Department of Education, National Center for Education Statistics (NCES). The multilevel study provides a breadth and depth of data at the student, parent, and school personnel levels. The data represents students of diverse racial, ethnic and socioeconomic groups. At each data collection juncture, the teachers of the cohort students completed a teacher questionnaire. The *ECLS-K* study has been utilized by educational researchers to study numerous education topics as they relate to education, from parent involvement to teacher qualifications. *ECLS-K* resource experts describe the contribution of the teacher questionnaire component as "a valuable source of information on themselves, the children in their classrooms, and the children's learning environment" (Tourangeau et al., 2005, p. 1-6). By means of exploratory factor analysis, the *ECLS-K* teacher questionnaire provides an opportunity to utilize a national dataset as a secondary data source to empirically analyze components of teachers' beliefs, attitudes, and perceptions as they relate to the teacher work.

The importance of teacher belief systems has been documented in the literature. Teacher self-efficacy, self-concept, and self-esteem are specific types of beliefs that have been studied in relation to their implication for teaching practices. Teachers' attitudes toward their students, particularly at-risk students and students with disabilities, are a common topic in the literature. The literature provides an extensive number of quantitative and qualitative studies that endeavor to analyze the components and predictors of teacher job satisfaction. Such studies enable the educational community to institute practices and policies that positively impact teacher retention.

Social science researchers often utilize factor analysis as an exploratory or confirmatory tool to define constructs. Factor analysis pioneers, including Thurstone, Spearman, Kaiser, Caffrey, and Cattell, developed components and guidelines for factor analysis which assist with the decision making necessary to extract and retain factors. Subsequent researchers have sought to refine the components of factor analysis in an effort to assure the identification of factors that accurately account for the variability within a set of data. Factor analysis, historically, has been utilized in the social science research fields. Researchers in fields outside the social sciences identify a small, but growing, use of factor analysis as a research methodology. Confirmatory and exploratory factor analysis have been utilized in research related to K-12 and higher education.

This chapter has provided the background information necessary to understand the theoretical, historical, and methodological components which formed the basis for this study. The following chapter outlines the methodology implemented in this study.

Chapter 3: Methodology

This chapter focuses on the methodology of the study and is divided into four sections: Research Questions, Data Source, Description of the Instrument, and Data Analysis Procedures. This study utilized existing data from a nationally-sponsored research project, the Early Childhood Longitudinal Study , Kindergarten class of 1998-99 (*ECLS-K)* (U.S. Department of Education, 2013). Descriptions of the dataset, instrument, and procedures are presented to provide a framework and enable future researchers to more effectively build on this study. The first section of this chapter reviews the research questions of the study. The second section includes a description of the *ECLS-K* as a secondary data source, providing details of the existing data set that will be utilized in this study. Next, the chapter presents an examination of the *ECLS-K 5th Grade* (U.S. Department of Education, 2013) which was used to identify constructs related to teacher beliefs, attitudes, and perceptions as they relate to teachers' work. Finally, information is presented on the factor analysis, MANOVA, and post hoc tests utilized in this study.

Research Questions

This study incorporated a two-phase design. Phase 1 was exploratory in nature and sought to answer the following question:

Research question 1. Will a factor analysis of selected items from the *ECLS-K 5th Grade* reveal factors related to underlying constructs about upper elementary teachers' beliefs, attitudes, and perceptions regarding their work?

Phase 2 of the study examined the data to consider possible differences across various groups in light of the factors revealed in Phase 1. The following research question was considered:

Research question 2. When groups are established using selective demographic variables, are there differences between these groups based upon the factors established in Phase 1?

Data Source

In order to provide background information about the existing teacher dataset that was utilized in this study, the student cohort for the national dataset will be described in this section. The *ECLS-K* followed a nationally representative cohort of children from kindergarten into high school (Tourangeau et al., 2005). Originally, children in the *ECLS-K* study were members of the 1998-99 kindergarten cohort or the 1st grade cohort of 1999 - 2000. In 2004, these students were the 5th grade cohort for the *ECLS-K* Round 6 data collection. The members of the cohort included children who were in 5th grade in spring 2004 and others who were either held back or promoted. A total of 11,368 children were assessed in the school year 2003 - 2004. Of those, students assessed in the public schools numbered 9,187 (Tourangeau, Le, Nord, Pollack, & Atkins-Burnett, 2006).

The *ECLS-K* study was a multi-source study that included direct child assessment, student record abstracts, interviews with parents, and the collection of survey data from principals and teachers. The teacher data was the focus of this study.

Teacher data from the *ECLS-K.* This study utilized an existing dataset provided by the *ECLS-K 5th Grade*. Teacher data in this study was derived from the responses of individuals who completed the *ECLS –K 5th Grade* due to their identification as a teacher of one or more children in the *ECLS-K* 5th grade cohort in a public school setting. Additionally, data for this study was limited to the responses of those individuals who identified themselves as the child's only teacher in a self-contained classroom. Teacher data for this study was also limited to those teachers who identified themselves as holding a regular or standard state certificate and certified in Elementary Education.

A total of 10,872 teacher-level questionnaires were completed in the school year 2003 - 2004 (Tourangeau et al., 2006). Teachers' questionnaire responses were reported in the national dataset multiple times if they had multiple students participating in the study. Duplicate teacher questionnaire responses were removed from the dataset for this study. A final cohort of 1,314 non-duplicate questionnaires were determined to have been completed by teachers who met the criteria for this study.

Description of the Instrument

During the children's 5th grade year, data was collected from their regular classroom teachers during the period February through June 2004 using the *ECLS-K 5th Grade*. The survey was administered in a pencil-to-paper format. Each teacher was identified with a student, or students, from the cohort. Teachers responded to survey questions that elicited information about themselves, their experience, and their teaching practices. Additionally, teachers responded to survey items regarding the classroom environment. Questionnaire items also elicited responses from the teachers regarding cognitive and non-cognitive characteristics of the cohort students in their classrooms.

Questionnaire items. The *Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 ECLS-K K-8 Full Sample Public Use Data Files and Electronic Codebook (NCES No. 2009-005),* (U.S. Dept. of Education, 2013) omits any data reflecting teachers' responses regarding individual students in their classrooms. The lack of availability of student-level data had no bearing on this study because the focus was teacher responses regarding their own experiences and teaching practice. The teacher-level questionnaire items were selected based on three criteria: 1) the relevance of the questionnaire item to the determination of teachers' beliefs, attitudes, and perceptions regarding their work; 2) the usefulness of the questionnaire item to determine the teacher qualifications and classroom organization relevant to this study; 3) the usefulness of the questionnaire item to the provision of relevant demographic data of the surveyed teacher population.

Hair, Jr. et al. (2010) emphasized that the researcher who employs factor analysis should utilize informed judgment as to "the potential dimensions that can be identified through the character and nature of the variables submitted to factor analysis" (p. 99). *ECLS-K 5th Grade* items elicited teacher responses covering a wide range of workplace conditions. For this study, responses to 39 questionnaire items related to teacher beliefs, attitudes, and perceptions about their work were initially selected by an advisory panel based on the potential to illuminate aspects of the teacher experience that the research indicated are central to teaching and learning: collaboration with peers and school climate (Dufour, Eaker, & Dufour, 2005; Hord, 2003; Lee & Smith, 1996; Lee et al., 2011); teacher efficacy (Ashton & Webb, 1986; Bandura, 1986, 1999, 2000; Caprara et al., 2003; Caprara, Barbaranelli, Steca, & Malone, 2006) ; teacher autonomy (Cameron, 2008; Kreis & Brockopp, 1986; Porter, 1963); school leadership (Fullan, 2001; Korkmaz, 2007; Silins & Mulford, 2002); and teacher job satisfaction (Ho & Au, 2006; Loeb, Darling-Hammond, & Luczak, 2005; McCoach & Colbert, 2010; Sergiovanni, 1966). For example, teachers were asked to describe their evaluation and grading practices with respect to any differential treatment that they provided students based on their perceptions of the students' capabilities. Teachers were also asked to describe the nature of their collaboration with other teachers and the level of autonomy they experienced. An example questionnaire item from the *ECLS-K 5th Grade* follows:

24. How much control do you feel you have IN YOUR CLASSROOM over such areas as selecting skills to be taught, deciding about teaching techniques, and disciplining children? (U.S. Department of Education, 2013, p. 9)

For the purposes of this study, teacher-level data were limited to those teachers whose students participated in the 5th grade *ECLS-K* Round 6 data collection in a public school setting. Furthermore, study data were limited to that of teachers who identified themselves as regular classroom teachers responsible for teaching in a self-contained classroom and in possession of an elementary teaching certification. Below is a sample of a questionnaire item from the *ECLS-K 5th Grade* that provided delimiting teacher data:

42. Which category best describes the way your class(es) at this school (is/are) organized?

a. Self-contained class – You teach multiple subjects to the same class of children all or most of the day. (U.S. Department of Education, 2013, p. 15)

In order to address research question 2 of this study, questionnaire items related to teachers' race (White / Non-White), age, educational background, and years of teaching experience were analyzed. These demographic attributes were chosen because research suggests that such attributes are worthy of further study (e.g., Goe & Stickler, 2008; Jepsen, 2005; Rivken, Hanushek, & Kain, 2005; Wayne & Youngs, 2003). A sample demographic survey item from the *ECLS-K 5th Grade* is included here:

31. Which best describes your race? CIRCLE ONE NUMBER ON EACH LINE.

	Yes	No
a. American Indian or Alaska Native ……………	1	2
b. Asian…………………………………………..	1	2
c. Black or African American……………………	1	2
d. Native Hawaiian or Other Pacific Islander…….	1	2
e. White……………………………………………	1	2

(U.S. Department of Education, 2013, p. 11)

Data reliability from the *ECLS-K* study was established using standard errors and weights described in the National Center for Education Statistics (NCES) publication, *Findings From the Fifth Grade Follow-up of the Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K)* (Princiotta et al., 2006).

Data Analysis Procedures

Research question 1. The first phase of this study sought to determine the existence of underlying teacher constructs derived from teacher-level data provided by the *ECLS-K 5th Grade*. Due to the exploratory nature of this study, the large sample size, and the large number of variables, factor analysis was chosen as an appropriate procedure to determine the existence of underlying constructs (Gorsuch, 1974) within the data that would quantify aspects of the teacher experience.

IBM SPSS Statistics 22 was selected to conduct the analyses for this study. The original public-use file of 21,409 child cases was filtered for the aforementioned teacher demographic characteristics. A pre-screen of the initial dataset was conducted. All cases with missing data were eliminated. As previously mentioned, teachers' questionnaire responses had the potential to be reported in the national dataset multiple times if they taught multiple students participating in the study. Duplicate teacher questionnaire responses, indicated by student data cases containing the same teacher identification number, were removed from the dataset for this study. Additionally, Mahalanobis Distance was calculated to identify case outliers in the dataset. These case outliers were scrutinized, determined not to be consequential to any subsequent data findings, and, therefore, removed. Thus, the final teacher sample was established (N = 1,314).

Additional pre-analysis data screening was conducted to determine normality. Normality refers to the extent to which the sample observations associated with a variable are distributed normally. For this study, skewness and kurtosis measures were utilized to determine univariate normality as a condition of multivariate normality (Mertler & Vannatta, 2010).

Teachers' responses to 39 questionnaire item responses from the public-use file data set were used as the basis for establishing the factors. Principal components analysis was conducted on the established dataset as a data reduction tool. Frequencies, univariate descriptives, and a coefficients correlation matrix of the variables were computed. The correlation matrix indicated that factor analysis was appropriate for the set of selected variables. Field (2009) explained two critical aspects of the correlation matrix. First, the variables should have some degree of intercorrelation. Secondly, the variables should not be too highly correlated. If these conditions are not met, then it is difficult to determine factors and to determine the unique contributions of the various factors. According to Hair, Jr. et al. (2010), a correlation matrix should include a "substantial number" (p. 103) of correlations greater than .30 in order to support the utilization of factor analysis with the set of variables under consideration. Additionally, residuals, defined as the portions of scores not accounted by the analysis (Mertler & Vannatta, 2010), were computed between observed and reproduced correlations to establish the appropriateness of the components (factors) determined by the model. Lastly, communalities, defined as the proportion of each variable's variance accounted by the principal components (UCLA Statistical Consulting Group, 2015) were considered in the evaluation of the number of components to retain. With a sample size greater than 250 for this study, components with communalities greater than .30 were considered appropriate to retain (Mertler & Vannatta, 2010).

The unrotated factors were analyzed for their initial eigenvalues to determine the quantity of factors to extract. Factors with eigenvalues over 1 were retained as this value has been determined to be reliable when the number of variables is between 20 and 50 (Hair, Jr. et al., 2010). According to Mertler & Vannatta (2010), the eigenvalue criterion is reliable when $N > 250$ and a mean communality is $\geq .60$. The scree plot, a graphic representation of the eigenvalues, was examined for further consideration of the number of factors to extract. The percentage of variance criterion was also considered for factor extraction based on common practice which suggests that the extracted factors account for 60 – 70% of the total variance.

Initially, the extraction of unrotated factors resulted in one general factor upon which the preponderance of variables loaded. Therefore, to refine the interpretation of factors, orthogonal rotations were conducted to determine the optimal number of factors to extract. Specifically, varimax, equamax, and quartimax rotations were utilized. Orthogonal rotation, in contrast to oblique rotation, was employed because it results in non-correlated factors and was, therefore, most conducive to data reduction.

Components (or factors) were evaluated for the strength and direction of the variable loadings. Hair, Jr. et al., (2010) stated, "…a factor loading represents the correlation between an original variable and its factor" (p. 117). The suggested structure set forth by Guadagnoli and Velicer (1988) was used as a general guideline. Components with four or more items with factor loading of .60 were retained. Components with 10 or more loadings of .40 were considered for retention. Due to the large teacher sample size for this study (*N* = 1,314), loadings at lower levels (e.g. .30) were considered significant; however, the decision to retain an item was based on the premise that the higher the loading, the more well-defined, and desirable, the factor structure. Supported by research regarding exploratory factor analysis and large sample size, components with lower loadings were also considered for retention. The overall goal was to establish factors with loadings that were high and pure as indicated by items that tended to have high loading on their primary factor and relatively low loading on the other factors. Variable loadings across the factors were considered as factors were established; loadings and cross loadings were considered as factor solutions were identified (Costello & Osborne, 2005; Tabachnik & Fidell, 2007).

After the factors were established, the items associated with each factor were examined for similarity of content in order to appropriately name each factor. Components (underlying constructs) were labeled based on a determination of the nature of the grouping of variables that loaded onto each. The strength of variable loadings were also considered, with stronger loadings influencing the labeling of the component. Cronbach's alpha, a measure of internal consistency, was used to assess the reliability of the labeled constructs. According to Hair, Jr. et al. (2010), Cronbach's alpha should, at a minimum, measure .70 (or .60 for exploratory research).

Research question 2. The second phase of this study addressed the question of differences between selected teacher demographic groups in relation to the factors. A one-way multivariate analysis of variance (MANOVA) was conducted to determine if differences between the demographic groups existed. The groups were established based on race (White / Non-White), age, educational background, and years of teaching experience. The primary advantage of the MANOVA procedure was the inclusion of multiple dependent variables (Mertler & Vannatta, 2010). Stevens (1992) advocated for the use of multiple dependent variables when comparing groups to "obtain a more complete and detailed description of the phenomenon under investigation…" (p.152). The factors identified in Phase 1 of this study were the dependent variables. The Box's test was utilized to test for homogeneity of variance. For this study, separate multivariate analyses of variance were conducted for each demographic group. Main effects for each demographic group on the factor variables were analyzed as appropriate.

Post hoc analysis was conducted to investigate mean differences for factors that were determined to have significant effects among three or more groups. This analysis determined where the significant differences were found. Utilizing Tukey's HSD test, each pair of means was analyzed to determine if the means were significantly different from one another. Huck, Cormier, and Bounds (1974) studied five multiple comparison (post hoc) procedures and conceptualized a continuum of liberal to conservative that characterized the threshold of each procedure for determining significance. Liberal procedures required less of a difference between means, whereas conservative procedures required a greater difference between means. The authors placed Tukey's HSD center right (toward conservative) on the continuum.

Summary

This chapter has delineated the exploratory procedures that were followed with the existing dataset available from the *ECLS-K 5th Grade Spring 2004 Teacher Level Questionnaire* in order to answer the two established research questions. Details regarding the establishment of the teacher sample and the questionnaire items to be utilized from the *ECLS-K 5th Grade Spring 2004 Teacher Level Questionnaire* were outlined. A description of the data analysis procedures employed in this study were provided. The following chapter describes the results of the implemented data analysis procedures.

Chapter 4: Results of the Study

This study sought to substantiate the utility of a national dataset as a secondary data source for educators and educational researchers. Exploratory analysis techniques were applied to the existing dataset and quarried the potential to ascribe additional significance to existing data collected during national surveys. Specifically, this study applied exploratory factor analysis and multivariate analysis techniques to selected elements of the existing dataset provided by the *ECLS-K Spring Fifth Grade,* a component of the *Early Childhood Longitudinal Study (ECLS-K)* national dataset made available by the National Center for Educational Statistics (U.S. Department of Education, 2013). Presented in this chapter are the results of the data analysis regarding the following two research questions:

Research question 1. Will a factor analysis of selected items from the *ECLS-K 5th Grade* reveal factors related to underlying constructs about upper elementary teachers' beliefs, attitudes, and perceptions regarding their work?

Research question 2. When groups are established using selective demographic variables, are there differences between these groups based upon the factors established in Phase 1?

Teacher Data Provided by the ECLS-K Public-Use File

In 2004, 5th grade teachers associated with the 21,409 child cases of the Early Childhood Longitudinal Study (*ECLS-K*) cohort were requested to complete the *ECLS-K 5th Grade*. The questionnaire contained seven sections: Instructional Activities and Focus, Classroom Resources, Student Evaluation, School and Staff Activities, Views on Teaching, School Climate and Environment, Teacher Background, and Teaching

Assignment.

The initial removal of missing and duplicate cases and the filtering of cases for specific school (public), classroom (self-contained) and teacher characteristices (elementary credential) reduced the sample size for this study to 1,314 teachers. Teacher data provided by the *ECLS-K* public-use file included the following demographic groups: Race (White / Non-White), Age Group, Highest Level of Education, and Years of Teaching Experience.

Descriptive Statistics

For the purposes of this study, teacher data were studied through the lens of four demographic groups: Race (White / Non-White), Age Group, Highest Level of Education, and Years of Teaching Experience. Subgroups for two of the demographic groups, Race and Highest Level of Education, were established by the existing data set codebook. Subgroups for the remaining two demographic groups, Age Group and Years of Teaching Experience, were established by the researcher. A discussion of the groups and subgroups for this study follows.

Race. According to the *Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 ECLS-K K-8 Full Sample Public Use Data Files and Electronic Codebook (NCES No. 2009-005)* (U.S. Dept. of Education, 2013), data for the following subgroups for Race were suppressed and, therefore, unavailable for public study: American Indian or Alaska Native; Asian; Black or African American; Native Hawaiian or Other Pacific Islander. As a result, Race was divided into two groups, White and Non-White. A summary of the frequencies and percentages for the two Race subgroups for which data were made available is presented in Table 1. The subgroup White accounted for 84.3 %

of the sample (n = 1108). The subgroup Non-White accounted for 15.7% of the sample (n = 206).

Table 1

Summary of Frequencies and Percentages for Groups Established by Two Race Groups

Race	Frequency	Percent
White	1108	84.3%
Non-White	206	15.7%
Total	1314	100.0%

Highest education level. According to the *Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 ECLS-K K-8 Full Sample Public Use Data Files and Electronic Codebook (NCES No. 2009-005)* (U.S. Dept. of Education, 2013), data for Highest Education Level were recoded from its original stratification in the survey instrument. The survey instrument provided seven numbered choices to respondents: 1) High school diploma or GED; 2) Associate's degree; 3) Bachelor's degree; 4) At least one year of course work beyond a Bachelor's degree but not a graduate degree; 5) Master's degree; 6) Education Specialist or Professional Diploma based on at least one year of course work past a Master's degree level; 7) Doctorate. However, the codebook and public-use file provided data according to subgroups coded 1-4 and described as the following: 1) High School/Assoc. Degree/ Bachelor's; 2) At least 1 year beyond Bachelor's; 3) Master's Degree; 4) Education Specialist/Prof. Diploma/Doctorate. Public-use file data had been recoded to protect respondent confidentiality. Thus, four groups were used for this study.

A summary of the frequencies and percentages of subgroups determined by teachers' Highest Education Level completed is presented in Table 2. The subgroup High School Diploma / Associates' Degree / Bachelor's Degree accounted for 21.5% of the respondents (*n* = 282). Teachers whose highest level of education attainment was At Least One Year Beyond Bachelor's accounted for 33% of the respondents (*n* = 433). Master's Degree accounted for 37.4% of the respondents (*n* = 491). Teachers with an Education Specialist degree, Professional Diploma, or Doctorate accounted for 8.2% of the respondents (*n* = 108).

Table 2

Summary of Frequencies and Percentages for Groups Established by Highest Education

Highest Education Level	Frequency	Percent
High School / Associate's Degree/ Bachelor's Degree	282	21.5%
At least one year beyond Bachelor's Degree	433	33.0%
Master's Degree	491	37.4%
Education Specialist / Professional Diploma/ Doctorate	108	8.2%
Total	1,314	100.0%

Age. The *ECLS-K 5th Grade Spring 2004 Teacher Level Questionnaire* included the following survey item:

29. In what year were you born?

19___

Each of the 1,314 cases in the study sample, obtained from the public use file, contained the respondent's birth year. Birth years ranged from 1940 to 1981. For the purposes of this study, the birth years were recoded to age in years. Further recoding provided three age groups: 35 and Under; 36 – 45 Years; 46 and Older. An effort was made to avoid formulating an age group with a very low frequency. The optimal goal was the formation of similarly-sized groups. A summary of the frequencies and percentages of groups determined by Age is presented in Table 3. The 35 and Under group accounted for 32.7% of the respondents (*n* = 430). The 36 - 45 Years group accounted for 23.8% of respondents (*n* = 313). The 46 and Older group accounted for 43.5% of the respondents (*n* = 571).

Table 3

Summary of Frequencies and Percentages for Groups Established by Age Group

Age Group	Frequency	Percent
35 & Under	430	32.7%
36 – 45 Years	313	23.8%
46 & Older	571	43.5%
Total	1314	100.0%

Years of teaching experience. The *ECLS-K 5th Grade* asked the respondent to write-in the number of years of teaching experience:

32. Counting this school year, how many years have you been a school teacher, including part time teaching? WRITE NUMBER ON LINE.

_________ Years

Responses ranged from 1 to 35 years. For the purposes of this study, years were clustered and coded into four groups: 0-5; 6-15; 16-25; 26 or More. An effort was made to form Years of Teaching Experience groups of similar size and to avoid low frequencies. A summary of the frequencies and percentages of groups determined by Years of Teaching Experience is presented in Table 4: 0 - 5 years (*n* = 286, 21.8%); 6 - 15 years (*n* = 519, 39.5%); 16 - 25 years (*n* = 276, 21.0%); 26 or More years (*n* = 233, 17.7%).

Table 4

Summary of Frequencies and Percentages for Groups Established by Years of Teaching Experience

Years of Teaching Experience	Frequency	Percent
0-5	286	21.8%
6-15	519	39.5%
16-25	276	21.0%
26 or More	233	17.7%
Total	1,314	100.0%

Data Analysis

This section presents the results of data analysis for each of the two research questions. Factor analysis was conducted for research question 1. Reliability coefficients were computed using Chronbach's alpha. A multivariate analysis of variance (MANOVA) and relevant post hoc analyses were conducted for research question 2.

Research question 1. Will a factor analysis of selected items from the *ECLS-K*

5th Grade reveal factors related to underlying constructs about upper elementary teachers' beliefs, attitudes, and perceptions regarding their work?

The items from the *ECLS-K 5th Grade* were reviewed for this study by a panel of advisors for inclusion in the factor analysis. A total of 39 items from the existing data set were selected based on their relevancy to aspects of the teacher experience that the body of research indicated are central to teaching and learning. *Appendix B* provides a listing of the 39 selected items.

Initially, a principal components analysis was conducted on all 39 items. Based on eigenvalues > 1, there were 11 identified components accounting for 60.44% of the total variability. The results of the principal components analysis established the suitability of further factor analysis to determine goodness of fit (Mertler & Vannatta, 2010). Utilizing IBM SPSS 22, numerous rotations and extraction methods were applied to the dataset resulting in the identification of five factors related to underlying constructs of the teacher experience. Of the 39 questionnaire items initially selected for analysis, 26 were retained due to their substantive impact on the establishment of the underlying constructs. The following section details the data analysis procedures implemented to validate the study findings.

Pre-analysis data screening. Pre-analysis data screening consisted of the determination of cases with missing values, an examination of univariate normality, and an assessment of multivariate outliers. All cases from the initial dataset (N = 2,020) were examined for missing values. Missing values were coded in the existing data set as -9 ("not ascertained"). Cases with missing values were removed (n = 657), resulting in a study dataset of N = 1,363. An examination for univariate normality revealed 17 of 39 variables with a kurtosis or skewness outside of the range of -1 and +1. The Kolmogorov-Smirnov test for normality indicated that the null hypothesis for normality could not be rejected. It was determined, however, per Fabrigar et al. (1999), that there was no need for transformation as skewness was not greater than 2 and kurtosis was not greater than 7 for any of the variables.

Mahalanobis Distance was calculated with the remaining dataset (N = 1,363) at the X^2crit (df=38) of 70.703 ($p < .001$). A total of 49 cases exceeded the critical chi-square, representing 4% of the total number of cases. An examination of the demographic characteristics of the 49 outlier cases confirmed that removal of the outliers would have no substantive impact on the representation of cases for each of the variables. For example, 8 of the 49 outlier cases were of the Non-White demographic group. When these 8 cases were removed from the study dataset, the percentage of the Non-White demographic dipped only slightly from 15.7% to 15% of the total dataset. With the removal of the 49 cases, the study data set was revised to N = 1,314. Additionally, there was no impact on the Non-White demographic within the revised data set. The percent of Non-White (206/1,314) remained at 15.7%.

Factor analysis. Principal components analysis provides one or more uncorrelated variables (factors) that account for the largest part of the variance among the original items in a dataset (Joliffe, 2002). In this study, principal components analysis was conducted as an initial factor extraction tool in order to identify the presence of underlying constructs among the variables and to determine the extent to which the identified underlying constructs accounted for the majority of variability among the components (Mertler & Vannatta, 2010; Tabachnick & Fiddell, 1989). Potential underlying constructs, also referred to as factors, are identified in a principal components analysis by the magnitude of the eigenvalue. An eigenvalue greater than 1 is commonly considered to indicate a viable factor which should be retained, particularly if $N > 250$, and the mean communality is $\geq .60$ (Mertler & Vannatta, 2010). Eleven possible factors in the principal components analysis had an eigenvalue greater than 1, accounting for 60.448% of the cumulative variance. A summary of eigenvalues for the principal component analysis is presented in Table 5.

Table 5

Principal Components Analysis Total Variance Explained

Factor		Initial Eigenvalues	
	Eigenvalue	% of Variance	Cumulative %
1	7.020	18.000	18.000
2	3.005	7.704	25.704
3	2.321	5.951	31.655
4	2.161	5.542	37.196
5	1.755	4.501	41.698
6	1.567	4.017	45.715
7	1.343	3.443	49.158
8	1.232	3.158	52.316
9	1.085	2.783	55.099
10	1.071	2.747	57.846
11	1.015	2.602	60.448

Additional decision-making criteria included examination of the residuals and the scree plot. Residuals were computed between observed and reproduced correlations.

Ideally, reproduced correlation values closely mirror the values in the correlation matrix. Hence, the optimal computed residuals between the two sets of correlations are a measure as close to zero as possible (UCLA Statistical Consulting Group, 2015). For this study, *IBM SPSS 22* provided residual output at the 0.05 significance level. There were 147 (19%) non-redundant residuals with absolute values greater than 0.05. The relatively low percentage of residuals indicated that the components generated by the model could be retained.

The graphic representations of the components in relation to their corresponding eigenvalues were examined in the scree plot. In a scree plot eigenvalues less than 1 are evident in the flattened graph line and are disregarded because they indicate a component that accounts for a variance less than that of the original variables (which have a variance of 1). In this study, the sharp descent of the scree plot line indicated that Component 1 accounted for a greater percentage of variance than did subsequent components. The scree plot line leveled off at Component 9.

Mertler and Vannatta (2010) stated, "…use of the scree test with an $n > 250$ will provide fairly accurate results, provided that most of the communalities are somewhat large (i.e., > .30)" (p. 235). Based on a review of the eigenvalues, communalities, residuals, and scree plot, the decision was made to conduct forced factor rotations of five, six, seven, and eight factors to develop a goodness-of-fit model incorporating the goal of parsimony: to account for the greatest amount of variance with the smallest number of factors (Rummel, 1970).

For this study, the following extraction methods were utilized to develop the parsimonious, best fit solution: unweighted least squares, generalized least squares, maximum likelihood, and principal axis factoring. Mertler & Vannatta (2010) recommend orthogonal rotation (not oblique rotation) as the result provides an uncorrelated factor solution that tends to identify the unique aspects of the underlying structure of the dataset.

For each extraction method, the following orthogonal rotation procedures were applied: varimax, quartimax, and equamax. The resultant pattern matrix from each rotation was examined for high and pure loadings following the guidelines set forth by Comrey and Lee (as cited in Huber, Horn, & Martin, 2008): .32 is poor; .45 is fair; .55 is good; .63 is very good; and .71 is excellent. Due to the large dataset (*N* = 1,314), factor loadings of .330 (signifying10% overlap) were considered acceptable, though loadings of .450 (signifying 20% overlap) or higher were considered optimal. Cross loadings greater than .320 were considered unacceptable (Costello & Osborne, 2005).

Data reduction for this study was conducted in two rotations. In Rotation 1, response data for 39 items (variables) from the *ECLS-K 5th Grade* were included in the factor analysis. Based on results, the determination was made in the initial phase that six-, seven-, or eight-factor solutions were not viable; there were not sufficient numbers of unique, high variables loading on these factors. Costello and Osborne (2005) stated, "A factor with fewer than three items is generally weak and unstable; 5 or more strongly loading items (.50 or better) are desirable and indicate a solid factor" (p. 5). As a result of these factor solutions, four- and five-factor solutions were considered.

Additionally, variables that did not load highly on any factors were dropped because they did not contribute to a clear factor structure. One variable, *Parent Support* (J61PSUPP), was recoded from a negative to a positive statement (J61PSUPPNEW) because its 1 through 5 Likert scoring had an inverse relationship to the 1 through 5 Likert scoring of the associated variables for which factor loading was high and pure. The data reduction process in Rotation 1 resulted in 26 variables which were considered for further factor analysis in Rotation 2, with a focus on four- and five-factor solutions.

For the second data reduction phase, Rotation 2, factor analysis was conducted for 26 variables (see Table 7). generalized least squares, maximum likelihood, principal axis factoring, and unweighted least squares were once again applied as extraction methods for four- and five-factor solutions. Varimax, equamax, and quartimax rotation methods were utilized. Factor matrix analyses were conducted taking into account eigenvalues greater than 1, scree plot conformation, residuals, and the optimization of accountability of variance.

Factor retention of the best fit model. Each combination of factor extraction and rotation resulted in a possible solution that was compared to all others to ascertain the best fit model. The strength and direction (positive or negative) of the factor loadings were evaluated. Once again, due to the large dataset (N = 1,314), items with factor loadings of .330 (signifying10% overlapping variance) were considered acceptable, though loadings of .450 (signifying 20% overlapping variance) or higher were considered optimal. Strong loadings on each component were considered as well as the content of the item (face validity) and its contribution to the component. Based on the large number of data points (N = 1,314), guidelines established for this study required that items loaded high ($\geq$ .33) on the primary factor and pure ($\leq$ .27) on the other four factors. In addition, the difference between the loading on a primary factor was required to exceed the cross loadings by at least .15; that is, the difference between the high loading and the next highest loading was at least .15. Using these criteria, a five-factor solution with the 26 previously established variables was identified.

Four-factor rotations accounted for 48% of the total variance explained. Analysis of four-factor rotations for all extraction methods consistently revealed unacceptably high cross loadings (.320 or higher) per Costello and Osborne (2005). Additionally, the component loadings of the items for the various factors of the four-factor rotations were often characterized by a lack of cohesion and face validity.

Five-factor rotations accounted for 54% of the total variance. Five-factor solutions for all extraction and rotation combinations were similar in the strength and direction of factor loadings, as well as the composition of variables that constituted the factor loadings. Face validity across these five factors was strong. A comparison to the guidelines set forth by Comrey and Lee (as cited in Huber, Horn, & Martin, 2008) was conducted to facilitate the determination of best fit. A five-factor solution utilizing the maximum likelihood extraction method with equamax rotation was established as meeting Comrey and Lee's guidelines: There were zero factors with loadings of .32 (poor) or lower; each factor had a minimum of three loadings of .45 (fair) or higher; four of the five factors had a minimum of three loadings of .55 (good) or higher; each factor had between two and four factors loading at .63 (very good) or higher; four of the factors had at least one loading at .71 (excellent) or higher. The selected five-factor best fit solution is discussed in detail in the following sections.

Maximum likelihood with equamax rotation. Maximum likelihood extraction (ML) employs varied methods to establish goodness-of-fit and maximize the differences among factors. For this reason ML is often recommended as the best choice for factor analysis when there is a question of the existence of underlying structures as is the case with exploratory factor analysis. This method, however, is dependent on the assumption of multivariate normality. Fabrigar et al. (1999) recommended that the researcher choose ML as long as skew does not exceed 2 and kurtosis does not exceed 7, as was the case with the dataset for this study. Equamax rotation is an orthogonal rotation that combines characteristics of varimax and quartimax, producing uncorrelated factors. This was an advantage due to the exploratory nature of this study because uncorrelated factors facilitate the goal of identifying underlying structures. The selected extraction/rotation solution resulted in 54.667% of the total variance explained by the five factors. The number of items loading high on each factor ranged from four to six. The number of items that loaded on each factor and the percentage of variance accounted by the factor are summarized in Table 6.

Table 6

Total Variance Explained with Maximum Likelihood with Equamax Rotation

Factor	Number of Items Loading High	Initial Eigenvalue	Percentage of Variance Accounted for by the Factor
1	6	5.698	21.915
2	5	2.770	10.653
3	5	2.100	8.077
4	6	2.050	7.886
5	4	1.595	6.136
Total Variance Explained			54.667

All primary factor loadings were positive, and cross loadings were within the acceptable range as identified by Costello and Osborne (2005). See Appendix C for the complete rotated factor matrix produced from the adopted five-factor solution (maximum likelihood with equamax rotation).

Factor names. The face validity of each factor with corresponding component loadings was a point of consideration throughout the rotation phase of the data reduction process. The concept of face validity, defined as, “The extent to which a measure appears to be measuring what it is supposed to measure,” (Cramer & Howitt, 2004, p. 63) lends subjectivity to the data reduction process. A framework must be identified within which the evaluation of face validity will be conducted. For this study, the body of research regarding teachers’ beliefs, attitudes, and perceptions about their work informed the consideration of the face validity. The magnitude of the individual factor loadings was also considered; high component loadings were given more consideration in the labeling of the components. Components defined in the survey instrument topic sections also informed the labeling of the factors. Neill (2008) stated, “A well labeled factor provides an accurate, useful description of the underlying construct and helps to facilitate the clarity of the report” (p. 3).

Assigned factor names for this study were as follows: Factor 1, Leadership and Professional Learning Community (PLC); Factor 2, Student and Parent Effects; Factor 3, Student Evaluation; Factor 4, Teacher Efficacy; and Factor 5, Teacher Collaboration Time. The label assigned to each factor, the survey items associated with each factor, and the primary factor loading for each item are listed in Table 7.

Table 7

Factor Names and Corresponding Items Retained with Primary Factor Loading

Factor	**Items**	**Primary Factor Loading**
Leadership & PLC	Administration sets priorities, makes plans and sees that they are carried out	.841
	Administration deals effectively with pressures from outside the school that might otherwise affect my teaching	.840
	Administration knows what kind of school he/she wants and has communicated it to the staff	.818
	Administration's behavior toward the staff is supportive and encouraging	.729
	There is broad agreement among the entire school faculty about the central mission of the school	.491
	Staff members in this school generally have school spirit	.419
Student & Parent Effects	Physical conflicts among children are a serious problem at this school	.908
	Children bullying other children is a serious problem at this school	.825
	The level of child misbehavior in this school interferes with my teaching	.631
	Many of the children I teach are not capable of learning the material I am supposed to teach them	.399
	Parents are supportive of school staff	.395
Student Evaluation	How important is classroom behavior	.765
	How important is class participation	.731
	How important is student effort	.696
	How important is completion of homework	.585
	How important is improvement or progress over past performance	.344
Teacher Efficacy	I am certain I am making a difference in the lives of the children I teach.	.650
	I really enjoy my present teaching job.	.648
	If I could start over, I would choose teaching	.528

	again as my career.	
	I am adequately prepared to teach reading to the children who are in my class.	.421
	I feel accepted and respected as a colleague.	.410
	I am adequately prepared to assist children who are experiencing difficulties in reading.	.392
Teacher Collaboration Time	Meeting with other teachers or specialists to discuss individual children	.886
	Meeting with the special education teacher or service provider to discuss and plan for the children with disabilities in my class	.675
	Meeting with other teachers to discuss lesson planning	.467
	Meeting with other teachers to discuss curriculum development	.416

Factor scores. In preparation for subsequent MANOVA carried out in this study, factor scores were computed for the five identified factors. Factor scores are an estimate of the scores respondents would have generated had they been scored on each factor directly (Mertler & Vannatta, 2010). For the purposes of this study, factor scores were computed by summing data source scores for each item loading on each factor. That is, the factor score was the total of item responses that had primary loading on that specific factor.

Reliability. Reliability encompasses two constructs: (1) consistency between multiple measures of a variable; and, (2) internal consistency, referring to the consistency among variables ascribed to a scale. Internal consistency signifies that variables are measuring the same construct with the assumption that the variables should be highly correlated. An estimate of internal consistency is considered necessary in the determination of the validity of the composition of factors derived from an exploratory factor analysis (Hair, Jr. et al., 2010). Chronbach's alpha coefficient is a diagnostic measure that provides a reliability coefficient. The commonly agreed upon minimum specification for the Chronbach's alpha measure is $\alpha > .70$; Hair, Jr. et al. (2010) specified that $\alpha > .60$ is acceptable in exploratory research.

For this study, the Chronbach's alpha coefficients were computed. The computed values were within the acceptable parameters indicated. The Chronbach's alpha coefficient for all 26 items was $\alpha = .696$. Factor 1, Leadership and Professional Learning Community, comprised of 6 items, had a computed alpha of $\alpha = .874$. Factor 2, Student and Parent Effects, comprised of 5 items, had a computed alpha of $\alpha = .794$. Factor 3, Student Evaluation, comprised of 5 items, had a computed alpha of $\alpha = .761$. Factor 4, Teacher Efficacy, comprised of 6 items, had a computed alpha of $\alpha = .715$. Factor 5, Collaboration Time, comprised of 4 items, had a computed alpha of $\alpha = .726$. A summary of the Chronbach's alpha reliability coefficients produced is provided in Table 8.

Table 8

Summary of Chronbach's Alpha Reliability Coefficients for Five Factors

	Number of Items	Chronbach's Alpha (α)
Test of All Items	26	.696
Test of Factor 1: Leadership & PLC	6	.874
Test of Factor 2: Student & Parent Effects	5	.794
Test of Factor 3: Student Evaluation	5	.761
Test of Factor 4: Teacher Efficacy	6	.715
Test of Factor 5: Teacher Collaboration Time	4	.726

Factor correlations. To further determine the nature and degree of relationships between the identified factors in the five-factor solution, Pearsons' Product-Moment Correlation coefficients (*r*) were computed for the five factors identified in this study. A correlation is a measure of the linear relationship between two variables (Huck, Cormier, & Bounds, 1974). Correlation coefficients range from -1 to 1 and are commonly organized into a correlation matrix that presents all combinations of pairs of variables. Correlations below .500 are considered relatively weak. Correlations strengthen as they approach 1.0 or -1.0. See Table 9 for the Pearson's Product-Moment Correlation matrix associated with the factors for this study.

Table 9

Summary of Pearson's Product-Moment Correlation Coefficient Among Five Factors

Factor	Leadership & PLC	Student & Parent Effects	Student Evaluation	Teacher Efficacy	Teacher Collaboration Time
Leadership & PLC	1.000	-.365**	.104**	.386**	.216**
Student & Parent Effects		1.000	-.013	-.336**	-.088**
Student Evaluation			1.000	.139**	.120**
Teacher Efficacy				1.000	.257**
Teacher Collaboration Time					1.000

N = 1,314
** Correlation is significant at the .01 level (2-tailed)

The computed Pearson Product-Moment Correlation coefficients (*r*) were statistically significant ($p < .01$) in 9 of 10 cases, though all were below .500. The strongest correlation for this group of variables was between Factor 1, Leadership/ Professional Learning Community and Factor 4, Teacher Efficacy (*r* = .386). By generally agreed upon standards, this level of correlation is only moderate at best. Factor 1 had a moderately negative correlation with Factor 2: Student and Parent Effects (*r* = -.365). Factor 2 also had a moderately negative correlation with Factor 4 (*r* = -.336). The next strongest correlation was between Factor 4: Teacher Efficacy and Factor 5: Teacher Collaboration Time (*r* = .257). Factor 1: Leadership and Professional Learning Community and Factor 5: Teacher Collaboration Time had a correlation of

(r = .216). The remaining correlations were smaller. The only statistically non-significant correlation for this matrix was a negative correlation between Factor 2, Student and Parent Effects, and Factor 3, Student Evaluation (r = -.013). By general standards this matrix of correlations was moderately weak; however, the significance of correlation is a function of the sample size. For this study, N = 1,314; therefore, smaller correlations could take on increased significance due to the large sample size.

Research question 2. When groups are established using selective demographic variables, are there differences between these groups based upon the factors established in Phase 1?

The demographic variables considered for analyses in this phase of the study were Race (White / Non-White), Age, Years of Teaching Experience, and Highest Education Level. To establish the presence of significant differences among demographic groups, four one-way multivariate analyses of variance (MANOVA) were conducted. The same dataset (N = 1,314) employed for the factor analysis in Phase 1 was utilized for this phase of the study. The dependent variables for the MANOVA analyses were the five factors established in Phase 1: (1) Leadership and Professional Learning Community; (2) Student and Parent Effects; (3) Student Evaluation; (4) Teacher Efficacy; and (5) Teacher Collaboration Time. The procedures and results of the four MANOVA analyses are presented below.

A MANOVA was conducted for each demographic group to determine if significant differences among the groups existed. In each MANOVA, group means were compared and Box's Test of Equality was evaluated for significance level ($p < .05$). Based on this evaluation, the decision to interpret Wilk's Lambda or Pillai's Trace statistic was made. For this study, Wilk's Lambda was evaluated in each MANOVA. For each MANOVA, a test of Between Subject Effects was evaluated. A Tukey's HSD post hoc analysis was carried out for each MANOVA where significant levels of between subject effects were indicated and there were more than two demographic groups.

For the MANOVA, the independent variables were used to establish four demographic groups: Race, Age, Years of Teaching Experience, and Highest Education Level. Subgroups for Race and Highest Education Level were defined by the public-use file dataset (U.S. Dept. of Education, 2013). The demographic group, Race, was defined by two subgroups, White (*n* = 1,108) and Non-White (*n* = 206). The demographic group, Highest Education Level, was defined by four subgroups, High School/Associate's Degree/ Bachelor's Degree (*n* = 282), At least one year beyond Bachelor's Degree (*n* = 433), Master's Degree (*n* = 491), and Education Specialist/Professional Diploma/Doctorate (*n* = 108).

The demographic groups of Age and Years of Teaching Experience, were recoded to create the subgroups to be utilized in the MANOVA analyses.. The *n* - size was a consideration in the creation of the subgroups. An effort was made to ensure that subgroups were of similar *n* - size. The demographic group, Age, was defined by three subgroups, 35 and Under (*n* = 430), 36 – 45 Years (*n* = 313), and 46 and Older (*n* = 571). The subgroups for Years of Teaching Experience were 0 – 5 Years (*n* = 286), 6 – 15 Years (*n* = 519), 16 – 25 Years (*n* = 276), and 26 or More Years (*n* = 233).

Race. A MANOVA was conducted to determine if differences existed between Race groups, White and Non-White, based on five factors. The Box's Test was non-significant; therefore, Wilks' Lambda was the appropriate test statistic. MANOVA results revealed significant differences between the two Race categories (Wilks' Λ = .974, $F(5, 1308) = 6.96$, $p < .01$). Effect size was small ($\eta^2 = .026$). An examination of the univariate main effects supported a finding of statistical significance ($F(1, 1312)$ values ranged from 1.305 to 14.362, ($p \leq .01$) in two cases). Statistically significant univariate effects were obtained for the Student Evaluation factor ($F(1, 1312) = 9.518$, $p < .01$) and the Student and Parent Effects factor ($F(1, 1312) = 14.362$, $p < .01$). Effect sizes were small ($\eta^2 = .007$ and $\eta^2 = .011$, respectively). Results indicated that the Non-White subgroup rated a higher level of impact on teaching from student misbehaviors, student capability, and level of parent support. The Non-White subgroup rated higher the teacher practice of utilizing multiple measures (behavior, participation, effort, homework, improvement) for the evaluation of student progress. A summary of ANOVA main effect results for the demographic group RACE is presented in Table 10.

Table 10

Univariate Main Effect Results for Race Groups on Five Factor Scores

Variable	df	ms²	*F*	Sig	η²
Leadership & PLC	1	32.906	1.724	.189	.001
Error	1312	19.083			
Student & Parent Effects	1	205.172	14.362**	.000	.011
Error	1312	14.286			
Student Evaluation	1	52.767	9.518**	.002	.007
Error	1312	5.544			
Teacher Efficacy	1	11.164	1.305	.254	.001
Error	1312	8.557			
Teacher Collaboration Time	1	32.277	2.717	.100	.002
Error	1312	11.880			

**p < .01

Age. A MANOVA was conducted to determine if differences existed between Age groups based on the five factors. The Age groups were: (1) 35 and Under, (2) 36 – 45 Years, and (3) 46 and Older. The Box's Test was non-significant; therefore, Wilks' Lambda was the appropriate test statistic. The MANOVA results revealed significant differences among the Age categories on the dependent variables [Wilks' $\Lambda = .975$, $F(10, 2614) = 3.331$, $p < .01$]. Effect size was small ($\eta^2 = .013$).

Univariate analyses of variance (ANOVAs) were computed for each factor. The univariate computed values of F had probabilities that ranged from .639 to 7.954. An examination of the results of the ANOVAs indicated that a significant difference among groups existed for Factor 5, Teacher Collaboration Time [F(2, 1311) = 7.954, p < .01]. In addition, a statistically significant difference was found for Factor 2, Student and Parent Effects [F(2, 1311) = 4.482, p < .05]. For both ANOVAs the effect size was small. The results of the ANOVAs are summarized in Table 11 for the demographic group Age.

Table 11

Univariate Main Effect Results for Age Groups on Five Factor Scores

Variable	df	ms²	*F*	Sig	η²
Leadership & PLC	2	23.201	1.216	.297	.002
Error	1311	19.087			
Student & Parent Effects	2	64.344	4.482*	.011	.007
Error	1311	14.355			
Student Evaluation	2	3.565	.639	.528	.001
Error	1311	5.583			
Teacher Efficacy	2	16.449	1.925	.146	.003
Error	1311	8.547			
Teacher Collaboration Time	2	93.627	7.954**	.000	.012
Error	1311	11.770			

*p < .05. ** p < .01.

For this ANOVA, the data was separated into three age groups; therefore, post hoc analysis was required for Factor 2, Teacher Collaboration Time and Factor 5, Student and Parent Effects. Post hoc Tukey HSD analyses were conducted for these factors. A summary of the significant results of the post hoc analyses of Age groups for Factor 2 and Factor 5 is presented in Table 12. Post hoc analysis indicated significant differences at the $p < .05$ level between the youngest group (35 and Under) and each of the other two Age groups (36 – 45 Years and 46 and Older) for Student and Parent Effects. The youngest group gave higher rating to the impact of student misbehaviors, student capability, and level of parent support on teaching. The means and mean differences are provided in Table 12. An inspection of the mean differences indicated that the obtained differences were small.

Table 12

Tukey HSD Comparison of Statistically Significant Differences Between Age Groups

Factor	Age (I)	Age (J)	Mean Difference (I – J)	Sig.
Student & Parent Effects	35 & Under (11.9442)	36 – 45 (11.2492)	.6950*	.036
	35 & Under (11.9442)	46 & Older (11.2942)	.6500*	.020
Teacher Collaboration Time	35 & Under (13.1163)	46 & Older (12.4448)	.6714**	.006
	36 – 45 (13.3003)	46 & Older (12.4448)	.8555**	.001

*$p < .05$. ** $p < .01$.

The post hoc analysis indicated that the oldest group, 46 and Older, was significantly different ($p < .01$) from each of the two younger groups (35 and Under and 36 – 45 Years) for Factor 5, Teacher Collaboration Time. The 46 and Older group rating in this factor indicated less time collaborating with peers than the two younger groups. The absolute value of the differences was small; these mean differences were less than 1.

Years of teaching experience. A one-way multivariate analysis of variance (MANOVA) was conducted to determine if differences existed between Years of Teaching Experience groups based on the five factors. The Years of Experience groups were: (1) 0 – 5 Years; (2) 6 – 15 Years; (3) 16 – 25 Years; and (4) 26 or More Years. The Box's Test was non-significant; therefore, Wilks' Lambda was the appropriate test statistic. The MANOVA results revealed significant differences among the four Years of Experience categories [Wilks' $\Lambda = .959$, $F(15, 3605) = 3.661$, $p < .01$]. Effect size was small ($\eta^2 = .014$).

Univariate ANOVAs were computed for each factor. The univariate computed values of F had probabilities that ranged from 2.250 to 8.073. An examination of the results of the ANOVAs indicated that significant differences among groups existed. Statistically significant univariate effects were obtained for the Student and Parent Effects factor [$F(3, 1310) = 8.073$, $p < .01$] and the Teacher Efficacy factor [$F(3, 1310) = 3.951$, $p < .01$]. Effect sizes were small, ($\eta^2 = .018$ and $\eta^2 = .009$, respectively). Statistically significant univariate effects were obtained for the Leadership and Professional Learning Community factor [$F(3, 1310) = 2.731$, $p < .05$] and the Student Evaluation factor [$F(3, 1310) = 2.762$, $p < .05$]. Effect sizes were small ($\eta^2 = .006$ for each factor). A summary of the results of the five ANOVAs is provided in Table 13.

Table 13

Univariate Main Effect Results for Years of Teaching Experience Groups on Five Factor Scores

Variable	df	ms²	*F*	Sig	η²
Leadership & PLC	3	51.937	2.731*	.043	.006
Error	1310	19.018			
Student & Parent Effects	3	114.659	8.073**	.000	.018
Error	1310	14.202			
Student Evaluation	3	15.348	2.762*	.041	.006
Error	1310	5.558			
Teacher Efficacy	3	33.591	3.951**	.008	.009
Error	1310	8.502			
Teacher Collaboration	3	26.692	2.250	.081	.005
Error	1310	11.861			

*$p < .05$. ** $p < .01$.

For the variable Years of Teaching Experience four groups were established; therefore, post hoc analysis was required for each significant ANOVA. Tukey HSD post hoc analysis was conducted for Years of Teaching Experience groups for each significant ANOVA (the four significant factors). Post hoc results indicated statistically significant differences at the $p < .05$ level among groups for Years of Teaching Experience for each of the four factors. Significant differences were found for Factor 1, Leadership and Professional Learning Community, Factor 2, Student and Parent Effects, Factor 3, Student Evaluation Practices, and Factor 4, Teacher Efficacy. A summary of the significant results of the post hoc analyses is presented in Table 14.

Table 14

Summary of Results of Tukey HSD Comparison for Statistically Significant Differences Between Years of Teaching Experience Groups

Factor	Years of Teaching Experience (I)	Years of Teaching Experience (J)	Mean Difference (I – J)	Sig.
Leadership & PLC	6 – 15 (23.4181)	26 or More (24.3691)	-.9510*	.029
Student & Parent Effects	0 – 5 (12.3462)	6 – 15 (11.5222)	.8240*	.016
	0 – 5 (12.3462)	16 – 25 (11.1051)	1.2411**	.001
	0 – 5 (12.3462)	26 or More (10.8584)	1.4878**	.000
Student Evaluation	16 – 25 (16.881)	26 or More (17.4549	-.5709*	.033
Teacher Efficacy	0 – 5 (25.4860)	16 – 25 (26.1522)	-.6662*	.035

*p < .05. ** p < .01.

Post hoc analysis indicated six pairs of differences among the groups across the various factors when groups were established by Years of Teaching Experience. The groups with the least teaching experience tended to score differently than the groups with more teaching experience. The 6 – 15 Years group rated the school environment lower than the 26 or More Years group for Factor 1, Leadership and Professional Learning Community. For Factor 2, Student and Parent Effects, the group with the least teaching experience was significantly different than the other groups. The 0 - 5 Years group was different from the 6 – 15 Years group, the 16 – 26 Years group, and the 26 or More Years group. There were no significant differences for Factor 2 among the three other groups. The group with the least teaching experience gave higher rating to the impact of student misbehaviors, student capability, and level of parent support on teaching. The means and mean differences are provided in Table 14. An inspection of the mean differences indicated that the obtained differences were small.

The post hoc analysis indicated a significant mean difference at the $p < .05$ level between the 16 – 25 Years group and the 26 or More Years group for Factor 3, Student Evaluation. The 16 – 25 Years group had lower ratings regarding items related to the teacher practice of utilizing multiple measures (behavior, participation, effort, homework, improvement) for the evaluation of student progress. The means and mean differences are provided in Table 14. An inspection of the mean differences indicated that the obtained differences were small.

The post hoc analysis for the variable Teacher Efficacy identified one significant difference. The group with the least experience, the 0 – 5 Years group, was significantly different from the 16 – 25 Years group for Factor 4, Teacher Efficacy. Those with the fewest years of teaching rated themselves significantly lower on items related to preparedness for teaching to the differentiated needs of their students. The means and mean differences are provided in Table 14. An inspection of the mean differences indicated that the obtained differences were small.

Highest level of education. A one-way MANOVA was conducted to determine if differences existed between Highest Level of Education groups in relation to the five factors. The Highest Level of Education groups were: (1) High School / Associate's

Degree / Bachelor's Degree; (2) At Least One Year Beyond Bachelor's; (3) Master's Degree; and (4) Education Specialist / Professional Diploma / Doctorate. The Box's Test was non-significant; therefore, Wilks' Lambda was the appropriate test statistic. The MANOVA results revealed significant differences among the four Highest Level of Education categories [Wilks' $\Lambda = .959$, $F(15, 3605) = 3.661$, $p < .01$]. Effect size was small ($\eta^2 = .008$).

Univariate ANOVAs were computed for each factor. The univariate computed values of F had probabilities that ranged from .126 to 3.523. An examination of the results of the ANOVAs indicated that significant differences among groups existed. Statistically significant univariate effects were obtained for the Student and Parent Effects factor [$F(3, 1310) = 3.523$, $p < .05$] and the Teacher Efficacy factor [$F(3, 1310) = 3.505$, $p < .05$]. Effect sizes were small ($\eta^2 = .008$ for each factor). Statistically significant univariate effects were also obtained for the Teacher Collaboration Time factor [$F(3, 1310) = 2.738$, $p < .05$]. Effect size was small, ($\eta^2 = .006$). A summary of the results of the five ANOVAs is provided in Table 15.

Table 15

Univariate Main Effect Results for Highest Level of Education Groups on Five Factor Scores

Variable	df	ms^2	*F*	Sig	η^2
Leadership & PLC	3	41.077	2.157	.091	.005
Error	1310	19.043			
Student & Parent Effects	3	50.553	3.523*	.015	.008
Error	1310	14.349			
Student Evaluation	3	.707	.126	.944	.000
Error	1310	5.591			
Teacher Efficacy	3	29.824	3.505*	.015	.008
Error	1310	8.502			
Teacher Collaboration	3	32.444	2.738*	.042	.006
Error	1310	11.848			

$^*p < .05$.

For the variable Highest Level of Education four groups were established; therefore, post hoc analysis was required for each significant ANOVA. Tukey HSD post hoc analysis was conducted for Highest Level of Education groups for each significant ANOVA (the three significant factors). Post hoc results indicated statistically significant differences at the $p < .05$ level among groups for Highest Level of Education for two of the three factors identified in the ANOVAs. Significant differences were found for Factor 2, Student and Parent Effects, and Factor 4, Teacher Efficacy. A summary of the significant results of the post hoc analyses is presented in Table 16.

Table 16

Summary of Results of Tukey HSD Comparison for Statistically Significant Differences Between Highest Level of Education Groups

Factor	Highest Level of Education (I)	Highest Level of Education (J)	Mean Difference (I – J)	Sig.
Student & Parent Effects	High School/AA/BA (12.0567)	Master's Degree (11.2077)	.8490*	.015
Teacher Efficacy	E.S./Prof Diploma/ Doctorate (26.4352)	High School/AA/BA (25.4326)	1.0026*	.013

*p < .05.

The post hoc analysis indicated a significant mean difference at the $p < .05$ level between the group with the fewest years of education (High School / AA Degree / BA Degree) and the Master's Degree group regarding Factor 2, Student and Parent Effects. The High School / AA Degree / BA Degree group rated higher the impact on teaching of student misbehaviors, student capability, and level of parent support. The means and mean differences are provided in Table 16. An inspection of the mean differences indicated that the obtained differences were small.

The post hoc analysis for Factor 4, Teacher Efficacy, identified one significant difference. The group with the least years of education (High School / AA Degree / BA Degree) was different from the group with the highest level of education (Education Specialist / Professional Diploma / Doctorate) for Factor 4, Teacher Efficacy. Those with the fewest years of education rated themselves lower on items related to preparedness for teaching to the differentiated needs of their students. The means and mean differences are provided in Table 16. An inspection of the mean differences indicated that the obtained differences were small.

Summary

This chapter presented a summary of the data analysis results to address the two research questions. Research question 1 was answered by means of a factor analysis procedure. Five factors were derived from the data reduction process utilizing selected survey responses from the *ECLS-K Spring 2004 5th Grade Teacher Questionnaire.* Research question 2 was answered utilizing a MANOVA procedure to analyze responses based on established demographic groups. Significant mean differences among the demographic groups were identified based on computed factor scores. Where applicable, these differences were further explored through a post hoc analysis.

Significant mean differences regarding Factor 1, Leadership and Professional Learning Community, were indicated within the Years of Teaching Experience group. Significant mean differences regarding Factor 2, Student and Parent Effects, were indicated within the Race, Age, Years of Teaching Experience, and Highest Level of Education groups. Significant mean differences regarding Factor 3, Student Evaluation, were indicated within the Race and Years of Teaching Experience groups. Significant mean differences regarding Factor 4, Teacher Efficacy, were indicated within the Years of Teaching Experience and Highest Level of Education groups. Significant mean differences regarding Factor 5, Teacher Collaboration Time were indicated within the Age group. However, for all significant ANOVAs effect sizes and pairwise differences for means were small; all differences were less than 1.5.

Chapter 5: Findings, Conclusions, and Recommendations

This study quarried the potential of a national dataset, the *1998-99 ECLS-K Spring 2004 Fifth Grade Teacher Questionnaire* (*ECLS-K 5th Grade*), to serve as a relevant secondary data source for educational research with the application of exploratory analysis techniques. This study was comprised of two phases to address two research questions. In Phase 1, exploratory factor analysis procedures were carried out with selected elements of the *ECLS-K 5th Grade* to identify underlying constructs associated with upper elementary teachers' beliefs, attitudes, and perceptions regarding their work. In Phase 2, identified factors from Phase 1 were further explored for possible differences among *ECLS-K 5th Grade* respondents from specified demographic groups. Quantitative methodology was applied in both phases.

Data reduction techniques in Phase 1 included principal components analysis and maximum likelihood extraction with equamax factor rotation. Factor validity was supported by an item review of constructs conducted by an advisory panel of experts with demonstrated expertise in the areas of educational leadership and educational research methodology. Factor internal reliability was established utilizing Chronbach's Alpha. Pearson's Product-Moment Correlation Coefficient was utilized to ascertain relationship among the identified factors. Phase 2 considered possible differences across identified demographic groups in light of the factors identified in Phase 1. A multivariate analysis of variance (MANOVA) and relevant post hoc analyses were carried out in Phase 2 for each group. This chapter presents the key findings of the study, implications for educators, and recommendations for further research.

Research Question 1

Will a factor analysis of selected items from the *ECLS-K 5^th Grade Spring 2004 Teacher Level Questionnaire* provide factors related to underlying constructs about upper elementary teachers' beliefs, attitudes, and perceptions related to their work environment?

As a primary data source, the purpose of the *ECLS-K* longitudinal study was to gather information that would inform the relationship between children's achievement and a multitude of school and home factors. The *ECLS-K 5th Grade* administration resulted in the collection of teacher data on a large scale (N > 10,000) regarding instructional activities, the classroom and school environment, student evaluation, and views on teaching.

As a secondary dataset for this study, usage of the *ECLS-K 5th Grade* shifted from illuminating the child experience, to illuminating the teacher experience. The advantages of using an existing dataset were established in the research: monetary savings, data quality, breadth of sample, and staff expertise in survey design (Crossman, 2014). Research on teachers and teaching in the United States supported the empirical relevance of this study. The study attempted to define the teacher experience and, potentially, provide the educational community with useful information needed to retain a highly effective teacher workforce. To empirically determine the existence of underlying constructs, or factors, of the teacher experience, an exploratory factor analysis was conducted.

Principal components analysis (PCA) was conducted as an initial factor extraction tool. With the input of a panel of advisors, 39 items from the *ECLS-K 5th Grade* were included in the analysis. Decision-making criteria applied to the analysis output resulted in the removal of 13 items that did not contribute to a clear factor structure. These items were removed for the remainder of the study. Based on the results of the PCA, the remaining 26 items underwent factor analysis with a focus on four- and five- factor solutions. Several extraction techniques were utilized with the parsimonius solution being a five-factor solution employing the maximum likelihood extraction method with equamax rotation.

Labeling of the five factors was conducted with the intent of providing an accurate, useful description of the underlying constructs based on quantitative strength of the contributing items. Relevancy to research-based components of the teacher experience and face validity was also considered. The five factors were labeled: Leadership and Professional Learning Community, Student and Parent Effects, Student Evaluation, Teacher Efficacy, and Teacher Collaboration Time.

An analysis of internal consistency utilizing Chronbach's alpha coefficient established the five factors as reliable. That is, the internal consistency of the constructs indicated the composition of factors to be reliable. Thus, the empirical analysis indicated that a factor analysis of selected items from the *ECLS-K 5th Grade* would provide factors related to underlying constructs about upper elementary teachers' beliefs, attitudes, and perceptions related to their work.

Research Question 2

When groups are established using selective demographic variables, are there differences between these groups based upon the factors established in Phase 1?

Phase 2 sought to amplify understanding of the five established factors by analyzing differences among the following demographic groups: Race (White/ Non-White), Age, Years of Teaching Experience, and Highest Education Level. Utilizing the same dataset (N = 1,314) employed for the factor analysis, four one-way multivariate analyses of variance (MANOVA) were conducted utilizing the five factors established in Phase 1 as dependent variables: Leadership and Professional Learning Community, Student and Parent Effects, Student Evaluation, Teacher Efficacy, and Teacher Collaboration Time. Box's Test of Equality significance levels for each demographic group supported the null hypothesis that the observed covariance matrices of the dependent variables were equal across groups, thereby establishing the robustness of each MANOVA conducted. Based on this statistic, Wilk's Lambda was utilized to establish the presence of differences among groups. Significance levels for main effects between groups were evaluated. As appropriate, Tukey's HSD post hoc analyses were conducted.

Statistically significant univariate differences were found between White (n = 1,108) and Non-White (n = 206) groups for two factors, Student Evaluation and Student and Parent Effects. The Non-White subgroup had higher ratings regarding the utilization of practices for evaluating student progress that incorporated the multiple measures of behavior, class participation, homework, and effort. The Non-White subgroup gave higher rating to the instructional impact of Student and Parent Effects, specifically levels of student misbehavior, student capability, and levels of parent support.

Differences for the factors Student and Parent Effects and Teacher Collaboration Time were indicated in the multivariate analyses when groups were established by age. The 35 and Under group was different than both the 36 – 45 Years group and the 46 and Older group. The 35 and Under group gave higher rating to the instructional impact of

Student and Parent Effects, specifically levels of student misbehavior, student capability, and levels of parent support.. The 46 and Older group differed from both the 35 and Under and 36 – 45 Years groups regarding Teacher Collaboration Time, indicating that the oldest teachers rated themselves as spending less time in formal peer collaboration activities.

The MANOVA for groups established by Years of Teaching Experience revealed significant differences among the factors Leadership and Professional Learning Community, Student and Parent Effects, Student Evaluation, and Teacher Efficacy. Follow-up univariate test results indicated that the 6 – 15 Years group rated the school environment lower in the areas of Leadership and Professional Learning Community, than the group with the most teaching experience, 26 or More Years. The group with the least teaching experience, 0 – 5 Years, gave higher ratings to the impact on teaching from Student and Parent effects than all other Years of Teaching Experience groups. Results indicated that the 16 – 25 Years group reported at a higher rate the implementation of the teacher practice of utilizing multiple measures (behavior, participation, effort, homework, improvement) for the evaluation of student progress than the group with the most teaching experience, 26 or More years. Significant mean differences were found between the 0 – 5 Years of Teaching Experience group and the 16 – 25 Years of Teaching Experience group regarding levels of Teacher Efficacy. The group with the least teaching experience had a lower perception of their preparedness to teach to the needs of all students.

Key Findings

This study resulted in two key findings. The first key finding was the appropriateness of the use of the *ECLS-K 5th Grade* teacher survey instrument as a data source with which to apply factor analysis processes to establish factors related to the underlying constructs of the teacher experience. Five factors were empirically identified. Due to the large sample size of the *ECLS-K 5th Grade* and the breadth of scope of data gathered, its relevance as a secondary data source for identifying underlying constructs of teachers' beliefs, attitudes, and perceptions about their work was established. This determination holds significance for educational researchers and practitioners who are seeking empirical methods to better understand the dynamics of teacher job satisfaction and teacher retention, yet may not have the financial or technical means to conduct an original survey of the same high quality as that of the *ECLS-K 5th Grade.*

The five factors were labeled as follows: (1) Leadership and Professional Learning Community; (2) Student and Parent Effects; (3) Student Evaluation; (4) Teacher Efficacy; and (5) Teacher Collaboration Time. The factors were determined to be reliable and reflect both construct and face validity. These factors were also consistent with the existing body of research regarding teachers' beliefs, attitudes, and perceptions of their work. The substantiation of empirically determined factors consistent with the body of research can serve to bolster the decision-making process for educational practitioners who seek to create optimal conditions for teacher job satisfaction and teacher retention.

The second key finding of this study was the empirical identification of differences among the demographic groups Race, Age, Years of Teaching Experience, and Highest Level of Education in relation to the five identified factors. Race (White / Non-White) differences were significant in the area of Student and Parent Effects. Age group data supported the conclusion that younger teaching staff identified student behaviors, student capability, and parent support impacting teaching more than was identified by their older peers. Data from this study supported the conclusion that older teachers spent less time collaborating with peers. Analysis of the Years of Teaching Experience demographic group revealed that the least experienced teachers perceived themselves as less efficacious, less likely to feel positive about school climate, and more highly impacted by student misbehavior and parents. Highest Level of Education data indicated teachers with the fewest years of education rated student behaviors, student capability, and parent support of higher impact on teaching than teachers with an earned Master's Degree. Teachers with the fewest years of education rated themselves lower than teachers with the most years of education on items related to preparedness for teaching to the differentiated needs of their students. These results provide empirical support for practitioners who are seeking to design new-hire procedures for teaching staff that result in more successful experiences for teachers during their early years in the profession.

Discussion

This study served to empirically substantiate the experiences of upper elementary teachers utilizing a national dataset made available by means of public-use files. The results of this study hold significance on two fronts: (1) The established efficacy of applying exploratory analysis techniques to an existing national data set to seek new information for which the dataset was not originally designed, and (2) The utility of the additional data derived from the exploratory techniques. In the case of this study, exploratory factor analysis empirically identified underlying constructs of teachers' beliefs, attitudes, and perceptions about their work.

***ECLS-K 5^th^ Grade* as secondary data source.** Research has established that secondary data sources can save researchers time and money. The use of secondary data sources can also provide researchers technical expertise and access to populations that would not otherwise be available. This study substantiated the quality of the *ECLS-K 5th Grade* as a secondary data source for gathering upper elementary teacher perceptual data. The *ECLS-K 5th Grade* is one component of a longitudinal study spanning grades Kindergarten through Eighth grade. Each year of the longitudinal study the teachers of 20,000 or more students were surveyed. As a secondary data source, the longitudinal study holds much potential for researchers to further study the dynamics of the teacher experience throughout the elementary and middle school grades.

Five factors established. Of import in this study was the empirical identification of the five factors related to upper elementary teachers' beliefs, attitudes, and perceptions: Leadership and Professional Learning Community, Student and Parent Effects, Student Evaluation, Teacher Efficacy, and Teacher Collaboration Time. Each of these factors is supported by the body of literature regarding teachers' beliefs, attitudes, and perceptions of their work. Results of this study were derived from an exploratory factor analysis model applied to a large sample size (N = 1,314) which adds a level of utility to the data that may not be present in smaller studies and serves to quantitatively support prior research in each area identified by the factors.

Refinement of teacher professional development. Research has shown that teachers make a difference in the achievement of students. This study provided quantitatively established factors that, if optimized, can assist educational leaders in designing professional development that effectively prepares teachers to meet the needs of their students. The study also provided insight into the perceptions of certain upper elementary teacher demographic groups regarding the five factors. For example, demographic data from this study revealed that younger teachers and teachers with less years of teaching experience were more likely to assign impact on instruction from student misbehavior, student capability, and level of parent support. Teachers from these groups were also more likely to express concern about preparedness for teaching to the needs of all students. Older teachers provided perceptual data suggesting that they did not collaborate as much as their younger peers. Older teachers and teachers with more experience and education also reported higher levels of efficacy in teaching all students, higher levels of parent support, and less impact on instruction from student misbehavior and student capability.

The results of this study, taken as a whole, provide educational policymakers and site leaders a multi-dimensional look at research-based teacher factors known to affect student achievement. In addition, the results inform stakeholders of differences in the implementation of activities associated with those factors among the diverse individuals that comprise a teacher workforce. Demographic data from this study could assist practitioners in the refinement of teacher professional development programming. Areas of teacher concern identified in this study could be monitored by school leaders within their own teacher workforce by means of enhanced teacher induction and teacher evaluation processes. Teacher professional development structures such as mentoring and peer feedback could be refined with a heightened awareness of varied individual needs.

Recommendations for Further Research

This study established the appropriateness of using a national dataset as a secondary data source. Quantitative methodology, specifically exploratory factor analysis techniques, established factors associated with upper elementary teachers' beliefs, attitudes, and perceptions regarding their work. Data from identified demographic groups assisted in providing a multifaceted consideration of the upper elementary teacher experience that holds benefit for all educational stakeholders. Methodology and findings from this study have bearing on possible future research.

1. **Follow-up item analysis.** An advisory group of experts with demonstrated expertise in the areas of educational leadership and educational research methodology identified the original 39 survey items submitted for factor analysis. Based on applied factor extraction and rotation techniques, 26 of the original 39 items were found to be relevant to the selected five-factor solution. Future factor analysis research should be conducted to determine the possible contribution of the other 13 items in determining a factor solution that amplifies the understanding of the underlying constructs of the teacher experience.
2. **Analysis of K - 8 teacher data.** The *ECLS-K* longitudinal study was carried out with a cohort of students from kindergarten through eighth grade. Teacher survey data was collected during each round of data collection. Future

research utilizing factor analyses and demographic data analyses should be carried out with *ECLS-K* longitudinal study teacher data from other grade levels to compare and contrast teacher perceptual data at the various levels. At the middle school level teacher data could be compared among teachers from varying content areas. Factor stability could be analyzed. Studies of K – 8 teacher beliefs, attitudes, and perceptions about their work would contribute to a fuller understanding of optimal teaching and learning conditions. Factor stability could be analyzed.

3. **Local study.** Factors identified in this study should be tested at a local level utilizing the selected survey items. A mixed-method approach could be devised to follow up the factor and multivariate analyses with qualitative interviews. The qualitative design would serve to amplify the teacher perceptual data and enable local entities to customize data collection for the local needs.
4. **Varied educational settings.** This study was limited to 5th grade public school teachers in the self-contained classroom setting. The kindergarten and 1st grade rounds of the *ECLS-K* longitudinal study administration included collection of teacher data from the following educational settings: public and private schools, Catholic and non-Catholic, rural and urban. This study could be conducted with the kindergarten or 1st grade teacher data to test for factor stability across educational settings.
5. **Replication of this study.** This study should be replicated to affirm the findings of the exploratory factor analysis. Future researchers may carry out

the exploratory decision making process differently which could result in the identification of additional factors from the dataset which are central to the teacher experience.

Summary

An exploratory analysis of selected items from the *ECLS-K 5th Grade* established the utility of the national data set as a secondary data source for identifying constructs related to the upper elementary teacher experience. Five empirical factors were identified, determined to be reliable, and determined to reflect construct validity. These factors were consistent with the existing body of research regarding teachers' beliefs, attitudes, and perceptions of their work. Additional analysis of the factors indicated statistically significant differences among selected demographic groupings. These findings may prove useful to educational practitioners who seek to create the optimal conditions for teacher effectiveness. Several recommendations for further research were presented that would further affirm the use of the *ECLS-K* longitudinal national dataset to inform the understanding amongst all stakeholders of K-8 teachers' beliefs, attitudes, and perceptions about their work.

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Appendix A

Institutional Review Board Approval Certification

University of Nevada, Reno

Research Integrity Office
218 Ross Hall / 331,
Reno, Nevada 89557
775.327.2368 / 775.327.2369 fax
www.unr.edu/research-integrity

DATE:	March 19, 2015
TO:	Billy Thornton, PhD
FROM:	University of Nevada, Reno Social Behavior and Education IRB
PROJECT TITLE:	[701141-1] An Exploratory Factor Analysis of Teachers' Beliefs, Attitudes, and Perceptions Utilizing the 1998-99 ECLS-K Spring 2004 Fifth Grade Teacher Questionnaire
REFERENCE #:	
SUBMISSION TYPE:	Exempt/New Project
ACTION:	DETERMINATION OF EXEMPT STATUS
DECISION DATE:	March 19, 2015;Expiration Date: March 19, 2018;Next status report due March 19, 2016
REVIEW CATEGORY:	Exemption category # 2

The UNR Institutional Review Board has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations. Please note, the federal government has identified certain categories of research involving human subjects that qualify for exemption from federal regulations. The IRB is authorized by the federal government to determine whether studies thought by the principal investigator (PI) to be exempt from federal regulations actually qualify for exemption criteria. Only the IRB has authority to make a determination that a study is exempt from federal regulations and from IRB review and approval. The above-referenced protocol was reviewed and the research deemed eligible to proceed in accordance with the requirements of the Code of Federal Regulations on the Protection of Human Subjects (45 CFR 46.101 paragraph [b]).

- Application Form - Exempt: Review of Existing Records (Not from Medical Charts), Social/ Educational (UPDATED: 12/31/2014)
- Other - Responsible Official Attestation (UPDATED: 03/8/2015)
- Questionnaire/Survey - #11 Appendix B Selected 1998-99 ECLS-K Spring 2004 5th Grade Questionnaire Items with Variable Descriptions (UPDATED: 12/31/2014)
- University of Nevada, Reno - Part I, Cover Sheet - University of Nevada, Reno - Part I, Cover Sheet (UPDATED: 03/13/2015)

We will retain a copy of this correspondence within our records.

If you have any questions, please contact Nancy Moody at 775.327.2367 or nmoody@unr.edu. Please include your project title and reference number in all correspondence with this committee.

Sincerely,

Nancy Moody JD MA
Director, Research Integrity Office
University of Nevada Reno

Appendix B

Selected ECLS-K 5th Grade Questionnaire Items with Variable Descriptions

In this section are listed the 39 selected *ECLS-K 5th Grade Spring 2004 Teacher Level Questionnaire* survey items used in this study to investigate teacher variables. The list includes the variable names and variable descriptions taken from the 2009 U.S. Department of Education, National Center for Education Statistics, Institute of Education Sciences *Early childhood longitudinal study, kindergarten class of 1998-99 ECLS-K K-8 full sample public use data files and electronic codebook (NCES No. 2009-005)* (U.S. Department of Education, 2013).

Teacher beliefs, attitudes, and perceptions of their work.

13 a. Individual child's achievement relative to the rest of the class.

J61TOCLA J61 Q13A EVAL CHILD RELATIVE TO CLASS

13 b. Individual child's achievement relative to local or state standards.

J61TOSTN J61 Q13B EVAL CHILD RELATIVE TO STANDARD

13 c. Individual improvement or progress over past performance

J61IMPRV J61 Q13C EVAL CHILD IMPROVEMENT/PROGRESS

13 d. Effort.

J61EFFO J61 Q13D EVAL CHILD'S EFFORT

13 e. Class participation.

J61CLASP J61 Q13E EVAL CHILD CLASS PARTICIPATION

13 f. Classroom behavior or conduct.

J61BEHAV J61 Q13F EVAL CHILD'S CLASS BEHAVIOR

13 g. Completion of homework.

J61CMPHW J61 Q13G EVAL COMPLETION OF HOMEWORK

14 a. I hold the same standard for most children, but I make exceptions for children with special needs.

14 b. I hold different standards for different children based on what I think they are capable of.

14 c. I hold the same standards for everyone in my class.

J61EVAL J61 Q14 TEACHER'S EVALUATION PRACTICES

20 a. Meeting with other teachers to discuss lesson planning.

J61LESPL J61 Q20A TIMES MEET FOR LESSON PLANNING

20 b. Meeting with other teachers to discuss curriculum development.

J61CURRD J61 Q20B TIMES MEET TO DISCUSS CURRICULUM

20 c. Meeting with other teacher or specialist to discuss individual children.

J61INDCH J61 Q20C TIMES MEET TO DISCUSS A CHILD

20 d. Meeting with the special education teacher or service providers to discuss and plan for the children with disabilities in my class.

J61DISCH J61 Q20D TIMES MEET W/ SPEC ED TEACHER

22 a. Staff members in this school generally have school spirit.

J61SCHSP J61 Q22A STAFF HAVE SCHOOL SPIRIT

22 b. The level of child misbehavior (for example, noise, horseplay, or fighting in the halls or cafeteria) in this school interferes with my teaching.

J61MISBH J61 Q22B CHILD MISBEHAVIOR AFFECTS TCHING

22 c. Many of the children I teach are not capable of learning the material I am supposed to teach them.

J61NOTCA J61 Q22 CHILDREN INCAPABLE OF LEARNING

22 d. I feel accepted and respected as a colleague by most staff members.

J61ACCPT J61 Q22D STAFF ACCEPT ME AS COLLEAGUE

22 e. Teachers in this school are continually learning and seeking new ideas.

J61CNTNL J61 Q22E STAFF LEARN/SEEK NEW IDEAS

22 f. Routine administrative duties and paperwork interfere with my job of teaching.

J61PAPRW J61 Q22F PAPERWK INTERFERES W/ TCHING

22 g. Parents are supportive of school staff.

J61 PSUPP J61 Q22G PARENTS SUPPORT SCHOOL STAFF

23. At your school how much influence do you think teachers have over school policy, in areas such as determining discipline policy, deciding how some school funds will be spent, and assigning children to classes?

J61SCHPL J61 Q23 HOW MUCH TEACHERS IMPACT POLICY

24. How much control do you feel you have in your classroom over such areas as selecting skills to be taught, deciding about teaching techniques, and disciplining children?

J61CNTRL J61 Q24 HOW MUCH TCHRS CNTRL CURRICULUM

25a. The academic standards at this school are too low.

J61STNDL J61 Q25A ACADEMIC STANDARDS TOO LOW

25 b. There is a broad agreement among the entire school faculty about the central mission of the school.

J61MISSI J61 Q25B FACULTY ON MISSION

25 c. The school administrator knows what kind of school he/she wants and has

communicated it to the staff.

J61ALLKN J61 Q25C SCH ADMIN COMMUNICATES VISION

25 d. The school administrator deals effectively with pressures from outside the school (for example, budget, parents, school board) that might otherwise affect my teaching.

J61PRESS J61 Q25D SCH ADMIN HANDLES OUTSD PRESSUR

25 e. The school administrator sets priorities, makes plans, and sees that they are carried out.

J61PRIOR J61 Q25E SCH ADMIN PRIORITIZES WELL

25 f. The school administration's behavior toward the staff is supportive and encouraging.

J61ENCOU J61 Q25F SCH ADMIN ENCOURAGES STAFF

25 g. Physical conflicts among children are a serious problem in this school.

J61PHSCN J61Q25G PHYS CONFLICTS SERIOUS PROBLEM

25 h. Children bullying other children is a serious problem in this school.

J61BULLY J61 Q25H

26 a. I really enjoy my present teaching job.

J61ENJOY J61 Q26A TEACHR ENJOYS PRESENT TCHING JOB

26 b. I am certain I am making a difference in the lives of the children I teach.

J61MKDIF J61 Q26B

26 c. If I could start over, I would choose teaching again as my career.

J61TEACH J61 Q26C TEACHR WOULD CHOOSE TCHNG AGAIN

26 d. I am satisfied with my class size.

J61CLSZO J61Q26D SATISFIED WITH CLASS SIZE

26 e. I worry about the security of my job because of the performance of the children in my class(es) on state or local tests.

J61JOBTS J61 Q26E JOB SECURITY STATE/LOCAL TEST

27 a. I am adequately prepared to teach reading to the children who are in my class.

J61PRREA J61 Q27A ADEQ PREP TO TEACH READING

27 b. I am adequately prepared to assist children who are experiencing difficulties in reading.

J61RDPRO J61 Q27B ADEQ PREP TO HELP W/RDG PROBS

27 c. I am adequately prepared to use computers for instruction.

J61PRCOM J61 Q27C ADEQ PREP TO USE COMPUTER W/CLS

27 e. I am adequately prepared to teach the children with disabilities who are in my class.

J61ADTRN J61 Q27E CAN TEACH DISABLED IN MY CLASS

27 g. I am adequately prepared to teach the LEP students in my class.

J61LEPTR J61 Q27G CAN TEACH LEP IN MY CLASS

Teacher qualifications and classroom organization

40. Are you certified in these areas?

b. Elementary education 1

J61 ELEMC J61 Q40B CERTIFICATION: ELEMENTARY ED

41. How do you classify your main assignment at this school, that is, the activity at which you spend most of your time during this school year?

a. Regular classroom teacher 1

J61MASSI J61 Q41 MAIN ASSIGNMENT AT SCHOOL

42. Which category best describes the way your class(es) at this school (is/are) organized?

a. Self-contained class – You teach multiple subjects to the same class of children all or most of the day 1

J61CLORG J61 Q42 HOW CLASSES ARE ORGANIZED

Teacher demographics

28.	J61TGEND	J61 Q28 TEACHER'S GENDER
29.	J61YRBOR	J61 Q29 TEACHER'S YEAR OF BIRTH
30.	J61HISP	J61 Q30 HISPANIC OR LATINO
31 a.	J61RACE1	J61 Q31A AMERICAN INDIAN / ALASKA NATIVE
31 b.	J61RACE2	J61 Q31B ASIAN
31 c.	J61RACE3	J61 Q31C BLACK OR AFRICAN AMERICAN
31 d.	J61RACE4	J61 Q31D NATIVE HAWAIIAN OR OTHER PAC IS
31 e.	J61RACE5	J61 Q31E WHITE
32.	J61YRSTC	J61 Q32 NUMBER YEARS BEEN SCHOOL TEACHER
33.	J61YRSGR	J61 Q33 YEARS TAUGHT THIS GRADE
34.	J61YRSCH	J61 Q34 YRS TCHR TAUGHT AT THIS SCHOOL
35.	J61HGHST	J61 Q35 HIGHEST ED LVL TEACHER ACHIEVED
39.	J61TCHCT	J61 Q39 TYPE OF TEACHING CERTIFICATE

Public School Setting.

School Type, Spring 2004 S6PUPR

Appendix C

SPSS 22 Five-Factor Rotated Solution

Extraction Method: Maximum Likelihood (ML)

Rotation Method: Equamax Rotation

Rotated Factor Matrix[a]

	Factor				
	1	2	3	4	5
J61PRIOR	.841	-.123	.059	.102	.114
J61PRESS	.840	-.158	.034	.085	.092
J61ALLKN	.818	-.122	.077	.102	.084
J61ENCOU	.729	-.170	.014	.174	.095
J61MISSI	.491	-.161	.058	.158	.077
J61SCHSP	.419	-.220	.008	.267	.149
J61PHSCN	-.113	.908	-.014	-.025	-.022
J61BULLY	-.099	.825	-.047	-.052	-.002
J61MISBH	-.148	.631	.017	-.153	-.015
J61NOTCA	-.111	.399	.057	-.189	-.050
NEWJ61PSUPP	-.182	.395	-.025	-.212	-.060
J61BEHAV	.066	.053	.765	-.014	.024
J61CLASP	-.013	.061	.731	.058	.059
J61EFFO	.021	-.001	.696	.032	.020
J61CMPHW	.052	-.019	.585	.012	.082
J61IMPRV	.021	-.059	.344	.149	.051
J61MKDIF	.137	-.151	.099	.650	.108
J61ENJOY	.249	-.253	.002	.648	.070
J61TEACH	.063	-.060	-.028	.528	.115
J61PRREA	.057	-.116	.130	.421	.124
J61ACCPT	.240	-.159	.010	.410	.122
J61RDPRO	.064	-.079	.197	.392	.124
J61INDCH	.029	-.020	.004	.007	.886
J61DISCH	.039	-.059	.003	.018	.675
J61LESPL	.095	-.037	.074	.170	.467
J61CURRD	.100	.037	.123	.176	.416