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The Type of Questions Being Promoted in a 3rd Grade Reading Textbook

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APPROVAL FOR SUCCESSFUL DEFENSE

Suzanne Olivero has successfully defended and made the required modifications to the text of the doctoral dissertation for the **Ed.D.** during this **Fall** Semester 2020.

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The mentor and any other committee members who wish to review revisions will sign and date this document only when revisions have been completed. Please return this form to the Office of Graduate Studies, where it will be placed in the candidate's file and submit a copy with your final dissertation.

Dedication and Acknowledgements

I have accomplished many goals in my life. I have always had my family, friends, and colleagues support me throughout my educational journey. This stage has been by far the most difficult and grueling, yet most rewarding.

From a young age, the importance of education was impressed upon me by my parents, Ismael and Graciela Olivero. They have instilled in me the drive to work hard, sacrifice, and persevere through any obstacle I am faced with. Mom and Dad, I truly appreciate all the sacrifices you have made for me and the opportunities you have given me throughout my life. You have provided endless love, support, and encouragement throughout my educational career. It brings me great joy that you can now revel in my success.

To my son, Christian, this dissertation is dedicated to you. I hope all of the hard work and countless hours dedicated to my studies shows you that you can achieve anything you set your mind to. Every sacrifice I have made is a testament of my desire to provide you with the best life possible. You can accomplish anything in life as long as you are willing to put the work into it.

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Abstract

Asking questions is essential for checking student understanding and keeping them engaged with the task at hand. It is crucial to the way students receive and process information and it encourages independent and critical thinking. Statistics show that the average teacher asks between 300 and 400 questions per day. To have the desired effect, these questions need to be effective, well-considered, and challenging.

Effective, cognitively complex questioning involves using questions in the classroom to open conversations, inspire deeper intellectual thought, and promote student-to-student interaction. Effective questions focus on eliciting the process, i.e. the 'how' and 'why' in a student's response, as opposed to answers which just detail 'what.' Using effective questions in the classroom creates opportunities for students to analyze their own thinking, that of their peers, and their work.

Research suggests that a majority of questions are at the lower end of cognitive complexity and do not promote higher-order or critical thinking. The New Jersey State Learning Standards (NJSLS) have embedded these types of skills into the state teaching standards. Textbook resources are still one of the most influential forces on pedagogy and the overall type of thinking that is promoted in the classroom. There is growing concern with the claims these companies make regarding alignment to standards, whether their claims are audited for validity, and specifically, whether or not the content is aligned with the higher-order thinking required of students. Most textbook series do not undergo an independent analysis of their claims. The purpose of this mixed-methods study was to determine how the language of written questions in a 3rd grade reading textbook series compares with the language of higher-order thinking found in research literature represented by the Hess Cognitive Rigor Matrix.

Keywords: teacher questioning, critical thinking, higher-order thinking, 21st century skills, cognitive complexity

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Chapter I

Introduction

Background

Over the last twenty years, New Jersey's academic standards have laid the foundation for local district curricula that is used by teachers in their daily lesson plans. The standards have been reviewed, revised, and renamed every five years.

According to the New Jersey Department of Education NJDOE (2016), the New Jersey State Board of Education adopted the state's first set of academic standards, called the Core Curriculum Content Standards (CCCS), in May of 1996. The standards described what students should know and be able to do upon completion of fourth, eighth, and twelfth grade. The CCCS became the basis for assessing academic achievement of students, specifically in Grades 3 through 12. Additionally, the standards defined New Jersey's high school graduation requirements.

With the implementation of the CCCS came the development of three subsequent statewide assessments: the Elementary School Proficiency Assessment (ESPA) that was administered from 1997-2002; the Grade Eight Proficiency Assessment (GEPA) administered from 1998-2008, and the High School Proficiency Assessment (HSPA).

In response to the *No Child Left Behind Act of 2001 (NCLB)*, the New Jersey Department of Education initiated an overhaul of the statewide assessment system. According to the NJDOE website (2016), the legislation required that each state administer annual standards-based assessments to students in Grades 3 through 8 and at least once in high school. States were expected to provide assessments that were "grounded in rigorous state content standards and that would assess student achievement in language arts literacy, mathematics, and at three benchmark levels, science (NJDOE, 2016)." As a result of this mandate, third grade would now be included in the assessment. The New Jersey Assessment of Skills and Knowledge (NJASK3) was implemented in 2003. Consequently, the ESPA became NJASK4. NJASK was expanded to include Grades 5 through 7 in 2006.

The New Jersey State Board of Education adopted the Common Core State Standards (CCSS) in mathematics and literacy in June of 2010, less than a month after the revised draft of the CCSS was released. The standards were created through the Common Core State Standards Initiative in an attempt to "ensure that all students are college and career ready in literacy no later than the end of high school" (CCSS, 2010). According to the Council of Chief State Officers (CCSSO) and the National Governors Association (NGA), the Standards were "research and evidence based, aligned with college and work expectations, and rigorous"(CCSS, 2010). College and Career Readiness (CCR) standards in reading, writing, speaking, listening, language, and mathematics were developed, outlining the skills required for college and career readiness in multiple disciplines.

With that, the state joined the Partnership for Assessment of Readiness for College and Careers (PARCC) testing consortium. According to the NJDOE Archives (2020), the PARCC assessments were aligned to the CCSS and were created to measure students' ability to apply their knowledge of concepts rather than memorizing facts. The PARCC electronic assessments replaced the NJASK in 2014.

New Jersey renamed the Common Core State Standards in 2015 under the guise of a revision. The NJDOE stated the purpose was to "ensure that they set consistently high expectations for New Jersey's students" (NJDOE, 2016). These standards were revised based on the recommendations of teams of teachers, parents, administrators, supervisors, and other stakeholders. However, there was not a substantive change in any of the standards. In May 2016, the NJ Student Learning Standards (NJSLS) were adopted. The NJSLS were simply the CCSS with a new name. According to the NJDOE (2020), "the New Jersey Student Learning Standards build on the best of existing standards and reflect the skills and knowledge students need to succeed in college, career, and life."

The current College and Career Readiness Standards outline the expectations for students in order to demonstrate deep content knowledge through the application of knowledge and skills. However, content standards provide little guidance as to what degree specific skills should be emphasized in the classroom. Without clarification and the implementation of engaging learning tasks, then these important skills will be improperly addressed or possibly forgotten. Furthermore, they will not be considered when designing curricular materials or assessments. If curriculum materials and assessments solely measure the basic application of academic skills and concepts, then there is little incentive for schools to focus instruction and assessment on deeper understanding and transfer of learning to new and authentic contexts (Hess & Gong, 2014).

With standards and trends in pedagogy being reviewed and revised every five years, textbook publishing companies are faced with having to design textbook programs that appeal to educators and reflect the changes being made. According to Sue Scott, former editor for McGraw-Hill, "Textbook and textbook programs usually are carefully outlined before they are written. State curricula, analysis of competitors, focus groups with teachers, educational trends, and other factors are blended into the plan" (Venzon, 2011). There is growing concern with the claims textbook publishing companies make regarding alignment to standards, whether their claims are audited for validity, and specifically, whether or not the content is aligned with the higher-order thinking required of students. Most textbooks do not undergo an independent analysis of their claims. They are reviewed in-house and then released to the public.

Higher-Order Thinking

Education for Life and Work (NRC, 2012) defines higher-order thinking, which is also referred to as “deeper learning,” as the process through which an individual becomes capable of taking what was learned in one situation and applying it to new situations (pp. 5-6). Higher-order thinking skills (HOTS) include synthesizing, analyzing, reasoning, comprehending, application, and evaluation. Historically, instruction has been focused on the acquisition of knowledge, especially among elementary school-age children, over the application of knowledge and critical thinking. Advocates believe that without a basis in fundamental concepts, students cannot learn the skills they will need to survive in the work world (Watson, 2019). Placing emphasis on higher-order thinking skills, as opposed to rote memorization, will allow students to reach their highest potential.

Although we can directly teach facts and procedures, understanding of conceptually larger ideas and abstract processes must be constructed in the mind of the learner. According to McTighe and Silver (2020), “Students earn understanding through the active mental manipulation of content via higher-order thinking skills” (p. 1). In order to encourage higher-order thinking, the teacher serves as the facilitator, as opposed to merely a dispenser of information. Students process the content being delivered and build on the ability to make meaning which leads to a deeper understanding. In turn, they are building the ability to apply learning to new situations.

Questioning has been utilized as a critical assessment tool for centuries. There is a direct correlation between asking good questions and effective teaching. The type of questions a teacher asks in the classroom has a significant impact on learning. Learners often mimic and copy their teachers' behavior (Lortie, 1975), so the questions teachers pose have a direct influence on the learning and thinking habits of their learners. Although teachers ask a large number of questions, these are typically low-level, memory-intensive questions (Almeida, 2010) which, although effective for confirming learned facts and checking for errors in concepts, do not engage learners in higher levels of thinking. As helpful as low-level questions can be, they alone do not promote synthesis or application of knowledge.

High-level questions allow for a range of answers and allow students to think critically and creatively. Redfield and Rousseau (1981) stated that in addition to improving students' critical thinking skills, high-level questioning stimulates students' active participation and facilitates learning. Additionally, these types of questions trigger students' prior knowledge and allow them to apply and synthesize new knowledge. Teachers are expected to ask higher-level questions for higher-level learning. However, most studies indicate that teachers generally ask lower-level questions and most questions in textbooks trend toward the lower level. This is a skill that needs to be researched and developed.

Frameworks of Higher-Order Thinking

Higher-order thinking is often associated with learning frameworks such as Bloom's Taxonomy, Webb's Depth of Knowledge (DOK), and Hess' Cognitive Rigor Matrix, which is a combination of both. These frameworks provide guidance for teachers, and describe rigor and deeper learning.

Bloom's Taxonomy, created in 1956 by Benjamin Bloom and revised in 2001, classifies thinking skills into six hierarchically organized categories that range from lower-level cognitive skills (know and understand) through higher-order cognitive skills (apply, analyze, evaluate, create) based on the verbs teachers select when they describe expectations for students' thinking skills and behaviors in a learning outcome. The framework is presented in a triangle, with the highest skill located at the top. As displayed in Figure 1, the levels are Create, Evaluate, Analyze, Apply, Understand, and Remember.

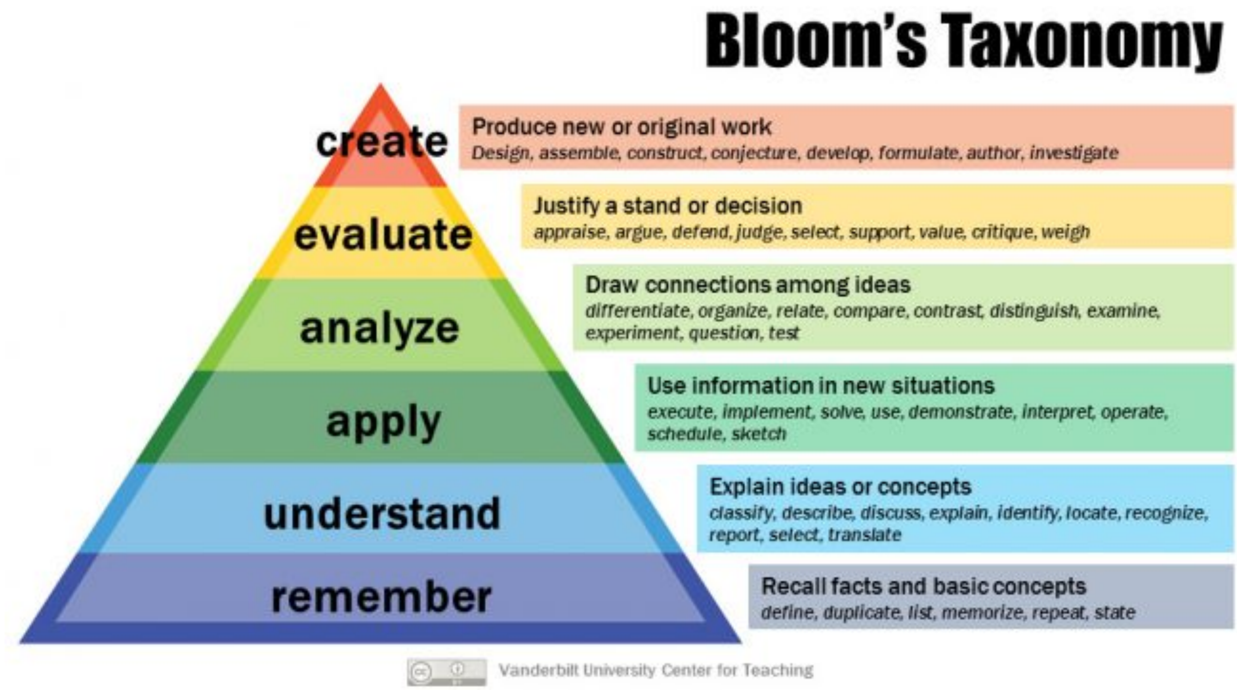

Figure 1. Bloom's Taxonomy (Source: Vanderbilt University Center for Teaching, 2020)

Another framework utilized by educators is Webb's Depth of Knowledge (DOK), created by Norman Webb in 1997, then revised in 1999. Webb's Depth of Knowledge includes four levels, from the lowest (basic recall) to the highest (extended thinking). The framework is presented in a circle, with the four levels (from lowest, DOK 1, to highest, DOK 4) including Recall and Reproduction, Skills and Concepts, Strategic Thinking/Reasoning, and Extended Thinking.

Table 1

Webb's Depth-of-Knowledge levels

Level	Description
DOK-1	Recall & Reproduction — Recall a fact, term, principle, or concept; perform a routine procedure.
DOK-2	Basic Application of Skills/Concepts — Use information, conceptual knowledge; select appropriate procedures for a task; perform two or more steps with decision points along the way; solve routine problems; organize or display data; interpret or use simple graphs.
DOK-3	Strategic Thinking — Reason or develop a plan to approach a problem; employ some decision-making and justification; solve abstract, complex, or non-routine problems, complex. (DOK-3 problems often allow more than one possible answer.)
DOK-4	Extended Thinking — Perform investigations or apply concepts and skills to the real world that require time to research, problem solve, and process multiple conditions of the problem or task; perform non-routine manipulations across disciplines, content areas, or multiple sources.

(Source: Hess, Jones, Carlock &Walkup, 2009)

In 2005, Karin Hess combined both frameworks, resulting in the Cognitive Rigor Matrix. This tool connects Bloom's Taxonomy and Webb's depth of knowledge, allowing for educators to develop their understanding of cognitive rigor, thus applying it to a classroom setting. Furthermore, the matrix guides test developers in designing and aligning test items and performance tasks. Content-specific descriptors in each of the Cognitive Rigor Matrices (CRMs) allow for an analysis of the mental processing required of assessment questions and learning tasks (Hess, 2018). For this study, the Hess Cognitive Rigor Matrix will be utilized to determine the type of thinking that is being promoted in a 3rd grade reading textbook.

Statement of the Problem

Historically, some people have equated having a good memory with being smart. If students memorized material quickly and could regurgitate it, they usually got a good grade on traditional school assignments. Students were praised if their hand was up first when a question was posed to the class. It was all about memorization, with little to no reliance on critical thinking. Sadly, in some classrooms today, this is still the case.

Textbook resources, both print and digital, are still one of the most influential forces on pedagogy and the overall type of thinking promoted in the classroom. There is growing concern with the claims textbook publishing companies make regarding alignment to standards, whether their claims are audited for validity, and specifically, whether or not the content is aligned with the higher-order thinking required of students. Most textbooks do not undergo an independent analysis of their claims. They are reviewed in-house and then released to the public.

Generally speaking, school districts adopt textbooks to complement the local curriculum and use as teaching resources. My school district purchased a new textbook series for elementary school reading in 2013. One specific claim of the textbook regarding higher-order thinking was to "aspire readers and writers with the skills they need to scale the challenges of today's rigorous assessment demands" (Houghton Mifflin Harcourt, 2020). Third grade is an especially important year for reading development because reading proficiency by the end of third grade can be a make-or-break benchmark in a child's educational development. Three quarters of students who are poor readers in third grade will remain poor readers in high school. Students with relatively low literacy achievement tend to have more behavioral and social problems in subsequent grades and higher rates of retention in their current grade (Fiester, 2010). Additionally, it is the first year that students are administered the state mandated test of language arts. A lack of independent mixed-methods research on the type and frequency of higher-order thinking exists in the reading textbook series adopted by my district.

Purpose of the Study

The purpose for this mixed-methods study was to determine how the language of written questions in a 3rd grade reading textbook series compare with the language of higher-order thinking found in research literature, represented by Hess' Cognitive Rigor Matrix.

Research Questions

The study was guided by the following overarching question: What are the types of thinking being promoted in a 3rd grade reading textbook?

The study included two sub questions, which guided the specific inquiry of the study, as follows:

1. In what ways does the language found in questions within the text of a 3rd grade reading textbook compare with language that promotes higher-order thinking found in research literature?
2. What is the frequency and percentage of higher-order thinking, as described by the Hess Cognitive Rigor Matrix, embedded in reading comprehension questions presented in the student textbook of a 3rd grade reading textbook series?

Methodology Overview

For this study, all 138 questions were analyzed from the Journeys Common Core 3rd grade reading textbook series. Two coders collected data by reviewing each question presented in the weekly anchor texts. Each question was aligned with the language found in the Hess Cognitive Rigor Matrix. Once all questions were coded, the two coders compared the frequency of questions categorized as higher level, requiring higher-order thinking skills. Additionally, a focus was on the frequency of questions categorized as lower-level questions requiring students to recall or reproduce, and would not lead to deeper understanding. This study relies on qualitative and quantitative methods, with quantitative statistics utilized in order to explain the percentage of questions that were categorized within the Hess Cognitive Rigor Matrix.

The Hess Cognitive Rigor Matrix and questions presented in a 3rd grade reading textbook were selected as focal points of this mixed-method analysis study. This grade level was selected because research states that “the ability to read and comprehend by third grade is critical to a child’s success in school, life-long earning potential, and their ability to contribute to the nation’s economy and its security” (Annie E. Casey Foundation, 2010). A further explanation of the coding procedure will be provided in Chapter III.

Conceptual Framework

The Hess Cognitive Rigor Matrix (CRM) was utilized as the conceptual framework for the study. This tool was developed in order to assist teachers in envisioning what cognitive demand might look like in the classroom, and to guide assessment developers in designing and aligning test items and performance tasks. Additionally, it provides educators with a guide to create and analyze cognitively engaging and challenging tasks in order to increase the rigor of instruction. Often times, the use of this tool leads to refinements in classroom questioning, the design of learning tasks, and development of high-quality assessments (Hess, 2018).

According to Hess (2018), “cognitive rigor is not only about deciding what we teach, but how we teach it, how we assess it, and what we believe about our students’ abilities to successfully work through challenging material” (p. 16). It is engagement, collaboration, and discourse that makes learning and thinking visible. The language used in questions presented within a 3rd grade reading textbook was analyzed using the Hess Cognitive Rigor Matrix in order to determine if the language promotes higher-order thinking.

The Reading CRM lists the six Bloom’s Taxonomy levels along the rows of the matrix and the four Webb’s Depth-of-Knowledge levels along the columns. Generally speaking, cognitive complexity increases as you read from left to right on the chart and as you read from DOK 1 to DOK 4. At the lowest level of the Hess Cognitive Rigor Matrix is the linking between Bloom’s *Remember* and Webb’s DOK 1, *Recall and Reproduction*. The goal at both of these levels is to recall basic facts and concepts through rote memorization. The next level of Bloom's taxonomy is *Understand*, which can be applied to each of Webb's Depth of Knowledge levels.

Since the Cognitive Rigor Matrix is a combination of Bloom's Taxonomy and Webb's Depth of Knowledge, it can measure the cognitive complexity an activity requires from the student, and the tasks associated with a particular level of understanding. Hess (2019) indicates that by utilizing the Cognitive Rigor Matrix, educators now have a lens to systematically guide the creation of cognitively engaging and challenging assessment tasks while offering a range of choices when planning for increasing the rigor of instruction. Descriptors offer a common language for analyzing the levels of rigor in assessments, units of study, and learning tasks. This analysis will in turn lead to modifications in classroom questioning, the design of learning tasks, and development of high-quality assessments. The use of Hess' Cognitive Rigor Matrix will allow educators to examine and assess students' higher-order thinking. For this study the Cognitive Rigor Matrix will analyze the language in questions found in a reading textbook and assess the type of thinking skills required by students.

Significance of the Study

With new standards embedded into the New Jersey State Learning Standards, educators are faced with a push to enhance and develop higher-order thinking skills among students in order to prepare them for 21st century demands. Textbook publishing companies have capitalized on this trend by developing programs and learning tools to sell to school districts in order to develop these skill sets. Existing literature, however, does not focus on these programs as a means of developing higher-order thinking skills. Additionally, there is no independent research that analyzes the types of activities, problems, or tasks specifically focusing on the level of cognitive complexity that these programs present to students. As a result, school districts that purchase these products do not fully know the extent to which these products can help students to build higher-order thinking skills and cannot assess whether these products are the best fit to meet students' needs.

This study intends to determine how the language of written questions in a 3rd grade reading textbook series compare with the language associated with higher-order thinking found in research literature.

Limitations

The design of this study precludes one from determining whether the questions in the textbook cause higher-order thinking to take place. Neither students or teachers were interviewed. The study used two trained coders and only one framework to determine the cognitive complexity of the questions in the textbook.

Delimitations

Delimitations of this study include the grade level and subject matter selected. For this study, the researcher chose to focus specifically on the Grade 3 level of this reading program and chose reading because of the researcher's own comfort level in this content area as a former district instructional reading coach. This study cannot be generalized to other grade levels or content areas.

Definition of Terms

Cognitive complexity is the extent to which classroom instruction demands students to use critical thinking skills (Nease, Paige, & Sizemore, 2013).

Cognitive rigor encompasses the complexity of the content, the cognitive engagement with that content, and the depth and scope of the planned learning activities (Hess, 2018).

Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication as a guide to belief and action (Scriven & Paul, 2003).

Higher-level cognitive questions are open, divergent, and dialectical; they allow for a range of answers and help learners think critically, imaginatively, and creatively (Kiss & Wang, 2017).

Lower-level cognitive questions are more basic and memory-intensive questions. They are generally fact based, direct, and require recall from the students. Most studies indicate that teachers generally ask lower-level questions.

Teacher questioning encompasses a teacher's interaction with his or her students. Questions provide teachers with the ability to check on and enhance student learning. Research indicates that asking questions is second only to lecturing. Teachers typically spend anywhere from 35-50% of their instructional time asking questions.

Organization of the Study

Chapter II includes a review of relevant research, theory, and literature on higher-order thinking, and how higher-order thinking has been fostered through the use of questioning.

Chapter III further explains the design methods and procedures for the study. Data collected from the questions in a 3rd grade reading textbook series will be paralleled with the Hess Cognitive Rigor Matrix.

Chapter IV reports the study's main findings, including the presentation of relevant data related to the research questions.

Chapter V summarizes the statistical findings and analyzes the data further. Implications for schools, teachers, and students are developed. Recommendations for policymakers and education leaders are presented along with suggestions for future research related to the development of higher-order thinking through high-level questioning.

Chapter II

Review of the Literature

The purpose of this mixed-methods study was to determine how the language of written questions in a 3rd grade reading textbook series compared with the language of higher-order thinking found in research literature, represented by Hess' Cognitive Rigor Matrix. The literature review critiques existing literature regarding higher-order thinking and the role/importance of questioning in developing higher-order thinking skills. Additionally, this review analyzes the existing literature regarding the requirements pertaining to the development of higher-order thinking delineated in New Jersey State Learning Standards (NJSLS) with a focus on Grade 3 English/Language Arts.

Literature Search Procedures

The researcher utilized the Seton Hall Library Database in order to retrieve articles published through peer-reviewed journals as well as dissertations. The researcher was able to access articles through ProQuest, EBSCO, ERIC, and SAGE. In order to retrieve articles related to the focus of this study, terms were keyed in such as *higher-order thinking, critical thinking, New Jersey State Learning Standards, Hess Cognitive Rigor Matrix, Webb's Depth of Knowledge, Bloom's Taxonomy, and teacher questioning.*

Criteria for Inclusion of Literature

- Published, peer-reviewed studies that focused on higher-order thinking, critical thinking, teacher questioning, and 21st century skills
- Dissertations
- Theoretical literature
- Books

- Landmark legislation

Methodological Issues in Studies of Higher-Order Thinking

There were various issues regarding higher-order thinking, specifically in the lack of a formal accepted definition of higher-order thinking. Much of the literature cited examples of higher-order thinking, as well as including exemplars of student tasks that promote higher-order thinking. Similarly, many articles referred to the terms critical thinking and problem solving as synonyms of higher-order thinking, oftentimes failing to distinguish a difference between the terms.

Another issue encountered was the lack of results yielded for the term *cognitive complexity* that could be applicable at the elementary-school level. Much of the literature was focused on higher education, specifically, undergraduate and graduate students. Additionally, many studies found were small, and occurred outside of the United States, thus not being applicable to this study.

Review of Literature Topics

21st Century Skills

According to the Glossary of Education Reform (2016), the term 21st century skills refers to "a broad set of knowledge, skills, work habits, and character traits that are believed — by educators, school reformers, college professors, employers, and others — to be critically important to success in today's world, particularly in collegiate programs and contemporary careers and workplaces." Developments of education in the 21st century put stronger importance on higher-order thinking skills (Mustika et al., 2020). Teachers are being asked to develop more than the basic skills in their classrooms. Today's students need different skills than were taught to previous generations. These skills are commonly defined as 12 abilities that today's students need in order to succeed in their careers and keep up with today's economy (Applied Educational Systems, 2020). Each skill is broken into three categories: Learning skills, Literacy skills, and Life skills. These skills can be applied in all academic subject areas.

The Learning Skills encompass (a) critical thinking, (b) finding solutions to problems, (c) creativity, (d) thinking outside the box or from a new perspective, (e) collaboration or working with others, and (f) communication, speaking with others. These skills are designed for students to use throughout their lifetime in order to adapt to any situation they may encounter in the workplace. The four c's — critical thinking, creativity, collaboration, and communication — are by far the most popular 21st century skills, and are universal needs for any career.

The next category, Literacy skills, are also referred to as "IMT" skills. They are (a) information literacy, (b) media literacy, and (c) technology literacy, encompass all elements of digital comprehension. Information literacy is the foundational skill and refers to the understanding of facts, figures, statistics, and data. Media literacy is the ability to understand the methods and outlets in which information is published, and deeming sources to be credible or not. Technology literacy gives students the basic information they need to understand the way machines or tools perform.

The third category, Life skills, also called FLIPS, pertain to one's personal life. The skills include (a) flexibility, (b) leadership, (c) initiative, (d) productivity, and (e) social skills.

Although 21st century skills have always been important, they have become essential in a worldwide market that moves faster by the day (Applied Educational Systems, 2020). While all skills are equally important, they all gravitate around one key focus: one's ability to enact and adapt to change. This is because any industry can change within a moment's notice. Change will inundate students' lives and they need to be prepared to respond to it. The Glossary of

Education Reform (2016) argues that, "In today's world, information and knowledge are increasing at such an astronomical rate that no one can learn everything about every subject, what may appear true today could be proven to be false tomorrow, and the jobs that students will get after they graduate may not yet exist. For this reason, students need to be taught how to process, parse, and use information, and they need adaptable skills they can apply in all areas of life-just teaching them facts, without reaching them how to use them in real-life settings, is no longer enough."

Higher-Order Thinking

Traditional education has favored knowledge acquisition and the reliance on rote memorization over the application of knowledge and critical thinking. The current push for 21st century learning includes the acquisition of higher-order thinking skills (HOTS). According to Watson (2019), higher-order thinking distinguishes critical thinking skills from low-order outcomes, such as those attained by rote memorization. These thinking skills will allow students to learn and make sense of new information, which will in turn allow them to face and address challenges when entering the workforce and navigating through life.

Higher-order thinking skills include synthesizing, analyzing, reasoning, comprehending, application, and evaluation.

Analysis involves students using their own judgment in order to begin analyzing the knowledge they have learned. Synthesis moves students beyond relying on previously learned information, and requires students to infer relationships among sources. Watson's *Higher Order Thinking Skills Education* (2019) states that "the high-level thinking of synthesis is evident when students put the parts or information they have reviewed together to create new meaning or structure (p.3). Evaluation involves students mentally assembling all they have learned to make sound, informed evaluations of the material.

Knowing that critical thinking is valuable, embedding critical thinking skills in the curriculum through higher-order thinking skills-based learning is undeniably important since it helps sustain an educated citizenry, prepares students to be a success in both career and life, and prepares students to meet mandates of state and national tests and standards (Stobaugh, 2013). It is essential that teachers utilize questioning as a strategy for promoting higher-order thinking skills and cultivating critical thinking. Students' thinking levels are strongly affected by the level of questions asked by the teacher in class.

A qualitative study conducted by Schulz' and Fitzpatrick (2016) aimed to compare teachers' understanding of higher-order thinking and how it is incorporated into instruction. Thirty-eight teachers from 14 schools in Canada were interviewed. Their experience ranged from teaching kindergarten through ninth grade. Five themes emerged as a result of the interviews conducted. All teachers agreed that it is important for their students to develop thinking skills, specifically critical thinking and problem solving. Some teachers, especially those who taught at the elementary level, felt that students were not developmentally ready to grasp higher-order thinking. Additionally, these teachers disclosed that they did not incorporate questions that assessed higher-order thinking on written assessments, as they felt they would not understand the question or solve the problem correctly. Providing lower-level questions guaranteed that students would perform better, thus raising their self-esteem.

A disconnect was found amongst how the teachers viewed and assessed higher-order thinking in the classroom. In addition, teachers had differing opinions when it came to providing examples of how they incorporate higher-order thinking in their classrooms.

Critical Thinking

Although there is research on the topic of critical thinking, there appears to be no widely accepted definition of the term. There are many variations in the definition. While no educator opposes critical thinking, there is a lack of consensus as to its definition. A review of the literature easily reveals a multitude of definitions for critical thinking. Ennis (1985) defined critical thinking as reasonable, reflective thinking that is focused on deciding what to believe or do. It demands students to have good reasons for their decisions. It involves thinking about a problem from several angles, including thinking about the method for solving the problem. Additionally, Fisher (2011) defines critical thinking as "a skilled and active interpretation and evaluation of observations and communications, information, and argumentation."

Dewey (1910) defined reflective thought as "active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that supports it, and the further conclusions which it tends" (p.6). The concept of reflective thought, referred to by Dewey, is clearly aligned to the characteristics which encompass the concept of critical thinking. Learning should be active and education should center on judgments and reflective thinking, not solely knowledge acquisition. According to Dewey, reflective thinking consists of three features: "a controversy, consisting of opposite claims regarding the same objective situation; a process of defining and elaborating these claims and of sifting the facts adduced to support them; a final decision, or sentence closing the particular matter in dispute and also serving as a rule or principle for deciding future cases" (Dewey, 1910, pp.101-102). A result of Dewey's work led to the concept of progressive education, which was designed to make changes to education and improve critical thinking skills at the elementary school level (Morgan, 1995).

Edward Glaser was considered to be a pioneer in the area of critical thinking and education. He proposed three components of critical thinking: "an attitude of being disposed in a thoughtful way to the problems and subjects that come within the range of one's experiences; knowledge of the methods of logical inquiry and reasoning; and some skill in applying those methods" (Glaser, 1941, p. 5,6). Glaser argued that the ability to think critically is not well developed among students at all levels of education.

Benjamin Bloom was an educational psychologist best known for developing Bloom's Taxonomy, pertaining to cognitive thinking. He established a hierarchy of six levels: Knowledge, the recall of previously learned material; Comprehension, the ability to understand the meaning of the material presented; Application, the ability to use learned material and apply the material in new situations; Analysis, the ability to break down information into parts and examine relationships; Synthesis, the ability to organize many parts to form a new whole; and Evaluation, making judgments using evidence and based on internal or external criteria (Bloom, 1956, p. 201-207).

In 1990, a panel of experts on critical thinking worked to produce a definition of critical thinking that allowed for uniformity within the field of education. The definition reads:

> "We understand critical thinking to be purposeful, self-regulatory judgments which results in interpretation, analysis evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which judgment is based. The ideal critical thinker is inquisitive, well-informed, open-minded, flexible, prudent in making judgments, willing to reconsider, diligent in seeking relevant information, focused in inquiry, and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit" (Faccione, 1990, p.3).

This definition is commonly referred to as the “Delphi definition” and is the most often cited study in critical thinking in literature.

Higher/Lower Level of Questioning

According to the Cambridge English Dictionary (2020), a question is a sentence or phrase used to find out information. Additionally, a question is a problem that tests a person’s knowledge or ability. In the classroom, questions are stimulants which activate students’ cognitive skills and they have functioned as a primary educational tool for centuries (Aydemir and Ciftci, 2008). Questions are used to teach as well as to assess student learning. Thus questioning plays a vital role in the overall success of a classroom.

Asking questions is one of the most important aspects of teaching and can be highly effective when used appropriately. Learners often mimic and copy their teachers’ behavior, so the questions teachers pose have a direct influence on the learning and thinking habits of their learners (Kiss, 2017, p. 57). Questions play an important role in the classroom. They can be used for eliciting answers, guiding, scaffolding, and assessing.

Studies have shown that teachers ask many questions in the classroom. Teachers pose up to 400 questions a day when in the classroom, with 60-80% of the questions solely requiring recall (Tienken, Goldberg, & DiRocco, 2010). Accordingly, with more than 60,00 questions being asked in a classroom over the span of a year, approximately 12,000 encourage students to engage in higher-order thinking.

Although teachers ask a great number of questions, they are typically low-level, memory-intensive questions. These types of questions are called convergent questions. Convergent questions are generally questions with a single correct answer, are short, and are intended to recall acquired information. These questions are also referred to as closed-ended questions, because students aren't expected to contribute to an original idea. Almeida (2010) stated that although effective for confirming learned facts and checking for errors in concepts, lower-level questions do not engage learners in higher levels of thinking. As helpful as low-level questions can be, they alone do not promote the learners' cognitive development, contributing instead to dependence upon teacher-provided information instead of a co-constructive of knowledge (Kiss, 2017, p. 56).

High-cognitive-level questions, also known as divergent questions, allow for a range of answers and help learners think critically and creatively. According to Dos et al. (2016), "divergent questions are questions which students answer by analysis or evaluation using their related knowledge of a question, a problem or a situation" (p.2). In addition to improving students' critical thinking skills, high-level questioning encourages active participation and facilitates learning.

Entrepreneurs in Silicon Valley have indicated that "questions are new answers" (Berger, 2014). Having the ability to utilize questions critically will prepare students for the future competitive environment. Therefore, the critical use of questioning is crucial in the educational field. In the book, *Now That's a Good Question*, Erik Francis states, "When we ask our students good questions, our objective is not only to assess what they know or what they can do with what they have learned. It is also to explore how deeply they are able to respond to questions" (Francis, 2016, p.38). Moreover, it is essential for teachers to develop questions that will allow students to respond at all stages of the thinking process, ranging from recall of facts to engagement in critical thinking. Although low-level questions posed by teachers do not require students to engage in deep thinking, it has been argued that low-level questions lay the groundwork for higher-level cognition (Tienken et al., 2010).

School Culture and Student Achievement

The passage of the Every Student Succeeds Act, signed by President Barack Obama on December 10, 2015, prompted some educational leaders thinking about school culture as one indicator of school success. School culture is an important facet of a school community. According to the Glossary of Education Reform (2020), it generally refers to the beliefs, perceptions, relationships, attitudes, and written and unwritten rules that shape and influence every aspect of how a school functions, but the term also encompasses more concrete issues such as the physical and emotional safety of students, the orderliness of classrooms and public spaces, or the degree to which a school embraces and celebrates racial, ethnic, linguistic, or cultural diversity. Students, parents, teachers, administrators, and other staff members all contribute to their school's culture, as do other influences. It includes an atmosphere of mutual respect amongst all stakeholders where teaching and learning are valued, achievements and successes are celebrated, and where ongoing collaboration is the norm (Meador, 2017).

School cultures can be divided into two basic forms: positive cultures and negative cultures. Numerous researchers, educators, and writers have attempted to define the major features of positive and negative school cultures, and an abundance of studies, articles, and books are available of the topic. According to the National School Climate Center (2020), positive school cultures are conducive to professional satisfaction, morale, and effectiveness, as well as to student learning, fulfillment, and well-being. Characteristics commonly associated with positive school cultures include: recognize and celebrate the successes of teachers and students; relationships amongst staff members are collegial and collaborative; staff members are held to high professional standards; students and staff members feel emotionally and physically safe; school leaders and teachers model positive and healthy behaviors for students; mistakes are not punished as failures, but viewed as opportunities to learn and grow; leadership decisions are made collaboratively with input from all stakeholders; and educational resources and learning opportunities are equitably distributed (Meader, 2017).

Dr. Joseph Murphy, Associate Dean at Vanderbilt's Peabody College of Education stated, "Seeds of change will never change in toxic soil. School culture matters" (Meader, 2017, p.2). School culture has become a central focus in an attempt to change how schools operate and improve educational results. School culture is a crucial component of the work educators need to do if students are going to achieve at high levels. When all stakeholders have the same goals and are on the same page, a school will flourish.

Recent studies have shown that school leaders should focus on school climate and culture to help drive positive academic outcomes, particularly as they work to bridge the achievement gap. When schools have a positive school culture, students feel more encouraged to attend school and achieve academically. Asking students about their experiences and gauging their perceptions will allow an educational leader to gain an understanding of where there is room to improve school culture and to focus on the areas for greatest growth. Youth Truth, a national nonprofit organization, analyzed survey data from more than 80,000 students between 2013 and 2016 by means of online surveys given to students matriculated in public schools across 24 states. Students were asked questions relating to school culture, and largely about respect and fairness. Across all grade levels, only one in three students rated their school cultural positively. Of the students surveyed, 57 percent of students agreed that most adults treat students with respect, while only 34% of students agreed that students treat adults with respect. Across all demographics, only 37 percent of students felt that discipline at their school was fair. This statistic emphasizes the importance of transparent and comprehensible discipline policies.

Student experiences with discipline affects many different aspects of their school experience. According to the Partnership for 21st Century Learning, students who are suspended are less likely to graduate on time and are more likely to be suspended again, drop out, or become involved in the juvenile justice system.

New Jersey State Learning Standards-English/Language Arts

The New Jersey State Board of Education adopted the state's first set of academic standards called the Core Curriculum Content Standards (CCCS) in May of 1996. The standards described what students should know and be able to do upon completion of fourth, eighth, and twelfth grade. The CCCS became the basis for assessing academic achievement of students specifically in Grades 3 through 12. Additionally, the standards defined New Jersey's high school graduation requirements (NJDOE, 2016).

The New Jersey State Board of Education adopted the Common Core State Standards (CCSS) in mathematics and literacy in June of 2010, less than a month after the revised draft of the CCSS were released. The standards were created through the Common Core State Standards Initiative in an attempt to "ensure that all students are college and career ready in literacy no later than the end of high school" (CCSS, 2010). According to the Council of Chief State Officers (CCSSO) and the National Governors Association (NGA), the Standards were "research and evidence based, aligned with college and work expectations, and rigorous" (CCSS, 2010). College and Career Readiness (CCR) standards in reading, writing, speaking, listening, language, and mathematics were developed, outlining the skills required for college and career readiness in multiple disciplines.

The New Jersey State Board of Education adopted the New Jersey Student Learning Standards (NJSLS) in 2016 to replace the Common Core State Standards. These standards in

New Jersey are reviewed and revised, if needed, every five years. The 2020 New Jersey Student Learning Standards were adopted by the State Board of Education on June 3, 2020 in the following content areas: Career Readiness, Life Literacies and Key Skills; Comprehensive Health and Physical Education; Computer Science and Design Thinking; Science; Social Studies; Visual and Performing Arts; and World Languages. The NJSLS in English Language Arts and Mathematics were not under review, as they were adopted in May 2016.

The New Jersey Student Learning Standards for English Language Arts (ELA) "build on the best of existing standards and reflect the skills and knowledge students need to succeed in college, career, and life" (NJDOE, 2020). The ELA Standards were revised in 2016, with the recommendations of various stakeholders and reflect the following strong beliefs:

- Literature and informational (nonfiction) text are important for our students and should maintain their rightful place in our classrooms;
- Background knowledge and motivation are critical to the success of students when learning to read and when accessing complex text;
- Research by students provides the opportunity to learn more about a subject, but equally as important, provides students the opportunity to look beyond their research to questions left unanswered;
- Using evidence remains a critical skill, interspersed throughout the standards, allowing students to ground their thinking in the work of authors and experts in literature and in the content areas;
- Literacy must be recognized and guided in content areas so that students recognize the academic vocabulary, media representations, and power of language inherent in the work of scholars and experts, and

- The importance of foundational skills in the early grades, as students learn to read, cannot be overstated and calls for targeted, sustained intervention at any point of struggle for a student.

Cognitive Complexity

To some, cognitive complexity refers to the amount of time or the degree of time it takes a student to complete a task, particularly a task that requires a higher level of higher-order thinking (Paige et al., 2013). A study published in 2013 regarding cognitive complexity, referred to as cognitive rigor, compared the level of critical thinking and higher-order thinking tasks offered to students with the students' overall engagement level (Paige et al., 2013). In this study, 362 students in ninth grade were observed from an urban school in a low socioeconomic area. Paige et al., created a Student Engagement and Rigor Scale for the Classroom (SER-C) to cross-reference the behaviors of engagement expressed by students and the cognitive complexity of tasks or problems presented to students. The results of the study showed that student engagement increased as the amount of higher-order thinking activities increased in the classroom, but engagement began to decrease from the beginning of the class period to the end, with the end of the class period having the lowest engagement. Regardless of the decrease as class time progressed, the results of the study indicated that exposing students to higher-order thinking tasks can increase overall engagement and, in turn, could promote greater academic achievement.

Sousa (2006) states that cognitive complexity is regarded as "the thought process required to address a task, which can range from simple recall tasks to more advanced skills of creating and designing" (as cited in Sforza et al., 2016, p.9). Therefore, remembering facts and imitating procedures are considered to be less cognitively complex than the converse of developing an original conclusion, process, or product.

Metacognition

Metacognition refers to the processes used to plan, monitor, and assess one's understanding and performance (Chick, 2019), also described as thinking about one's thinking. Schoenfield (1991) asserted that metacognitive practices in the classroom increase students' abilities to transfer or adapt their learning to new contexts and tasks. They do this by "gaining a level of awareness above the subject matter; they also think about the tasks and contexts of different learning situations and themselves as learners in these different contexts" (Schoenfeld, 1991). It is crucial for students to know about different kinds of strategies for learning, thinking, and problem solving, which will in turn promote higher-order thinking.

Metacognition instruction should be embedded within the content and activities students are engaged in. Zohar and David (2009) state that metacognition is not generic, but instead is most effective when it is adapted to reflect the specific learning contexts of a specific topic, course, or discipline. Explicitly connecting a learning context to its relevant processes will allow students to be more able to adapt strategies to new contexts, rather than assume that learning is the same everywhere.

Bloom's Taxonomy

In 1956, Benjamin Bloom worked with a group of educational psychologists to develop a framework for classifying educational goals. Bloom and his colleagues focused on the levels of questions being asked in various educational settings. This framework, known today as Bloom's Taxonomy, focuses on verbs that appear in questions, which in turn dictates the level of complexity of the questions being asked. Through their observations, it was noted that more than 95% of the assessment questions posed to students only required recall, the lowest level of thinking.

It is from this work that Bloom, Englehart, Furst, Hill, and Krathwohl (1956) developed a taxonomy, Bloom's Taxonomy of Educational Objectives, providing a framework for teachers to use when developing questions. It was originally constructed as a way to identify desired student behavior useful for curriculum building and test construction (Bloom, et al., 1956). It categorizes the cognitive skills required of the brain to perform a task, describing the type of thinking processes necessary to answer a question or complete a task (Hess, 2018, p.46). Educational objectives are classified into three domains: cognitive, affective, and psychomotor. The cognitive domain involves the development of knowledge and intellectual skills, the affective domain includes the manner in which individuals deal with things emotionally, and the psychomotor domain includes physical movement and motor skills (Bloom et al., 1956). The taxonomy is comprised of six categories: knowledge, comprehension, application, analysis, synthesis, and evaluation.

The taxonomy is represented as a pyramid with higher-order thinking at the top. It provides a scaffold for asking questions that become progressively more challenging and provides a structure for teachers to model complex thinking that, ultimately, can guide students to become independent thinkers who can develop their own viewpoints (Nappi, 2016, p.32). The lowest level, knowledge, refers to the mental recall of previously learned material. Just above knowledge is comprehension, which refers to the ability to grasp or understand the meaning of material. The next level is application, referring to the ability to use the information learned previously in new and concrete situations. Analysis refers to the ability to break down material into its component parts in order find new or hidden meaning. Synthesis refers to the ability to put parts together to create something new. At the highest level of thy pyramid is evaluation, referring to the ability to make accurate judgments and assess the value for a given purpose (Bloom, et al., 1956). Table 2 presents the taxonomy with examples of verbs and student behaviors or outcomes.

Table 2

Bloom et al. (1956) taxonomy with illustrated verbs and student behaviors.

LEVEL	DEFINITION	SAMPLE VERBS	SAMPLE BEHAVIORS
KNOWLEDGE	Student recalls or recognizes information, ideas, and principles in the approximate form in which they were learned.	Write, List, Label Name, State, Define	The student will define the 6 levels of Bloom's taxonomy of the cognitive domain.
COMPREHENSION	Student translates, comprehends, or interprets information based on prior learning.	Explain Summarize Paraphrase Describe Illustrate	The student will explain the purpose of Bloom's taxonomy of the cognitive domain.
APPLICATION	Student selects, transfers, and uses data and principles to complete a problem or task with a minimum direction.	Use, Compute Solve Demonstrate Apply, Construct	The student will write an instructional objective for each level of Bloom's taxonomy.
ANALYSIS	Student distinguishes, classifies, and relates the assumptions, hypotheses, evidence, or structure of a statement or question.	Analyze Categorize Compare, Contrast Separate	The student will compare and contrast the cognitive and affective domains.
SYNTHESIS	Student originates, integrates, and combines ideas into a product, plan or proposal that is new to him or her.	Create, Design Hypothesize, Invent, Develop	The student will design a classification scheme for writing educational objectives that combines the cognitive, affective, and psychomotor domains.
EVALUATION	Student appraises, assesses, or critiques on a basis of specific standards and criteria.	Judge Recommend Critique, Justify	The student will judge the effectiveness of writing objectives using Bloom's taxonomy.

Bloom's Taxonomy Revised

During the 1990s, Anderson, along with her colleagues, set to update the taxonomy in an effort to add relevance for 21st century students and teachers. In 2001, Anderson and Krathwohl revised Bloom's Taxonomy, naming it, *A Taxonomy for Teaching, Learning and Assessment.* This involved retaining the original number of categories with changes such as switching the names of some levels from nouns to verbs and reversing the order of the highest two levels (Krathwohl, 2002). The two highest levels of Bloom's Taxonomy, synthesis and evaluation, were reversed and renamed evaluating and creating. Comprehension was retitled to understanding.

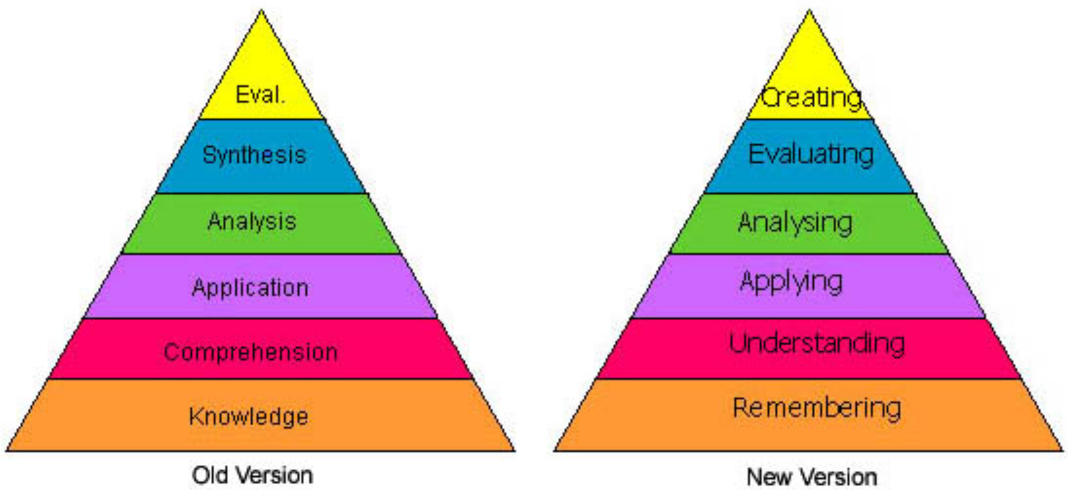

Figure 2. Original Bloom vs. Revised Bloom's Taxonomy (Conklin, 2011)

The new terms are defined as: **Remembering** refers to retrieving, recognizing, and recalling relevant knowledge from long-term memory; **Understanding** refers to constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining; **Applying** refers to carrying out or using a procedure through executing or implementing; **Analyzing** refers to breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing, and attributing; **Evaluating** refers to making judgments based on criteria and standards through checking and critiquing; and **Creating** refers to putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing (Anderson & Krathwohl, 2001, pp-67-68).

The last three levels of the revised taxonomy — creating, evaluating, and analyzing — are sometimes wrongly considered to be the only higher-order thinking and representative of critical thinking. However, critical thinking can be part of activities that require comprehension and application, although this fact is not clearly represented on the taxonomy. In addition to revising the taxonomy, Anderson and Krathwohl (2001) added a knowledge dimension, the kind of knowledge to be learned. The knowledge dimension is at the basis of the six cognitive processes, and illustrates where each of the cognitive processing dimensions is used. The types of knowledge identified are: factual knowledge, conceptual knowledge, procedural knowledge, and metacognitive knowledge.

The revised Bloom's Taxonomy provides an even more powerful tool to fit today's teacher and student needs. The structure provides a clear, concise visual representation of the alignment between standards and educational goals, objectives, products, and activities (Krathwohl, 2002).

Webb's Depth of Knowledge

While Bloom's Taxonomy focused on educational goals and student objectives, Norman Webb's Depth of Knowledge (1997) framework outlined the manner in which students interact with the content. Webb's model focused on classifying tasks according to the difficulty of thinking required to complete the tasks. It requires students to delve into the thinking process which in turn will deepen their learning. For this reason, Webb's model has been utilized in a number of states to construct educational materials and performance assessments as well as alignment between standards and assessments (Hess, 2008).

Although related through their natural ties to the complexity of thought, Bloom's Taxonomy and Webb's DOK model differ in scope and application. Bloom's Taxonomy categorizes the cognitive skills required of the brain when faced with a new task, therefore describing the type of thinking processes necessary to answer a question. The DOK model, on the other hand, relates more closely to the depth of content understanding and scope of a learning activity, which manifests in the skills required to complete the task from inception to finale (e.g., planning, researching, drawing conclusions). This framework consists of four levels, with the simplest level at level 1 and the most complex level at level 4 (as displayed in Figure 3).

Level 1 (Recall) is the basic recall of information, such as a fact, definition, term, or a procedure. Typically, this is as simple as remembering a formula or following a recipe.

Level 2 (Skill/Concept) requires a student to make informed decisions about problem-solving and procedures. In this level, students are asked to complete multiple steps in order to find a solution, like collecting and then displaying data in a chart.

Level 3 (Strategic Thinking) requires reasoning, planning, using evidence, and a higher level of thinking. Asking students to explain their thinking is a part of this level.

Level 4 (Extended Thinking) requires complex reasoning, planning, developing, and thinking. A student both designing and conducting an experiment is a demonstration of this level.

Figure 3. Webb's Depth of Knowledge (Webb, 2005).

Hess Cognitive Rigor Matrix

The Hess Cognitive Rigor Matrix (Table 3) will be used as the framework in this study by measuring the frequency and percentage of questions at each level of thinking as the frequency and percentage of higher-order thinking embedded in the questions found in a 3rd grade reading textbook. The Hess Cognitive Rigor Matrix (CRM) was created in 2005 by Karin Hess in an attempt to combine two existing models for describing rigor and deeper learning. This model is a combination of Bloom's Taxonomy and Norman Webb's Depth of Knowledge levels. The Hess CRM assists teachers in applying what cognitive rigor might look like in the classroom and guides test developers in designing test items and performance tasks. Content-specific descriptors in each of the Hess CRMs are used to categorize and plan for various levels of abstraction — meaning an analysis of the mental processing required of assessment questions and learning tasks (Hess, Carlock, Jones, &Walkup, 2009).

The first Hess CRMs started with the six Bloom's Taxonomy levels along the rows of the matrix and the four Webb's Depth of Knowledge levels along the columns. However, the CRMs have been revised in an attempt to better clarify and encompass new content descriptors and content areas.

Table 3

Hess Cognitive Rigor Matrix (Reading CRM): 2018

TOOL 1

HESS COGNITIVE RIGOR MATRIX (READING CRM):

Applying Webb's Depth-of-Knowledge Levels to Bloom's Cognitive Process Dimensions

Revised Bloom's Taxonomy	Webb's DOK Level 1 Recall & Reproduction	Webb's DOK Level 2 Skills & Concepts	Webb's DOK Level 3 Strategic Thinking/Reasoning	Webb's DOK Level 4 Extended Thinking
Remember Retrieve knowledge from long-term memory, recognize, recall, locate, identify	o Recall, recognize, or locate basic facts, terms, details, events, or ideas explicit in texts o Read words orally in connected text with fluency & accuracy	Use these Hess CRM curricular examples with most close reading or listening assignments or assessments in any content area.		
Understand Construct meaning, clarify, paraphrase, represent, translate, illustrate, give examples, classify, categorize, summarize, generalize, infer a logical conclusion), predict, compare/contrast, match like ideas, explain, construct models	o Identify or describe literary elements (characters, setting, sequence, etc.) o Select appropriate words when intended meaning/definition is clearly evident o Describe/explain who, what, where, when, or how o Define/describe facts, details, terms, principles o Write simple sentences	o Specify, explain, show relationships; explain why (e.g., cause-effect) o Give non-examples/examples o Summarize results, concepts, ideas o Make basic inferences or logical predictions from data or texts o Identify main ideas or accurate generalizations of texts o Locate information to support explicit-implicit central ideas	o Explain, generalize, or connect ideas using supporting evidence (quote, example, text reference) o Identify/ make inferences about explicit or implicit themes o Describe how word choice, point of view, or bias may affect the readers' interpretation of a text o Write multi-paragraph composition for specific purpose, focus, voice, tone, & audience	o Explain how concepts or ideas specifically relate to other content domains (e.g., social, political, historical) or concepts o Develop generalizations of the results obtained or strategies used and apply them to new problem-based situations
Apply Carry out or use a procedure in a given situation; carry out (apply to a familiar task), or use (apply) to an unfamiliar task	o Use language structure (pre/suffix) or word relationships (synonym/ antonym) to determine meaning of words o Apply rules or resources to edit spelling, grammar, punctuation, conventions, word use o Apply basic formats for documenting sources	o Use context to identify the meaning of words/phrases o Obtain and interpret information using text features o Develop a text that may be limited to one paragraph o Apply simple organizational structures (paragraph, sentence types) in writing	o Apply a concept in a new context o Revise final draft for meaning or progression of ideas o Apply internal consistency of text organization and structure to composing a full composition o Apply word choice, point of view, style to impact readers' /viewers' interpretation of a text	o Illustrate how multiple themes (historical, geographic, social, artistic, literary) may be interrelated o Select or devise an approach among many alternatives to research a novel problem
Analyze Break into constituent parts, determine how parts relate, differentiate between relevant-irrelevant, distinguish, focus, select, organize, outline, find coherence, deconstruct (e.g., for bias or point of view)	o Identify whether specific information is contained in graphic representations (e.g., map, chart, table, graph, T-chart, diagram) or text features (e.g., headings, subheadings, captions) o Decide which text structure is appropriate to audience and purpose	o Categorize/compare literary elements, terms, facts/details, events o Identify use of literary devices o Analyze format, organization, & internal text structure (signal words, transitions, semantic cues) of different texts o Distinguish: relevant-irrelevant information; fact/opinion o Identify characteristic text features; distinguish between texts, genres	o Analyze information within data sets or texts o Analyze interrelationships among concepts, issues, problems o Analyze or interpret author's craft (literary devices, viewpoint, or potential bias) to create or critique a text o Use reasoning, planning, and evidence to support inferences	o Analyze multiple sources of evidence, or multiple works by the same author, or across genres, time periods, themes o Analyze complex/abstract themes, perspectives, concepts o Gather, analyze, and organize multiple information sources o Analyze discourse styles
Evaluate Make judgments based on criteria, check, detect inconsistencies or fallacies, judge, critique	"UG" – unsubstantiated generalizations = stating an opinion without providing any support for it!		o Cite evidence and develop a logical argument for conjectures o Describe, compare, and contrast solution methods o Verify reasonableness of results o Justify or critique conclusions drawn	o Evaluate relevancy, accuracy, & completeness of information from multiple sources o Apply understanding in a novel way, provide argument or justification for the application
Create Reorganize elements into new patterns/structures, generate, hypothesize, design, plan, produce	o Brainstorm ideas, concepts, problems, or perspectives related to a topic , principle, or concept	o Generate conjectures or hypotheses based on observations or prior knowledge and experience	o Synthesize information within one source or text o Develop a complex model for a given situation o Develop an alternative solution	o Synthesize information across multiple sources or texts o Articulate a new voice, alternate theme, new knowledge or perspective

Theoretical Framework

Although numerous models for encouraging higher-order thinking skill development exist in schools throughout the United States, none have as much popularity as Bloom's Taxonomy and Webb's Depth of Knowledge. These two frameworks, although similar in many of the terms and descriptions used at each level, differ greatly in the area of focus regarding higher-order thinking. Bloom's Taxonomy, referring specifically to the knowledge-based taxonomy, concentrates on actions students perform in order to demonstrate an understanding of a particular concept. Webb's Depth of Knowledge, on the other hand, focuses on a task's level of cognitive complexity, which encompasses the number of connections a student makes, the level of reasoning, and reflective and self-monitoring processes utilized in order to effectively complete a task (Jirka & Hableton, 2005, p. 7).

Hess' Cognitive Rigor Matrix combines these two frameworks in a model that unifies the actions of Bloom's with the cognitive complexity of Webb's. This unification of the two frameworks provides a means for educators to be more cognizant of the ways in which classroom instruction can cultivate higher-order thinking skill set development while also increasing in cognitive complexity, furthering the levels of differentiated instruction that can occur in the classroom. Furthermore, Hess' Cognitive Rigor Matrix serves as a model that can help educators understand the complexity of the tasks and questions they assign to their students, allowing them to choose tasks that are developmentally appropriate in fostering higher-order thinking skills in each student. Overall, Hess' Cognitive Rigor Matrix blends the actions with the cognitive complexity of tasks and activities being asked of students in order to create a holistic model that can encourage higher-order thinking (Hess et al., 2009).

A major obstacle when describing and categorizing higher-order thinking skill set development lies in the definition of higher-order thinking, or lack thereof. Despite a plethora of research/studies that highlight the actions and tasks that contribute to higher-order thinking, such as critical thinking and problem solving, there is no unified definition of higher-order thinking to which educators and researchers can refer. Higher-order thinking contains a diverse, complex network of critical learning skills that can either be enhanced separately or together through consistent practice in the classroom. Because of the multiple components needed to reach a level of higher-order thinking, it is essential that educators utilize a variety of strategies. A diverse set of strategies and procedures will enable a teacher to enhance these deep learning skills, which will help the teacher and learner focus both on the task itself and the level of complexity of the task. The researched literature reveals that higher-order thinking is developed utilizing various learning activities within critical thinking, problem solving, reasoning, and judgment (Brookhart, 2010). As schools move toward 21st century learning, these skills should become the focal point of many standards and educational reforms. With the increase in technology use in schools, companies created online-based programs to aid in a student's educational experience, serving as a means to provide tutoring and reinforcement in a format that is engaging to students. Many of these companies excessively market their products to schools, claiming their product can enhance higher-order thinking skills through differentiation of tasks and through adaptive technology that increases complexity levels as students show success in completing each activity. Although published in reports on the programs' websites, there is little to no empirical evidence to support the claims that some of these online-based programs effectively promote higher-order thinking skill set development. Although many of these online-based programs claim to enhance higher-order thinking skill set development through the activities that are presented to students, no studies to date have analyzed the types of activities or the level of cognitive complexity of these activities.

The theoretical framework of this study uses Hess' Cognitive Rigor Matrix to determine how the language of written questions in a 3rd grade reading textbook series, compared with the language of higher-order thinking found in research literature. The frequency and percentage of questions at each level of thinking are categorized by the Hess Cognitive Rigor Matrix. The CRM helps to "uniquely categorize and examine selected questions that appear prominently in curriculum and instruction" (Hess et al., 2009, p.3). Using this framework provides a comprehensive analysis of the types, frequencies, and categories of questions presented to students in order to determine if they are promoting higher-order thinking.

Organization of the Dissertation

Chapter III includes an in-depth analysis of the methodology for this study, including an introduction to the study, research questions governing the study, and a description of the design and purpose of the study. Furthermore, Chapter III contains a description of the coding scheme utilized, a description of the qualifications for trained consultant coders, the method for ensuring credibility used, training in coding offered prior to the study, and a description of the method for analyzing the selected questions based on the Hess Cognitive Rigor Matrix.

Chapter III

Methodology

The purpose of this convergent, parallel mixed-methods study was to determine how the language of written questions in a 3rd grade reading textbook series associates with the language of higher-order thinking found in research literature, and specifically as defined by Hess' Cognitive Rigor Matrix. A mixed-method approach comprised of qualitative and quantitative content analysis methods was the research design utilized. The following chapter describes the methodology, in detail, used for this study.

Research Questions

The study was guided by the following overarching question: What types of thinking are being promoted in a 3rd grade reading textbook? The study included two sub questions that guided the specific inquiry of the study, as follows:

1. In what ways does the language found in questions within the text of a 3rd grade reading textbook compare with language that promotes higher-order thinking found in extant research literature?

2. What is the frequency and percentage of higher-order thinking, as described by the Hess Cognitive Rigor Matrix, embedded in reading comprehension questions presented in the student textbook of a 3rd grade reading textbook series?

Research Design

This study utilized a case study design with mixed methods. When using case study methodology, the researcher seeks to obtain a thorough knowledge and present a clear picture of an individual, a program, or a situation (Range, 2019). They may include observations, interviews, anecdotes, vignettes, direct quotes, audiovisual materials, psychological testing, documents, reports, and analysis. Case studies often provide implications for further studies.

Research Bias

Having 17 years of experience in the field of education as a teacher, instructional coach, vice principal, and a current elementary school principal, the researcher confirms confirmation bias may exist. "Confirmation bias occurs from the direct influence of desire on beliefs. When people would like a certain idea or concept to be true, they end up believing it to be true" (Hashmat, 2015). Once a view is formed, it becomes difficult for one to perceive circumstances objectively. Any information that supports one's view is embraced, while information refuting one's view or belief tends to be ignored or rejected. As a former instructional coach in the area of English Language Arts, the researcher is well-versed in terms of the components pertaining to this particular reading series. The researcher was provided with extensive training pertaining to the textbook series in all grade areas, and provided support, resources, and professional development to teachers. One could assume that the researcher may have some bias because of the current role as a school administrator, having conducted approximately 100+ formal and informal observations per academic year for the past three years, focusing on the types of questions being asked within textbooks, on assessments, and in the classroom. Additionally, it could assume that the researcher has preconceived notions about textbooks, and specifically the types of questions that are being asked within textbooks.

Although it is difficult to eliminate bias, it can be controlled. When coding, the researcher, in collaboration with the consultant coder, will use structured, consistent processes that will limit confirmation bias.

Data Collection

The data consisted of publicly available questions found in a 3rd grade reading textbook. In total, 138 questions were included within two volumes of the third grade reading textbook series. The publisher of the textbook claims to have created the series, and questions contained within each textbook of the series aligned to the former NJCCS. Additionally, it claims to "aspire readers and writers with the skills they need to scale the challenges of today's rigorous assessment demands" (Houghton Mifflin Harcourt, 2020). The essence of the publisher's claim is that the content, including the questions within the textbook, includes a range of higher-order thinking on a consistent basis. A majority of the questions presented in the textbook required an open response from the students. For this study, the researcher focused on the language found within the questions in order to determine the level of cognitive complexity and depth of knowledge needed to successfully answer the questions.

Methods

Deductive category application was used to link the Hess Cognitive Rigor Matrix to the questions found in the reading textbook. Deductive category application is the process in which text is analyzed based on pre-existing categories following a coding protocol (Mayring, 2000). The pre-existing categories for this study were the categorization of thinking as represented in Hess' Cognitive Rigor Matrix. Figure 4 highlights the step model of deductive category application, adapted from Mayring (2000).

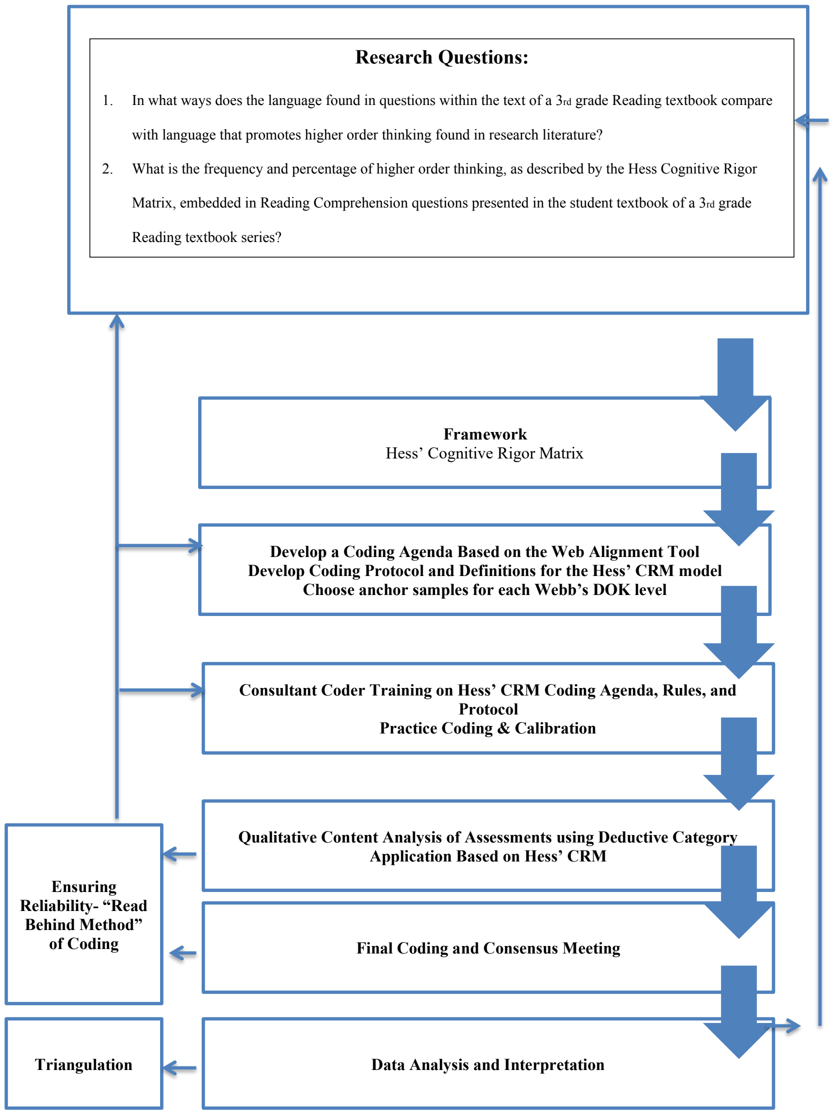

Figure 4. Step model for deductive category application, adapted from Mayring (2000).

Hess' Cognitive Rigor Matrix was best suited for this study because the framework is useful in categorizing the types of higher-order thinking, via content-specific descriptors in the questions presented to students. The language found in each category of the matrix associates with language related to different types of thinking found in the extent literature. The combination of Bloom's Taxonomy and Webb's Depth of Knowledge allows educators and test developers to look closely at tasks and examine the rigor associated with that task. The matrix allows for each question/task to be analyzed by type and by the level of cognition students are required to utilize, allowing each question to be examined from multiple perspectives. By using this matrix, various questions from the 3rd grade reading textbook were categorized.

Expert Coder

An expert coder provided the initial coding training for the researcher on July 22, 2020, as well as the coder calibration session held on August 27, 2020. He has experience in public school education and is a current associate professor of Education Administration. He holds a doctoral degree of education in Education Leadership, Management and Policy, and has participated in similar studies that have been accepted at national research conferences. He is the author of peer-reviewed studies that utilized Webb's Depth of Knowledge to categorize the cognitive complexity of the New Jersey Core Curriculum Content Standards, Common Core State Standards, and California curriculum standards.

Consultant Coder

This study utilized a two-coder system. The consultant coder earned an EdD in Education, Leadership, Management and Policy, and has participated in similar studies. His professional and academic background as well as his lengthy experience in school leadership, teaching and instructional practices, and curriculum and assessment were invaluable in the completion of this study's coding process.

Coding Scheme

The use of deductive coding by the researcher and the consultant coder guided the coding process. The descriptors note within specific cells of the Hess Cognitive Rigor Matrix served as the basis for the language of higher-order thinking. The Cognitive Rigor Matrix contained sample tasks and activities students are asked to do in each cell of the matrix, thus superimposing

Bloom's Taxonomy and Webb's Depth of Knowledge. Because the list was comprehensive, this reduced the possibility of a question being coded incorrectly, which increased the reliability among coders.

Hess' Cognitive Rigor Matrix is designed as a grid with Webb's Depth of Knowledge as the columns and Bloom's Taxonomy as the rows. A specific matrix was assigned to each cell, thus providing an accurate and comprehensive coding scheme. The letter in the matrix described Webb's Depth of Knowledge level and the number described Bloom's Taxonomy level for each cell. Hess' Cognitive Rigor Matrix for ELA/literacy is shown as Table 4.

Table 4

Hess Cognitive Rigor Matrix ELA/Literacy

Hess Cognitive Rigor Matrix & Curricular Examples: Applying Webb's Depth-of-Knowledge Levels to Bloom's Cognitive Process Dimensions – ***ELA***

Revised Bloom's Taxonomy	**Webb's DOK Level 1 Recall & Reproduction**	**Webb's DOK Level 2 Skills & Concepts**	**Webb's DOK Level 3** **Strategic Thinking/ Reasoning**	**Webb's DOK Level 4 Extended Thinking**
Remember Retrieve knowledge from long-term memory, recognize, recall, locate, identify	a. Recall, recognize, or **locate facts, terms, details, events, or ideas explicit in texts** b. Read words orally in connected text with fluency & accuracy	The Hess CRM uses descriptors for ELA/Literacy that integrate Bloom-Webb frameworks. **BOLD TEXT** indicates commonly assessed ELA/literacy content.		
Understand Construct meaning, clarify, paraphrase, represent, translate, illustrate, give examples, classify, categorize, summarize, generalize, infer a logical conclusion), predict, compare/contrast, match like ideas, explain, construct models	c. **Identify or describe literary elements** (characters, setting, dialogue, problem, etc.) d. Select appropriate words when intended meaning/definition is clearly evident **e. Describe/explain who, what, where, when, or how** **f. Define/describe facts, details, terms, principles** g. Write simple sentences	a. **Specify/explain, relationships; explain why** (e.g., cause-effect) b. Give non-examples/examples c. **Summarize** results, concepts, ideas, steps in a process d. **Make basic inferences or logical predictions** from data or text e. **Identify main ideas or accurate generalizations** of a text **f. Locate information to support explicit-implicit central ideas**	a. **Explain or generalize purpose or theme of 1 text**, using supporting evidence (quote, examples, text reference) b. **Describe how word choice, point of view, or potential bias may affect the readers' interpretation** of a text c. **Write multi-paragraph composition** for specific purpose, focus, voice, tone, & audience	**a. Explain how concepts or ideas specifically relate to *other* content domains (e.g., social, political, historical) or concepts or other texts,** using evidence from multiple sources b. Develop generalizations of the results obtained or strategies used and apply them to new problem-based situations
Apply Carry out or use a procedure in a given situation; carry out (apply to a familiar task), or use (apply) to an unfamiliar task	h. **Use language structure** (pre/suffix) ,**word relationships** (synonym/antonym) to determine meaning of words i. **Apply rules or resources to edit** spelling, grammar, word use, punctuation, conventions **j. Apply basic formats for documenting sources**	g. **Use context to identify the meaning** of words/phrases h. **Obtain, interpret, explain information** using text features i. Develop a text that may be limited to one paragraph **j. Apply simple organizational structures (paragraph, sentence types) in writing**	d. Apply a concept in a new context e. Revise final draft for meaning, logic, or progression of ideas **f. Apply internal consistency of text organization and structure to composing a full composition** **g. Apply word choice, point of view, style to impact readers' /viewers' interpretation of a text**	c. **Illustrate how multiple themes across texts (historical, geographic, social, artistic, literary) may be interrelated**, using evidence from multiple sources d. Select or devise an approach among many alternatives to research a novel problem
Analyze Break into constituent parts, determine how parts relate, differentiate between relevant-irrelevant, distinguish, focus, select, organize, outline, find coherence, deconstruct (e.g., for bias or point of view)	k. **Identify specific information contained in graphic representations** (e.g., map, chart, table, graph, diagram) or **text features** (e.g., headings, subheadings, captions) l. Decide which text type or text structure is appropriate to audience and purpose m. Determine topic key words for Internet search	**k. Compare literary elements, terms, facts/details, events** l. Identify use of literary devices m. **Analyze format, organization, & internal text structure** (signal words, transitions, semantic cues) **n. Distinguish: relevant-irrelevant information; fact/opinion** o. Identify characteristic text features; distinguish between texts, genres	**h. Analyze information within data sets in a given text** **i. Analyze interrelationships among concepts, issues, problems in a text , website, etc.** j. **Analyze or interpret author's craft** (literary devices, viewpoint, or potential bias) to create or critique a text k. **Use reasoning, planning, and evidence** to support inferences	**e. Analyze multiple sources of evidence, or multiple works by the same author, or across genres, time periods, themes** **f. Analyze contrasting themes, perspectives, policies** **g. Gather, analyze, and organize multiple information sources** h. Analyze discourse styles across texts
Evaluate Make judgments based on criteria, check, detect inconsistencies or fallacies, judge, critique			**l. Cite evidence and develop a logical argument for conjectures** m. Describe, compare, and contrast solution methods **n. Justify/critique author logic, results, or conclusions**	i. Evaluate relevancy, accuracy, & completeness of information from multiple sources **j. Apply understanding in a novel way, provide argument or justification for the application**
Create Reorganize elements into new patterns/structures, generate, hypothesize, design, produce	n. Brainstorm ideas, concepts, problems, or perspectives related to a topic, principle, or concept	p. **Generate conjectures, claims, or believable grounds for opinion-argument,** based on observations or prior knowledge and experience	o. Synthesize information within one source or text p. Develop a complex model for a given situation **q. Develop an alternative solution**	k. Synthesize information across multiple sources or texts **l. Articulate alternate theme, a new voice, new knowledge or nuanced perspective**

The coding scheme developed included the following categories and explanations (adapted from Hess, 2009).

- **(A,1): Webb's Level 1, Bloom's Level 1:** Recall, recognize, or locate facts, terms, details, events or ideas explicitly stated in texts. Retrieve knowledge from long-term memory, recognize, recall, locate, identify.

- **(A,2): Webb's Level 1, Bloom's Level 2:** Identify or describe literary elements (characters, setting, dialogue, problem, etc.). Select appropriate words when intended meaning/definition is clearly evident. Describe/explain who, what, where, when, or how. Define/describe facts, details, terms, principles. Write simple sentences. Construct meaning, clarify, paraphrase, represent, translate, illustrate, give examples, classify, categorize, summarize, generalize, infer a logical conclusion, predict, compare/contrast, match like ideas, explain, construct models.

- **(A,3): Webb's Level 1, Bloom's Level 3:** Use language structure, word relationships to determine meaning of words. Apply rules or resources to edit spelling, grammar, word use, punctuation, conventions. Apply basic formats for documenting sources. Carry out or use a procedure in a given situation; carry out (apply to a familiar task), or use (apply) to an unfamiliar task.

- **(A,4): Webb's Level 1, Bloom's Level 4:** Identify specific information contained in graphic representations or text features. Decide which text type or text structure is appropriate to audience and purpose. Determine topic key words for internet search. Break into constituent parts, determine how parts relate, differentiate between relevant, irrelevant, distinguish, focus, select, organize, outline, find coherence, deconstruct.

- **(A,6): Webb's Level 1, Bloom's Level 6:** Brainstorm ideas, concepts, problems, or perspectives related to a topic, principle, or concept. Reorganize elements into new patterns/structures, generate, hypothesize, design, produce.

- **(B, 2): Webb's Level 2, Bloom's Level 2):** Specify/explain relationships; explain why. Give non-examples/examples. Summarize results, concepts, ideas, steps in a process. Make basic inferences or logical predictions from data or text. Identify main ideas or accurate generalizations of a text. Locate information to support explicit-implicit central ideas. Construct meaning, clarify, paraphrase, represent, translate, illustrate, give examples, classify, categorize, summarize, generalize, infer a logical conclusion, predict, compare/contrast, match like ideas, explain, construct models.

- **(B, 3): Webb's Level 2, Bloom's Level 3:** Use context to identify the meaning of words/phrases. Obtain, interpret, explain information using text features. Develop a text that may be limited to one paragraph. Apply simple organizational structures in writing. Carry out or use a procedure in a given situation; carry out (apply to a familiar task), or use (apply) to an unfamiliar task.

- **(B, 4): Webb's Level 2, Bloom's Level 4:** Compare literary elements, terms, facts/details, events. Identify use of literary devices. Analyze format, organization, and internal text structure. Distinguish relevant-irrelevant information; fact/opinion. Identify characteristic text features; distinguish between texts, genres. Break into constituent parts, determine how parts relate, differentiate between relevant, irrelevant, distinguish, focus, select, organize, outline, find coherence, deconstruct.

- **(B, 6): Webb's Level 2, Bloom's Level 6:** Generate conjectures, claims, or believable grounds for opinion-argument based on observations or prior knowledge and experience. Reorganize elements into new patterns/structures; generate, hypothesize, design, produce.

- **(C, 2): Webb's Level 3, Bloom's Level 2:** Explain or generalize purpose or theme of one text using supporting evidence. Describe how word choice, point of view, or potential bias may affect the readers' interpretation of a text. Write a multi-paragraph composition for specific purpose, focus, voice, tone, and audience. Construct meaning, clarify, paraphrase, represent, translate, illustrate, give examples, classify, categorize, summarize, generalize, infer a logical conclusion, predict, compare/contrast, match like ideas, explain, construct models.
- **(C, 3): Webb's Level 3, Bloom's Level 3:** Apply a concept in a new context. Revise final draft for meaning, logic, or progression of ideas. Apply internal consistency of text organization and structure to composing a full composition. Apply word choice, point of view, style to impact readers'/viewers' interpretation of a text. Carry out or use a procedure in a given situation; carry out (apply to a familiar task), or use (apply) to an unfamiliar task.
- **(C, 4): Webb's Level 3, Bloom's Level 4:** Analyze information within data sets in a given text. Analyze interrelationships among concepts, issues, problems in a text, website, etc. Analyze or interpret author's craft to create to create or critique a text. Use reasoning, planning, and evidence to support inferences. Break into constituent parts, determine how parts relate, differentiate between relevant, irrelevant, distinguish, focus, select, organize, outline, find coherence, deconstruct.
- **(C, 5): Webb's Level 3, Bloom's Level 5:** Cite evidence and develop a logical argument for conjectures. Describe, compare, and contrast solution methods. Justify/critique author logic, results, or conclusions. Make judgments based on criteria, check, detect inconsistencies or fallacies, judge, critique.

- **(C, 6): Webb's Level 3, Bloom's Level 6:** Synthesize information within one source or text. Develop a complex model for a given situation. Develop an alternative solution. Reorganize elements into new patterns/structures, generate, hypothesize, design, produce.

- **(D, 2): Webb's Level 4, Bloom's Level 2:** Explain how concepts or ideas specifically relate to other content domains or concepts or other texts using evidence from multiple sources. Develop generalizations of the results obtained or strategies used and apply them to new problem-based situations. Construct meaning, clarify, paraphrase, represent, translate, illustrate, give examples, classify, categorize, summarize, generalize, infer a logical conclusion, predict, compare/contrast, match like ideas, explain, construct models.

- **(D, 3): Webb's Level 4, Bloom's Level 3:** Illustrate how multiple themes across texts may be interrelated using evidence from multiple sources. Select or devise an approach among many alternatives to research a novel problem. Carry out or use a procedure in a given situation; carry out (apply to a familiar task), or use (apply) to an unfamiliar task.

- **(D, 4): Webb's Level 4, Bloom's Level 4:** Analyze multiple sources of evidence, or multiple works by the same author, or across genres, time periods, themes. Analyze contrasting themes, perspectives, policies. Gather, analyze, and organize multiple information sources. Analyze discourse styles across texts. Break into constituent parts, determine how parts relate, differentiate between relevant, irrelevant, distinguish, focus, select, organize, outline, find coherence, deconstruct**.**

- **(D, 5): Webb's Level 4, Bloom's Level 5:** Evaluate relevancy, accuracy, and completeness of information from multiple sources. Apply understanding in a novel way, provide argument or justification for the application. Make judgments based on criteria, check, detect inconsistencies or fallacies, judge, critique.

- **(D, 6): Webb's Level 4, Bloom's Level 6:** Synthesize information across multiple sources or texts. Articulate alternate theme, a new voice, new knowledge, or nuanced perspective. Reorganize elements into new patterns/structures, generate, hypothesize, design, produce.

Coding Protocol, Data Analysis and Reliability

During the initial coding training session held on July 22, 2020, the expert coder and the researcher reviewed the Webb Alignment Tool, specifically, Section C, referring to the reading DOK levels (Alt, Ely, Vesperman, & Webb, 2005). The Cognitive Rigor Matrix was reviewed in order to calibrate the categories. A review and discussion of each cell of the Cognitive Rigor Matrix provided clarity on the types of questions that would be placed into each category. The training session began with both coders reading each level of Webb's Depth of Knowledge individually, then referring to pages 70 and 71 of Webb's Alignment Tool. Additionally, exemplars were reviewed and discussed. The sample Language Arts Objectives in the WAT Training Manual were also reviewed and coded.

The Web Alignment Tool provided detailed descriptions of ways in which English Language Arts tasks are organized based on cognitive complexity (Alt, Ely, Vesperman, & Webb, 2005). The alignment tool provided additional clarity, which in turn reduced discrepancies in coding. Webb's four Depth of Knowledge levels were used to judge all English Language Arts objectives and tasks.

Reading Level 1. Level 1 requires students to recite facts or to use simple skills and abilities. Oral reading that does not include analysis of the text, as well as basic comprehension of a text, is included. Items only require a shallow understanding of the text presented and consist of verbatim recall from text.

Reading Level 2. Level 2 involves the engagement of some mental processing beyond recalling or reproducing a response; it requires both comprehension and subsequent processing of text or portions of text. Some important concepts are covered, but not in a complex way. Questions, standards, and items at this level may include words such as summarize, interpret, infer, classify, organize, collect, display, compare, and determine whether fact or opinion. A Level 2 item may require students to apply skills and concepts that are covered in Level 1. These items require closer understanding of the text.

Reading Level 3. Deep knowledge becomes a greater focus at Level 3. Students are expected to go beyond the text while demonstrating a solid understanding of the ideas in the text. Students may be encouraged to explain, generalize, or connect ideas. Standards and items involve reasoning and planning. Students must be able to support their thinking. Additionally, items may involve abstract theme identification, inference across an entire passage, or application of prior knowledge, with more superficial connects made between texts.

Reading Level 4. Level 4 is comprised of higher-order thinking and deep knowledge. Standards and items will most likely be an extension activity and will require the application of significant conceptual understanding. Students may be asked to take information from at least one text and apply this information to a new task. They may be asked to develop hypotheses and perform complex analyses of the connections among texts.

After carefully reviewing the English Language Arts components of the Web Alignment Tool Training Manual, the coders then read the corresponding categories of Hess' Cognitive Rigor Matrix in order to familiarize themselves with how Webb's Depth of Knowledge intersects Bloom's Taxonomy on the Cognitive Rigor Matrix. The coders discussed the specific characteristics of each category of the matrix and made clarifications in order to reach consensus on the meanings of the examples presented in each cell of the matrix.

The coders practiced coding five reading comprehension prompts from a 3rd grade reading comprehension test. First, the coders practiced categorizing each question according to Webb's Depth of Knowledge levels. After they reached a consensus on the Webb's level, the two coders discussed placement of the question on Hess' Cognitive Rigor Matrix at the applicable intersection with Bloom's Taxonomy. Sample questions were coded with 100% agreement after utilizing the consensus read-behind method of referring to the WAT Training Manual, reviewing samples, followed by discussion.

The first coding session took place on August 27, 2020. This session involved coder calibration, with the coders and researcher agreeing that any question placed into Categories 1 and 2 of Webb's levels would be considered low level because of the simplicity of questions being asked. Furthermore, any question placed in Categories 3 and 4 of Webb's levels would be considered high level. These categories demand more of the students in terms of cognitive complexity. Each cell of the Cognitive Rigor Matrix was examined, with key words and phrases being highlighted and discussed. This provided clarity and alignment in the coding process. The coders examined how Webb's DOK intersects with Bloom's Taxonomy on the Cognitive Rigor Matrix. After reviewing the categories identified by Hess' Cognitive Rigor Matrix, the guidelines of the Web Alignment Tool Training Manual (Alt, Ely, Vesperman, & Webb, 2005) were revisited and reviewed. A protocol for disagreement was established. The coders would utilize the consensus read-behind method, and consult the Web's Alignment Tool Training Manual in order to reach an agreement. Following the recommendation of the manual, questions would be categorized at the higher rating if consensus could not be reached. For calibration, it was agreed that questions would be coded in sets of 10.

Immediately thereafter, the researcher and consultant coder began the first coding session using publicly available questions from a third grade reading textbook. Initially the coders categorized each question according to Webb's DOK levels, located along on the top of the Cognitive Rigor Matrix. After reaching a consensus, the researchers then discussed placement of each question at the appropriate intersection with Bloom's Taxonomy, located along the side of the Cognitive Rigor Matrix. For the first set of questions, the coders had 90% initial direct agreement, with 100% consensus after the read-behind method. The next set of questions generated an initial direct agreement of 90%, with 100% consensus being reached after the read-behind method.

Following the calibration session, the coding team continued to code the questions in sets of 10 until they were completed. A second coding session was held on August 28, 2020, to review three sets of 10 questions, and to discuss any disagreements with the codes selected for each question. The two coders read each question and worked toward consensus for the categorization on the Cognitive Rigor Matrix. As each question was reviewed, one coder would present a categorization, while the second coder would either agree or challenge this categorization by discussing Hess' Cognitive Rigor Matrix and referencing the Web Alignment Tool. Each coder presented his evidence for each categorization, and utilized the double-rater read-behind method when there was a disagreement. The coding team calculated and recorded the percentage of agreement after each set.

The researcher used a table in order to organize the coding data and to visually represent the category each question was assigned. Table 5 represents an example of the template used for this study for the questions reviewed from the third grade reading textbook.

Table 5

Sample Coding Template

Question	,1	,2	,3	,4	,5	,6	,2	,3	,4	6	,2	,3	,4	,5	,6	,2	,3	,4	,5	,6

During this coding session, the review of the first set of questions resulted in 100% initial direct agreement. The next set of questions resulted in 80% initial direct agreement, with 100% consensus reached after the read-behind method was employed. The final set of questions yielded 80% initial direct agreement, with 100% consensus reached after utilizing the read-behind method, and consulting the Web's Alignment Tool Training Manual.

The final coding session took place on October 29, 2020. The remaining sets (7.8) of questions from the sample of 138 publicly available questions from a 3rd grade reading textbook were reviewed and coded. When there was disagreement about particular questions, the team utilized the read-behind method, which resulted in attainment of 100% consensus. The results for each set are as follows: Set 1: 80% initial direct agreement; Set 2: 100% initial direct agreement; Set 3: 90% initial direct agreement; Set 4: 90% initial direct agreement; Set 5: 90% initial direct agreement; Set 6: 90% initial direct agreement; Set 7: 90% initial direct agreement; Set 8 (only 8 questions): 100% initial direct agreement.

Chapter Summary

Chapter III included an in-depth description of the coding protocol used to align 138 reading questions found embedded in a textbook to the Hess Cognitive Rigor Matrix. For this study, a mixed-method (qualitative and quantitative) content analysis research methodology was utilized in order to answer the research questions. Additionally, Mayring's (2000) step model for deductive category application was used to create a visual representation of the research process, including methods to ensure credibility in the overall study. Examples, definitions, and coding rules were evident, as indicated in this chapter, and thus placed into a specific coding agenda.

Chapter IV presents the findings of the study, with an analytical focus on answering all three research questions as presented in the aforementioned chapters.

Chapter IV

Results

The following chapter presents the findings of the study on determining how the language of written questions in a 3rd grade reading textbook series compared with the language of higher-order thinking found in research literature. This study aimed to categorize and analyze the frequency and percentage of higher-order thinking via the questions asked of the students in a reading textbook. The sample size included all 138 publicly available questions in the textbook.

Two trained coders held three coding sessions in which they utilized the double-rater read-behind consensus model to review and categorize each question in the textbook. During the coding sessions, Hess' Cognitive Rigor Matrix was utilized as the alignment tool. The coders agreed that questions placed into the third and fourth levels of Webb's Depth of Knowledge, as identified in Hess' Cognitive Rigor Matrix, would be considered higher-order thinking. As such, higher-order thinking categories were coded as, (C,2), (C,3), (C,4), (C,5), (C,6), (D,2), (D,3), (D,4), (D,5), and (D,6).

The coders utilized the double-rater read-behind consensus model in order to align each of the questions found in the reading textbook. This model allowed for the coders to discuss placement of each question within a category of the Cognitive Rigor Matrix, and to provide a rationale for their placement. Furthermore, this method increased reliability between the coders. During each coding session, the two coders discussed the placement of each question into a specific category and examined differences in placement until a consensus was reached. After coding and discussing each question, the total number of questions in each category of Hess' Cognitive Rigor Matrix and the percentages were calculated.

This mixed-methods study was guided by the following overarching question: *What are* *the types of thinking being promoted in a 3rd grade reading textbook?* There were two sub questions that further broke down the overarching question and guided the specific inquiry of the study.

Qualitative Findings

The first sub question was: *In what ways does the language found in questions within the text of a 3rd grade reading textbook compare with language that promotes higher-order thinking found in research literature?*

According to Hess' Cognitive Rigor Matrix, the lowest level of cognitive complexity was assigned to Level 1, in accordance with Webb's Depth of Knowledge. This level requires students to simply recall and reproduce facts and key ideas, terms, details, events, etc. Students are able to use procedures such as copying, defining, or identifying information directly from the text. Items only require a shallow understanding of the text presented and often consist of verbatim recall from the text, slightly paraphrasing of specific details from the text, or simple understanding of a single word or phrase (Webb et al., 2005, p.70). The complexity of the task can increase within Level 1 in accordance with the six levels of Bloom's Taxonomy. The researcher used the following codes derived from the Hess Cognitive Rigor Matrix to represent the lowest level of cognitive complexity: (A,1), (A,2), (A,3), (A,4) and (A,6). Level 2 thinking was represented by the following codes (B,1), (B,2), (B,3), (B,4), (B,5), and (B,6). According to the Webb Alignment Tool, Levels 3 and 4 require analysis of texts, use of prior knowledge, and abstract or critical thinking and represent the language of higher-level thinking (Webb et al., 2005, pp. 70-71). The codes identified at Level 3 are (C,2), (C,3), (C,4), (C,5) and (C,6). Level 4 codes were (D,2), (D,3), (D,4), (D,5) and (D,6).

An example of an (A,1) question found in the textbook was the following: *Identify the main idea and the supporting details in the first paragraph on this page*. Students are required to retrieve information explicitly stated within the text. Additionally, the question directs the students to a specific area of the text in order to retrieve the information. Another question categorized at this level of the matrix (A,1) was*, What tasks has Maria spent hours on? Include examples from the story in your response.* Students simply had to locate details within the text and restate them in their response. An example of a question with language aligned to (A,2) found in the textbook was the following: *The city has grown, causing more traffic. What is another result, or effect, of the city growing larger and busier?* Students were asked to identify an effect that was stated in the text. In another example, *What steps do the scouts follow? Use time-order words in your response.* This question was categorized as Webb's DOK Level 1 with an intersection of Bloom's Taxonomy Level 2, Understand (A,2). Students had to describe the sequence of events that were stated in the story. In addition, they were instructed to include time-order words that were utilized in the text.

An example of a question coded as (A,4) was: *These pages include headings, a caption, and a box fact. What kinds of information do these text features provide?* Students referred to specific features of the text and were asked to explain/analyze them, demonstrating a basic comprehension of the text. There were no questions placed into cells (A,3), (A,5) and (A,6) on the matrix.

The next level of cognitive complexity noted in the matrix is Level 2, which is also aligned with Webb's Depth of Knowledge Level 2. This level encompasses comprehension and basic analysis of text, with some mental processing beyond recalling or reproducing a response (Webb et al., 2005, p.70). It requires both comprehension and processing of text. Some important concepts are addressed, but not in a complex way. Similar to Level 1, the complexity of the task increases within Level 2 in accordance with the six levels of Bloom's Taxonomy. Cells within Level 2 include: (B,2), (B,3), (B,4), and (B,6).

Questioning at the (B,2) level was the most prevalent in this study. At this level (Webb's DOK Level 2, Bloom's Taxonomy, Understand), students are required to specify, explain, show relationships; give examples and non-examples, summarize results and ideas, make basic inferences, identify main ideas, and locate information to support explicit-implicit central ideas. An example of a question with the language that aligns to (B,2) was: *Sarah says "land rolls a little like the sea." What do you think she means?* Another example of a question coded as (B,2) was: *What is the main idea of this paragraph? Explain how details in this paragraph support the main idea.* The question asks students to identify the main idea and to locate details within the text supporting their response.

Questions coded (B,3) require students to apply their knowledge by using context to identify the meaning of words/phrases, obtain and interpret information using text features, and apply simple organizational structures in writing. An example of a question with the language that aligns to (B,3) was: *What do you think Thomas Edison would invent today if he were alive? Use text evidence from "Young Thomas Edison" to support your ideas.* This question was categorized as Webb's Depth of Knowledge 2 with an intersection of Bloom's Taxonomy Level 3, Apply. In this question, students are required to demonstrate their understanding through the application of new ideas. New ideas must be logical and relevant based on information provided in the text.

An example of a question with the language that aligns to (B,4) was: *How has the author organized information? How does it support her purpose for writing?* At this level, with an intersection of Webb's DOK Level 2 with Bloom's Taxonomy Level 4, Analyze, students are required to identify the use of literary devices, analyze format, organization, and internal text structure, distinguish relevant/irrelevant information or fact/opinion, and categorize or compare literary elements, terms, facts/details, and events. There were no questions placed within the cells (B,5) and (B,6) of the matrix.

The third level of Hess' Cognitive Rigor Matrix aligns with Webb's Depth of Knowledge Level 3. Students are encouraged to extend their thinking beyond the text and to connect ideas using reasoning or planning (Webb, et al., 2005, p. 70). Deep knowledge becomes a greater focus, with the expectation that students apply prior knowledge and support their thinking. Cells in Level 3 include: (C,2), (C,3), (C,4), (C,5), and (C,6).

An example of a question with the language that aligns to (C,2) was: *What do you learn from the illustration that the words alone don't express?* Students were asked to make an interpretation relying solely on the illustration. This information is not explicitly stated in the text.

At this level (Webb's DOK Level 3, Bloom's Taxonomy, Understand), students are required to explain, generalize, or connect ideas using supporting evidence, describe how word choice, point of view, or bias may affect interpretation of the text, or identify/make inferences about explicit or implicit themes.

An example of a question with the language that aligns to (C,3) was the following: *What new inventions may change how stories are told in the future?* Students read a text about storytelling, and were asked to apply the concept of storytelling to a new context. At this level, with an intersection of Webb's DOK Level 3, with Bloom's Taxonomy Level 3, Apply, students are required to apply a concept to a new context, or apply word choice, point of view and style in order to impact the readers' interpretation of a text.

An example of a question with the language that aligns to (C,4) was the following: *Imagine that Jiichan from Kamishibai Man could meet Grandpa Chon from The Harvest Birds. Do you think they would become friends? Why or why not?* In this question, students are asked to analyze and make a connection between two different texts. Questions coded (C,4) with an intersection of Webb's DOK 3 and Bloom's Taxonomy Level 4, Analyze, require students to analyze information within data sets or texts, analyze interrelationships among concepts, issues or problems, analyze or interpret author's craft, and use reasoning, planning, and evidence to support inferences. There were no questions placed in (C,5) and (C,6) cells of the matrix.

The highest level of cognitive complexity in Hess' Cognitive Rigor Matrix was categorized as Level 4, in correspondence with Webb's Depth of Knowledge Level 4. At this level, extended activities are encouraged that target deep understanding and analysis of text. Higher-order thinking is central, with students expected to take information from at least one passage of a text in order to apply this information to a new text (Webb et al., 2005, p.71). Students are essentially "connecting the dots" in order to come up with a bigger idea that is not stated. The cells in Hess' Cognitive Rigor Matrix for Level 4 include (D,2), (D,3), (D,4), (D,5) and (D,6). Of the 138 questions examined, there were no questions with language that aligned to (D,2), (D,3), (D,5) and (D,6).

An example of a question with the language that aligns to (D,4) was the following: *How are the themes and plots of these two stories by the same author alike, and how are they different?* Students were expected to analyze two sources by the same author, specifically identifying and comparing/contrasting the themes implicitly stated in the text. This question was categorized as Webb's DOK Level 4 with an intersection of Bloom's Taxonomy Level 4, Analyze. Students are required to analyze multiple sources of evidence, or multiple works by the same author, across genres, times periods, and/or themes. They are required to analyze complex/abstract themes, perspectives, or concepts. Additionally, they are expected to gather, analyze, and analyze multiple information sources.

Quantitative Findings

The second sub question was: *What is the frequency and percentage of higher-order thinking, as described by the Hess Cognitive Rigor Matrix, embedded in reading comprehension questions presented in the student textbook of a 3rd grade reading textbook series?* The Hess Cognitive Rigor Matrix encompasses the following codes, representing the lowest level of cognitive complexity: (A,1), (A,2), (A,3), (A,4) and (A,6). Level 2 thinking was represented by the following codes (B,1), (B,2), (B,3), (B,4), (B,5), and (B,6). According to the Webb Alignment Tool, Levels 3 and 4 require analysis of texts, use of prior knowledge, and abstract or critical thinking and represent the language of higher-level thinking (Webb et al., 2005, pp. 70-71). The codes identified at Level 3 are (C,2), (C,3), (C,4), (C,5), and (C,6). Level 4 codes were (D,2), (D,3), (D,4), (D,5), and (D,6).

There were 23 questions placed into cell (A,1) of the matrix, making up 17% of the total questions examined. At this level (Webb's DOK Level 1, Bloom's Taxonomy, Remember), students are required to directly recall facts that had been explicitly stated in the text or passage provided. Similarly, 22 questions were placed into (A,2) cell of the matrix, totaling 16% of the questions examined. Four questions were placed into (A,4) cell of the matrix, totaling three percent of the questions examined. At this level (Webb's DOK Level 1, Bloom's Taxonomy, Analyze), students may be asked to analyze text/text features at a basic level.

Thirty-three questions were placed into (B,2) cell of the matrix, totaling 24% of the questions examined. This level of questioning was the most prevalent in this study. Similarly, nineteen questions were placed in (B,3) cell of the matrix, totaling 14% of the questions examined. Eleven questions were placed in (B,4) cell of the matrix, totaling eight percent of the questions examined. Six questions were placed in (C,2) cell of the matrix, totaling four percent of the questions examined.

Fourteen questions were placed in (C,3) cell of the matrix, totaling 11% of the questions examined. Four questions were placed in (C,4) cell of the matrix, totaling three percent of the questions examined. There were no questions placed in (C,5) and (C,6) cells of the matrix. Two questions were placed in (D,4) cell of the matrix, totaling one percent of the questions examined.

Of the 138 questions analyzed, 54 questions included language that aligned with higher-order thinking, and required cognitive complexity through strategic thinking, reasoning, and extended thinking. This represented 39% of the total questions examined in this study. Sixty-one percent of the questions (84 questions) were categorized as lower-level questions (Webb's DOK Level 1 or 2), requiring students to recall and reproduce and/or use skills and concepts (see Figures 5 & 6).

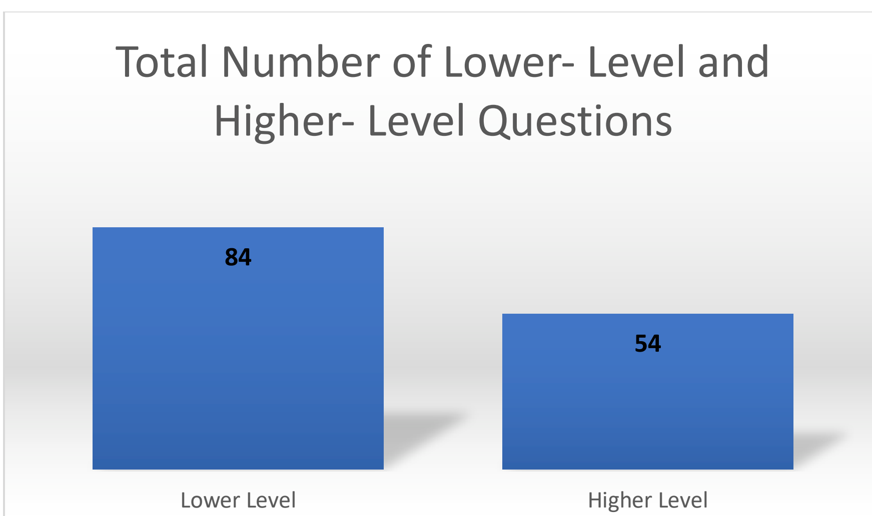

Figure 5. Total number of lower-level and higher-level questions

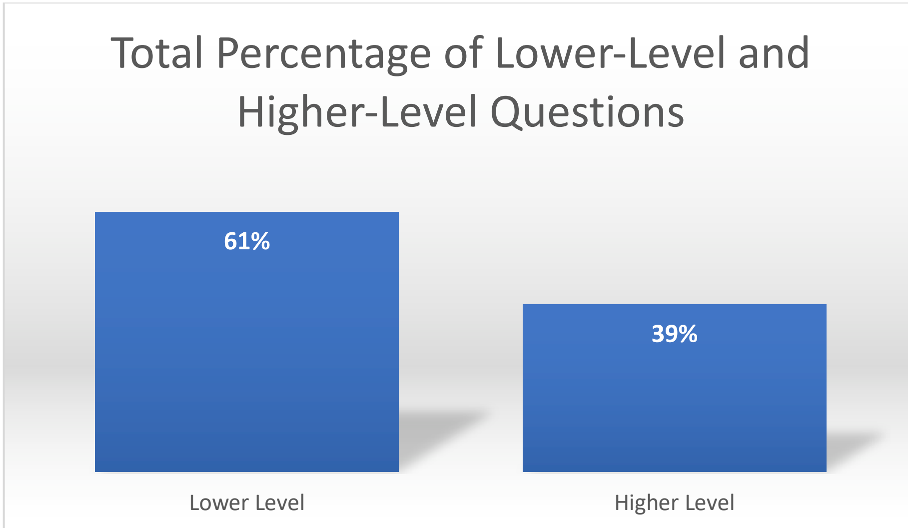

Figure 6. Total percentage of lower-level and higher-level questions

The cell with the highest frequency was (B,2), which had 33 questions, making up 24% of the total questions examined (see Figures 7 and 8). This level encompasses comprehension and basic analysis of text, with some mental processing beyond recalling or reproducing a response (Webb et al., 2005, p.70). It requires both comprehension and processing of text. Questions placed in this category required students to specify, explain, show relationships, give examples and non-examples, summarize results and ideas, make basic inferences, identify main ideas, and locate information to support explicit-implicit central ideas.

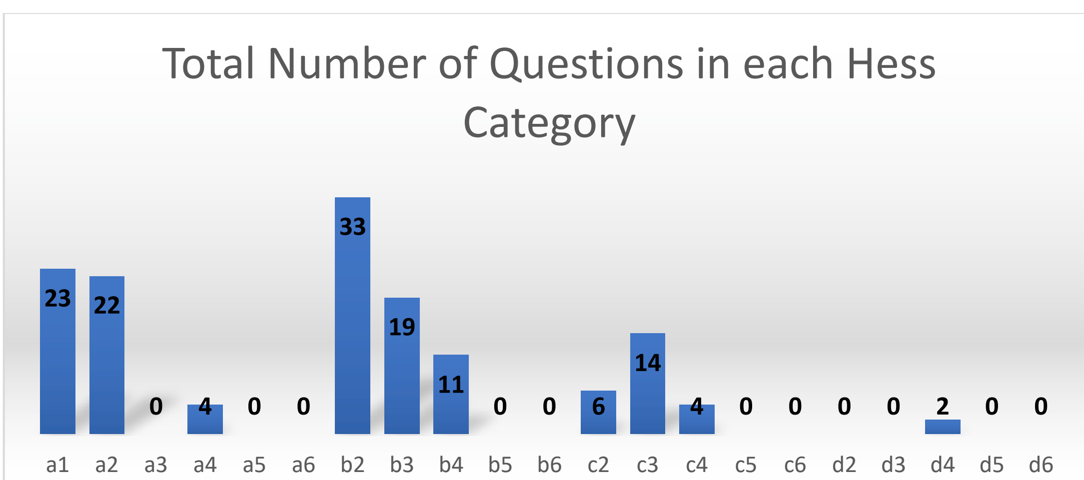

Figure 7. Total number of questions in each Hess category

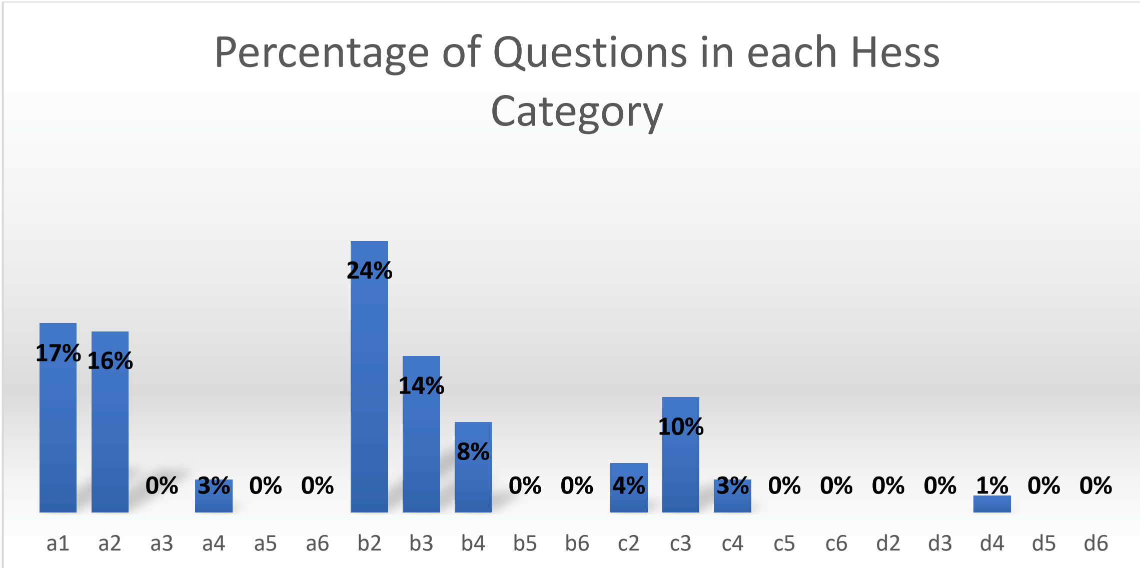

Figure 8. Percentage of questions in each Hess category

Conclusion

The purpose of this convergent, parallel mixed-methods study was to determine how the language of written questions in a 3rd grade reading textbook series associates with the language of higher-order thinking found in research literature. The Hess Cognitive Rigor Matrix was used to analyze the level of cognitive complexity that aligned with Webb's Depth of Knowledge and Bloom's Taxonomy. Questions placed into Levels 3 and 4 of Webb's Depth of Knowledge along the matrix were considered higher level, because the tasks requires students to engage in higher-order thinking skills in order to answer the question effectively.

In response to the overarching research question, data analysis revealed the following trends from the 138 questions taken from a 3rd grade reading textbook:

- Of the 138 questions reviewed, 84 were categorized as lower-level questions, equating to 61% of all questions examined and analyzed.
- Of the 138 questions reviewed, 54 were categorized as higher-level questions, equating to 39% of all questions examined and analyzed.

- The cell with the highest frequency was (B,2), which had 33 questions, making up 24% of the total questions examined. Questions in the cell asked students to specify, explain, show relationships, give examples and non-examples, summarize results and ideas, make basic inferences, identify main ideas and locate information to support explicit-implicit central ideas.

- A majority of the 138 questions examined were categorized in cells (B,2), (B,3), and (B,4), with a total of 63 questions. This constitutes 46% of the total questions reviewed in this study.

- No questions were categorized at the Bloom's Taxonomy Level 5 and 6, or Evaluate and Create.

Chapter V includes a summary of the methodology and a discussion of the findings as they relate to the two sub questions, as well as implications for policy and practice, and future research recommendations.

Chapter V

Conclusion

This chapter provides a summary of the study, including comments on the findings as they relate to the overarching research question and two sub questions, a conclusion, implementations for policy and practice, and recommendations for future research. The qualitative content analysis content study aimed to describe the level of distribution of higher-order thinking being promoted within a 3rd grade reading textbook. For this study, 138 questions embedded within the text were examined using the Hess Cognitive Rigor Matrix. The questions aligned with the New Jersey Student Learning Standards (NJSLS). According to the study, no empirical evidence exists in the 3rd grade reading textbook to promote higher-order thinking skills.

Methodology Summary

The theoretical framework used for this study was Hess' Cognitive Rigor Matrix, which superimposed Webb's Depth of Knowledge and Bloom's Taxonomy. Webb's Taxonomy, which categorizes the level of cognitive complexity of a task, contains four levels. At the lowest level, Level 1, there is minimal cognitive complexity, with questions that depend on basic operations that don't requires text analysis. Questions in the second level of Webb's Depth of Knowledge, Level 2, are also categorized as low-level because of their simplistic nature. These questions do not lead to deeper thinking. Level 3 of Webb's Depth of Knowledge is considered to be high-level because it requires students to do more complex thinking to answer questions. Webb's Depth of Knowledge Level 4 is the highest level of cognitive complexity, requiring students to expand their understanding and learning beyond the question that is asked or the text that was read.

The six levels of Bloom's Taxonomy, which are embedded into the Hess Cognitive Rigor Matrix include, from lowest to highest level: *remember, understand, apply, analyze, evaluate,* and *create.* Remembering refers to retrieving, recognizing, and recalling relevant knowledge from long term memory; Understanding refers to constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing and explaining; Applying refers to carrying out or using a procedure through executing or implementing; Analyzing refers to breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing, and attributing; Evaluating refers to making judgments based on criteria and standards through checking and critiquing; Creating refers to putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing (Anderson & Krathwohl, 2001, pp. 67-68). These levels increase in complexity based on the level of thought required to answer a question or complete a task. By superimposing Webb's Depth of Knowledge with Bloom's Taxonomy, questions can be assessed based on the depth of understanding required and the complexity of the task itself. By blending the actions with the cognitive complexity of tasks and activities, it creates a holistic model that can encourage higher-order thinking (Hess et al., 2009).

This case study employed mixed-methods with qualitative content analysis and descriptive statistics to examine the following overarching question: *What types of thinking are being promoted in a 3rd grade reading textbook?* Two coders utilized deductive category application in accordance with Mayring (2000), to categorize each question into the appropriate cell of the Hess Cognitive Rigor Matrix. Each cell was assigned a matrix based on the level of Webb's Depth of Knowledge and Bloom's Taxonomy. An example of a matrix is (B,4), which is Webb's Level 2, Skills and Concepts, and Bloom's fourth level, or analyze. The double-rater read-behind consensus model was used in the study to increase inter-rater reliability, and to allow the two coders to discuss the placement of each question. The coders held three Zoom video conferences in order to calibrate and discuss the questions in sets of 10. To ensure credibility, the data collection procedures, including the double-rater read-behind consensus model and Webb Alignment Tool calibration, were compared with prior studies that utilized similar methods.

Conclusions

This study has revealed that 61% of the questions are promoting lower-level thinking, and 39% promote higher-level thinking. Additionally, the language for 61 out of 138 questions associated with the language found in Webb's DOK Level 2 and Bloom's Taxonomy *Understand*, with minimal emphasis on the subsequent levels of *Apply* (33 out of 138 questions) and *Analyze* (21 out of 138 questions). There were no questions categorized in Levels 5 and 6, or *Evaluate* and *Create*. While higher-order thinking can be viewed as a kaleidoscope, the findings show that this textbook focuses merely on one lens, or way of thinking, *Understand*. Questions are focused around one way to think about literature, understanding the story, and not extending beyond the story. Additionally, students are not required to make real-world, authentic connections. In order to provide effective educational preparation for students built upon experiential learning, teachers and administrators need to begin with the review and revision of current curricula to ensure the inclusion of vital complex thinking skills (Burns, 2017).

An abundance of lower-level questioning can stunt the complex thinking development of students and lead to functional fixedness, or the perception of an entity as having only one function (Anderson & Johnson, 1966). Runco and Chand (1995) explain the concept of functional fixity as the "rigidity or mental set that locks out thinking so that an individual can't see alternatives" (p. 247). In schools, instruction is presented in step-by-step fashion whereby the student is to problem solve using specified strategies, methods, and formulas. This method of instruction and learning is presented as promoting higher-order thinking, yet functional fixedness is promoted instead. Students are denied the opportunity to explore alternate solutions and to think out of the box as they problem solve. When consistently taught specified strategies, methods, and formulas to solve problems, students become unable to think creatively and/or design original solutions to them.

For many K-12 schools, there is a push for teachers to develop a higher-order thinking skill set amongst students. In order to meet these demands, many publishing companies have developed programs claiming to be aligned to the standards, which develop the higher-order thinking that is required of students. The publishing company marketed the textbook analyzed in this study as being able to "aspire readers and writers with the skills they need to scale the challenges of today's rigorous assessment demands" (Houghton Mifflin Harcourt, 2020). Upon analyzing the featured questions from a third-grade reading textbook, the company does not hold true to its claim, indicating a discrepancy between the marketing and the questions and tasks that are presented to students. Findings suggest that this program does the opposite, by providing a majority of lower-level questions.

These findings raise further awareness of the importance of being a well-informed consumer and being more knowledgeable of the features offered by a program prior to making a commitment to purchasing a program. Programs must be thoroughly reviewed for the quality of the product in relation to the desired purpose of that product (i.e., the promotion of higher-level thinking, or remediation and support for struggling readers).

Recommendations for Practice

The findings of this study raise awareness for district leaders and teachers to be skilled enough to use the Hess Cognitive Rigor Matrix, Webb's Depth of Knowledge, and Bloom's Taxonomy in order to develop other types of thinking. Teachers need to be provided with professional development in order to self-assess and analyze their practices, lessons, activities, and assessments to ensure the promotion and development of higher-order thinking skills. These sessions will allow teachers to distinguish between cognitive complexity and difficulty. Teachers need to be given the opportunity to review questions posed in the classroom and then augment those that may be categorized as lower-level questions. When augmenting questions that are cognitively complex, teachers must ensure they are developmentally appropriate. If the textbook program is not up for re-adoption, then teachers must work together to plan strategies that will promote and develop other types of thinking that is not promoted within the current textbook.

The results of this study suggest there is a disconnect between what the textbook companies are promoting and the current demands on students for the 21st century. It is recommended that a textbook adoption committee be formed, comprised of curriculum specialists, department supervisors, principals, elementary teachers, Title One, and Special Education teachers, and remedial reading teachers. Committee members can be charged with seeking textbooks that align with state standards and the promotion of extended and higher-order thinking. When given the opportunity to review sample textbooks, committee members should evaluate a random sampling of questions utilizing the Hess Cognitive Rigor Matrix to ensure that the questions are aligned with the framework's definition of higher-order thinking skills.

Professional development of school employees is required if schools are to sufficiently prepare students for life in a world that is becoming increasingly complex (Sparks and Hirsh, 1997). It should be placed at the center of all education reform strategies. Schools cannot educate students to high standards without well designed staff professional development initiatives. Once a textbook has been rigorously reviewed and adopted, relevant and effective professional development must be provided to all teachers on ways to identify and encourage higher-order thinking in conjunction with implementation of the textbook program. Teachers should be given opportunity to familiarize themselves with the components of the program and be given feedback on ways in which to best implement the program. Likewise, members of the selection committee should meet with teachers in order to allow them to express questions or concerns or ask for more personalized support in successfully implementing the program. Ongoing professional development and research should be provided during the various stages of the implementation process. Concerns may arise, and guidance should be provided at the school and district level in order for the new textbook program to be successful for the intended goal. Bull (1998) stated that effective professional development has five characteristics: it is school based; it utilizes coaching and/or other follow-up procedures; it is collaborative; it is embedded in the daily lives of teachers and provide for continuous growth; and focus should be on student learning, which should be regularly evaluated.

Recommendations for Policy

The Every Student Succeeds Act (2010) provides flexibility and opportunity for state and local officials to develop curricula that instills complex thinking. This, in turn, prepares students for the required college and career readiness. With this flexibility comes the responsibility on states to make the proper changes that will cultivate complex thinking in students. Through

ESSA, educational stakeholders have been offered the much-needed flexibility to pursue the endeavors that are considered vital in the education of students.

Educational stakeholders must take on the responsibility of ensuring that policy, assessments, curricula, and programs include complex thinking skills. They must engage in the analysis of district and statewide assessments to ensure that questions are properly assessing students in all facets. This may include both lower-level and higher-order questions providing a glimpse of the student's capabilities at their specific grade level. Furthermore, school leaders will be tasked the job of ensuring that instructional opportunities are put into place that expands the students' creativity and include critical thinking through multiple measures.

Furthermore, educational stakeholders must take a collaborative approach to solve the lack of higher-order thinking implemented at the school level. Educators at the local level have it within their power to defy standardization and change the trajectory of education for millions of students (Tienken, 2016). The key to supporting a collaborative approach is to establish purposeful support structures and agreed-upon processes for encouraging open problem solving (Zhao, Wehmeyer, Basham, & Hansen, 2019). The decision about what is implemented or what is assessed should be determined and discussed by those affected.

Recommendations for Further Research

Further research comparing the distribution of cognitive complexity within the local curricula and instruction should be conducted in the language arts and mathematics areas at the elementary grade levels. This study examined questions aligned with 3rd grade standards. Further studies can be conducted to analyze and categorize questions from other grade levels to better understand the overall textbook series and how it affects students in other grade levels. The examination of other grade levels could identify similarities and differences in the frequency and percentage of higher-order questions being asked of students by comparing the questions being asked at different grade levels. Additionally, further studies of reading textbooks from other series would help to determine which, if any, textbook series promote critical thinking through the use of higher-order thinking questions.

This study focused solely on determining the frequency and percentage of higher-order questions being promoted in a 3rd grade reading textbook. The study did not examine the effects of these textbooks on other aspects such as the New Jersey Student Learning Assessment (NJSLA). Further studies analyzing the impact of the use of questioning on student achievement could provide valuable data regarding the textbook's effectiveness.

Furthermore, the standards implemented in states must be evaluated and modified to include skills that promote 21st century learning. Moreover, the information gained through analyzing assessments, standards, curriculum, and instruction can expand the research as what was presented in this particular study. The replication of this study or other related studies could also be conducted utilizing conceptual frameworks such as Hess' Cognitive Rigor Matrix to further the development and implementation of higher-order thinking in education. As the knowledge required for global citizenship becomes more complex, the systems in which we educate the rising generation must evolve (Nehring et al., 2019).

The implementation of traditional, low-level instructional practices and standardized assessments will not prepare today's students for the 21st century. Using current research to redefine educational expectations and provide the proper professional development for educators would be a great place to begin.

References

21st Century Skills. (2016). In *The Glossary of Education Reform.* Retrieved from https:///www.edglossary.org/21st-century-skills/

Almeida, A. (2010). Can I ask a question? The importance of classroom questioning. *International Journal of Learning and Change.* 4 (3), 237-251. Doi:10.1016/j.sbspro.2011.12.116.

Anderson, L.W., & and Krathwohl, D. (Eds.). (2001). *A taxonomy for learning, teaching, and Assessing: A revision of Bloom's Taxonomy of Educational Objectives*. New York, NY: Longman.

Anderson, B., & Johnson, W. (1966). Two kinds of set in problem solving. *Psychological Reports*, 19 (3, Pt. 1), 851-858. Doi: 10.2466/pr0.1966.19.3.851

Annie E. Casey Foundation (2010). *Early warning! Why reading by the end of third grade matters.* Retrieved from: www.kidscount.org

Applied Educational Systems, Inc. (2020) *What are 21st century skills?* Retrieved from https://www.aeseducation.com/blog/what-are-21st-century-skills

Aydemir, Y. and Cifci, O. (2008). Literature Questioning Skills. Gazi University Faculty of Education, *6*(2) 103-115.

Bloom, B.S. (Ed.). Englehart, M.D., Furst, E.J., Hill, & W.H., Krathwohl, D.R. (1956). *Taxonomy of educational objectives, Handbook I: The cognitive domain.* New York, NY: David McKay.

Brookhart, S.M. (2010). *How to assess higher-order thinking skills in your classroom*. Alexandria, VA: Association for Supervision and Curriculum Development.

Bull, B. (1998). ATE newsletter, 32(6), 4.

Burns, C.R. (2017). A comparison of complex thinking required by the middle school New Jersey student learning standards and past New Jersey curriculum standards. *(Doctoral Dissertation)*. Retrieved from https://scholarship.shu.edu/dissertations/2308/

Chick, Nancy. (2009). *Metacognition. Thinking about one's thinking*. Vanderbilt University Center for Teaching.

Common Core State Standards (2010). Retrieved from http://www.corestandards.org/the-standards

Conklin, W. (2011). *Higher-order thinking skills to develop 21st century learners*. Teacher Created Materials.

Dewey, J. (1910). *How we think*. Boston, D.C. Health & Co.

Ennis, R. (1985). A definition of critical thinking. *The Reading Teacher 17*(8), 599-612.

Every Student Succeeds Act (2010). Retrieved from https://www.ed.gov/essa?src=rn/

Faccione, P.A. (1990). *Critical thinking: A statement of expert consensus for purposes of education assessment and instruction.* American Philosophical Association. ERIC Reproduction Service No. ED 315-423.

Francis, Erik. (2016). *Now That's a Good Question! How to Promote Cognitive Rigor Through Classroom Questioning.*

Glaser, E.M. (1941). *An experiment in the development of critical thinking.* New York City, NY: Teachers College, Columbia University.

Hashmat, S. (2015). What is confirmation bias? People are prone to believe what they want to believe. Retrieved from https://www.psychologytoday.com/us/blog/science-choice/201504/what-is-conformation-bias

Hess, K. (2008). *Exploring cognitive complexity and depth of knowledge*. Dover, NH: National

Center for Assessment. Retrieved from http://www.nciea.org/publications-2/?keywords=Hess&x=0&action=search&current_page=1&items_per=20&sort_by=name_last&sort_dir=ASC

Hess, Karen. (2018). *A Local Assessment Toolkit to Promote Deeper Learning: Transforming Research Into Practice.* Thousand Oaks, California: Corwin.

Hess, K.K., Jones, B.S., Carlock, D., & Walkup, J.R. (2009a). *Cognitive rigor: Blending the strengths of Bloom's taxonomy and Webb's depth of knowledge to enhance classroom level processes.* Retrieved from https://files.eric.ed.gov/fulltext/ED517804.pd

Hess, K.K., Jones, B.S., Carlock, D., & Walkup, J.R. (2009b). *What exactly do "fewer, clearer, and higher standards" really look like in the classroom? Using a cognitive rigor matrix to analyze curriculum, plan lessons, and implement assessments.* Retrieved from http://schools.nyc.gov/NR/rdonlyres/D106125F-FFF0-420E-86D9 254761638C6F/0/HessArticle.pdf.

Houghton Mifflin Harcourt (2020). Retrieved from https://www.hmhco.com/programs/journeys

Jirka, J. and Hableton, Ronald. K. (2005). *Cognitive Complexity Levels for the MCAS Assessments.* University of Massachusetts, Amherst. Center for Educational Assessment MCAS Validity Report No. 10. (CEA-566). Amherst, MA: University of Massachusetts, Center for Educational Assessment.

Krathwohl, D. (2002). A revision of Bloom's taxonomy: An overview. *Theory into Practice, 41* (4), 212-218. Retrieved from http://www.unco.edu/cetl/sir/stating_outcome/documents/Krathwohl.pdf

Kiss, T. (2017). Investigating Teacher Questions Within the Framework of Knowledge Building Pedagogy. *Journal of International Studies*, *7*(1), 55-69.

Lortie, D. (1975). *Schoolteacher: A sociological study*. Chicago: University of Chicago Press

McTighe, J., and Silver, H.F. (2020). *Teaching for deeper learning*. Alexandria, VA: ASCD.

Mustika, N., Nurkamto, J., & Suparno, S. (2020). Influence of questioning techniques in EFL Classes on developing students' critical thinking skills. *International Online Journal of Education and Teaching*, *7*(1). 278-287.

Morgan, W.R., Jr. (1995). "Critical thinking"- What does that mean? *Journal for College Science Teaching*, 336-340.

Meador, D. (2017). *Why school culture matters and strategies to improve it.* Retrieved from https://www.thoughtco.com/strategies-to-improve-school-culture-3194578.

Mayring, P. (2000). Qualitative content analysis. Forum: Qualitative Social Research, p. 40.

Nappi, J. (2016). *The Importance of Questioning in Developing Critical Thinking Skills.* The Delta Kappa Gamma Bulletin: International Journal for Professional Educators, 30-40.

National Research Council. (2012). Pellegrino, J., Chudowsky, N., & Glaser, R. (Eds.) Knowing what students know: *The science and design of educational assessment*. Washington, D.C.: Academy Press.

Nehring, J.H., Charner-Laird, M., & Szczesiul, S.A. (2019). *Redefining excellence: Teaching in Transition, from test performance to 21st century skills*. NASSP Bulletin.

New Jersey Department of Education (2016). *The New Jersey Student Learning Standards for English Language Arts.* Retrieved from https://www.nj.gov/education/cccs/2016/ela/

Paige, D.D., Sizemore, J.M., & Neace, W. P. (2013). Working inside the box: Exploring the Relationship between student engagement and cognitive rigor. *NASSP Bulletin*, *97(2),* 105-123. doi: 10.1177/0192636512473505

Question. (2016). In *Cambridge Academic Content Dictionary*. Retrieved from http://dictionary.

cambridge.org/us/dictionary/English/question

Range, Lillian M. (2019). *Case study methodologies*. Salem Press Encyclopedia of Health.

Redfield, D.W., & Rousseau, E.W. (1981). A meta-analysis of experimental research on teacher questioning behavior. *Rev. Educ. Res,* 51: 237-245.

Runco, M.A., & Chand, I. (1995). Cognition and creativity. *Educational Psychology Review, 7*(3), 243-267.

Schoenfeld, Alan H. (1991). On mathematics as sense making: An informal attack on the fortunate divorce of formal and informal mathematics. In James F. Voss, David N. Perkins, and Judith W. Segal (Eds.), *Informal reasoning and education* (pp. 311-344). Hillsdale, NJ: Erlbaum.

Schulz, H. W., & Fitzpatrick, B. (2016). Teachers' understandings of critical and higher-order thinking and what this means for their teaching and assessments. *Alberta Journal of Educational Research, 62*(1), 61-86.

Sforza, D., Tienken, C. H., & Kim, E. (2016). A comparison of higher-order thinking between The Common Core State Standards and the 2009 New Jersey Content Standards in High School. *AASA Journal of Scholarship & Practice, 12*(4), 5-31.

Sparks, D., & Hirsh, S. (1997). *A new vision for staff development*. Alexandria, VA: ASCD.

Stobaugh, R. (2013). *Assessing critical thinking in middle and high schools: Meeting the Common Core*. New York: Routledge.

Tienken, C.H. (2016). Common Core creativity: Not so fast. *Kappa Delta Pi Record, 52*(2), 56. Doi: 10.1080/00228958.2016.1156509

Tienken, C.H., Goldberg, S., & DiRocco, D. (2010). Questioning the questions. *Education Digest: Essential Readings Condensed for Quick Review,* 75 (9), 28-32.

Venzon, C. (2011). *Doing your homework: Tips for cracking the educational market*. Retrieved from https://www.writing-world.com/children/textbooks.shtml.

Watson, S. (2019). Higher-order thinking skills (HOTS) in education. Retrieved from https://www.thoughtco.com/higher-order-thinking-skills-hots-education-3111297

Webb, N. (1997). *Research monograph number 6: Criteria for alignment of expectations and assessments on mathematics and science education.* Washington, D.C.: CCSSO.

Webb, N.L. (2005). *Webb Alignment Tool. Training Manual*. Wisconsin Center for Education Research.

Webb, N., Alt, M., Ely, R., & Vesperman, B. (2005). *Web Alignment Tool (WAT) training Manual*. Wisconsin Center for Educational Research, *1* (1) 1-177.

Youth Truth. *Learning from student voice: What do students have to say about school culture?* Retrieved from https://youthtruthsurvey.org.

Zhao, Y., Wehmeyer, M., Basham, J., & Hansen, D. (2019). Tackling the Wicked Problem of Measuring What Matters: Framing the Questions. ECNU Review of Education, 2(3), 262-278. Retrieved from https://search.ebscohost.com/login.aspx?direct=true&AuthType =sso&db=eric&AN=EJ1 230124&site=ehost-live&custid=s8475574

Zohar, Anat, and David, Adi Ben. (2009). Paving a clear path in a thick forest: A conceptual Analysis of a metacognitive component. *Metacognition Learning, 4,* 177-195.