

A Study of the Efficacy of Out-of-Field Teachers

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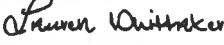
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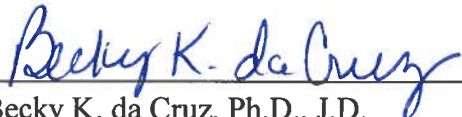
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ABSTRACT

The purpose of this study was to determine if teacher certification type impacted student achievement. The researcher hypothesized that students taught by teachers with out-of-field certification will have lower achievement-level scores on Georgia Milestone Assessments than students who are taught by teachers with in-field certification. The null hypothesis held that there is no association between teacher certification type and student achievement levels on Georgia Milestone Assessments.

For the purposes of this research, teachers were classified based on certification type—that is, in-field or out-of-field—and students were classified based on the certification type of their teacher and their achievement-level score on Georgia Milestone Assessments. The researcher obtained data from a Georgia school district for school years 2017, 2018, and 2019. The data included in-field and out-of-field teacher lists, teacher schedule files, student schedule files, and Georgia Milestone Assessment results by student. The data were organized and divided into various datasets.

The researcher applied the chi-square test to determine the statistical significance of the different datasets. In total, 42 datasets were reviewed and tested using the chi-square test; of these, 35 rejected the null hypothesis, thus showing significant evidence of an association between teacher certification type and student achievement level. Based on the data analyzed in this study, the results suggest that teacher certification type has an impact on student achievement. Limitations of the study include sample size and the inability to encompass other factors that could affect the learning levels. Future research needed includes incorporating the experience level of the teacher and the learning loss related to the COVID pandemic.

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LIST OF ACRONYMS

CTAE	career, technical, and agricultural education
ED	economically disadvantaged
EL	English learner
ELA	English language arts
EOC	End of course assessments (Georgia Milestones for High Schools)
EOG	End of grade assessments (Georgia Milestones for Elementary and Middle Schools)
EPP	educator preparation program
ESSA	Every Student Succeeds Act
GACE	Georgia Assessment for Certification of Educators
GaDOE	Georgia Department of Education
GaPSC	Georgia Professional Standards Commission
GaTAPP	Georgia Teacher Academy for Preparation and Pedagogy
GMAs	Georgia Milestone Assessments
GOSA	Governor’s Office of Student Achievement
IF	in-field
ITBS	Iowa Test of Basic Skills
LEA	local educational agency
LUA	local unit of administration
NBPTS	National Board for Professional Teaching Standards
NCLB	No Child Left Behind
OOF	out-of-field
PQ	professional qualification

RESA	regional educational service agencies
SGP	student growth percentiles
STEAM	science, technology, engineering, the arts, and mathematics
STEM	science, technology, engineering, and technology
SWD	students with disabilities
SY	School Year
TFA	Teach for America
USDOE	U.S. Department of Education

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Writing this dissertation has truly been one of the most challenging tasks I have ever committed to and accomplished. It has been a long difficult journey—but a journey well worth undertaking. This dissertation stretched me to limits both academic and personal that I cannot even put to words.

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Chapter I

Introduction

Background

In 2015, President Barrack Obama signed the Every Student Succeeds Act (ESSA) into law, replacing the No Child Left Behind (NCLB) Act. ESSA granted each state additional authority over and flexibility within its education system and scaled back the authority of the U.S. Secretary of Education and, more broadly, the U.S. Department of Education (USDOE) (Woods, 2017). With the law's passage, each state became responsible for writing and submitting an ESSA plan to the USDOE for approval. The State of Georgia's ESSA plan was approved on January 19, 2018.

Georgia's ESSA plan established the professional qualifications (PQs) for Georgia teachers, stipulating that state and local educational agencies must ensure that teachers meet applicable state certification requirements. However, under ESSA, local school systems have the option to waive certification requirements if they hold an approved charter or strategic waiver. If a local educational agency (LEA) chooses to waive certification, it must establish or define PQs for their teachers, and Georgia school districts are required to report PQs in their annual ESSA plans. In Georgia, PQ requirements apply to all teachers in all LEAs. State educational agencies are required to report teacher qualifications, specifically of those teaching out-of-field (OOF), under the guidelines set forth in ESSA. The Georgia Department of Education (GaDOE) collects data on OOF teachers through state reporting and by cross-referencing certification

records held by the Georgia Professional Standards Commission (GaPSC) (GaDOE, n.d.b).

Georgia's ESSA plan defines OOF teachers as those who are not teaching in their field of certification or in the subject and/or grade level assigned (Woods, 2017). Special education does not allow any OOF teachers, and certification cannot be waived for special education teachers. Based on ESSA and PQ plan guidelines, local school systems are required to notify parents annually when an OOF teacher is teaching students.

Statement of the Problem

This study sought to determine if student achievement was impacted by the type of certification held by teachers. In-field (IF) teachers are those who teach subjects and/or grade levels in the area of their certification, as defined by the GaPSC. By contrast, OOF teachers teach in areas in which they are not certified or hold non-teaching certificates. The researcher calculated the achievement levels of students in classrooms based on the certification type of the teachers and then analyzed the results to determine if the certification type had any relationship to students' achievement scores.

Research on the impact of IF versus OOF certification on student achievement is critical for ensuring that all students in Georgia receive a quality education. According to education rankings by U.S. News & World Report (n.d.), Georgia ranks 31st in pre-kindergarten through 12th-grade education. GaDOE envisions offering a holistic education to every child in the state; however, the impact of OOF teachers on student achievement may inhibit this educational vision. Thus, this study investigated whether student achievement is affected by teacher certification type.

Purpose, Aims, Rationale, and Research Question

The purpose of this research was to determine if teacher certification type impacts student achievement. As noted, in Georgia, teachers are either IF or OOF based on guidelines set forth by either GaPSC or ESSA. According to ESSA guidelines, a teacher is deemed IF if they teach the subject and/or grade level in the area in which they hold a teaching certificate. Under ESSA guidelines, teachers are deemed OOF if they do not teach in their field of certification or in the subject and/or grade level(s) assigned, or, for charter/strategic-waiver districts, if they do not teach in a field in which they hold equivalent content qualifications (GaDOE, n.d.e).

To be considered an IF teacher under GaPSC guidelines, an individual must complete one of the two routes to initial certification: (1) an approved educator preparation program (EPP) or (2) a master's degree if the teacher's bachelor's degree is not in an education field. In-field teachers can pursue certification through traditional or alternative means. A teacher who follows a traditional pathway completes certification requirements and then seeks employment as a teacher, while a teacher following an alternative route completes minimum requirements, attains employment as a teacher, and then completes remaining certification requirements. To become a certified teacher in Georgia, an individual must complete a GaPSC-approved or accepted EPP as well as other requirements. Initial educator certification programs fall into three categories: (1) bachelor's degree programs, (2) advanced degree programs, or (3) certificate-only programs. If an individual chooses the latter alternative pathway to certification, they must complete an EPP. The alternative EPP in most situations is part of the Georgia Teacher Academy for Preparation and Pedagogy (GaTAPP). Another alternative route to

certification involves acquiring a master's degree from a GaPSC-approved institution. After completing the GaTAPP program, the teacher receives a professional certificate from GaPSC, whereupon they can then transition to an IF certificate (GaPSC, 2014b).

However, a teacher may be considered IF under GaPSC rules but OOF under Georgia ESSA guidelines. For example, a teacher holding a non-renewable certificate in special education may meet GaPSC IF requirements but be considered OOF for ESSA reporting purposes in the field of special education (GaDOE, n.d.e). This study relied on Georgia's ESSA definitions of IF and OOF certifications. Additionally, teachers included in this study were identified as IF or OOF, and the measures for determining their effectiveness were student scores on the End of Grade (EOG) and End of Course (EOC) Assessments.

More specifically, this research compared student performance on the Georgia Milestone Assessments (GMAs) (i.e., EOG or EOC) with teacher certification type. The dataset of IF and OOF teachers was combined with student schedule files to identify students taught by IF teachers and students taught by OOF teachers. Once the datasets of teachers and students were identified, the student achievement scores were matched to complete an analysis of student achievement based on teacher certificate type.

Significance of the Research

This research centered on determining if teacher certification type had an impact on student achievement as measured by GMAs. The GaDOE's mission is to offer a holistic education to every child in the state, with a vision of educating Georgia's future by graduating students who are ready to learn, ready to live, and ready to lead. The notion of "ready to learn" applies to all students, who can choose from a variety of avenues to

success such as traditional colleges and universities, technical schools, apprenticeship programs, and military service. Under ESSA guidelines, “ready to learn” allows educational professionals to personalize learning by setting challenging goals and providing feedback and supports so every student in Georgia schools can reach their full potential. “Ready to live” implies that a high-quality education is expected to provide learning opportunities, tools, and knowledge necessary for students to experience a high quality of life as they learn and grow into adulthood. “Ready to lead” focuses on teaching students in Georgia how to think critically, communicate and collaborate well with others, present themselves in a professional manner, act ethically, and develop and carry out a vision (GaDOE, 2019b).

The GaDOE 2020–2024 strategic plan focuses on several goals that are relevant to ensuring that every student receives a high-quality and holistic public education.

Figure 1 illustrates the plan’s strategic goals.

COHERENT INSTRUCTION	
1	Revise/develop and implement viable academic standards that engage learners with essential knowledge, skills, and enduring concepts.
2	Increase the percentage of K–5 students with a strong knowledge of foundational skills and concepts.
3	Increase the percentage of high school students who graduate ready for enrollment, employment, or enlistment.
WHOLE CHILD FOCUS	
4	Expand educational opportunities and non-academic supports in order to maximize student engagement, meet student needs/interests, and ensure the relevance of learning.
PROFESSIONAL CAPACITY & EFFECTIVE LEADERSHIP	
5	Elevate districts, schools, leaders, and educators through high-quality, tiered, and tailored service and support.
SUPPORTIVE LEARNING ENVIRONMENT	
6	Foster a safe, healthy, and positive learning climate in every school.
FAMILY & COMMUNITY ENGAGEMENT	
7	Engage in effective communication and meaningful stakeholder input/feedback to strengthen the perception of public education and to inform decision-making.

Figure 1. *Georgia Department of Education 2020–2024 Strategic Goals.* Source: GaDOE (2019b, p. 12).

The Georgia Department of Education Vision 2020 document articulated the following goals relevant to a quality education and, indirectly, the distinction between IF and OOF teaching outcomes:

1. Every child will have access to Georgia-owned and Georgia-grown standards, and teachers will have access to high-quality instructional resources and support.
2. Every child in Georgia will be on a path to being proficient in reading by third grade and being proficient in math by fifth grade.

3. Georgia will exceed the national average graduation rate by 2020.
4. Every child in Georgia will earn college and/or career credit before they graduate from high school.
5. The number of high-stakes tests will be reduced to the federal minimum, while support for diagnostic tools in all core content areas will be provided.
6. Every child in Georgia will have access to computer science and fine arts learning opportunities.
7. Every teacher and leader in Georgia will have access to high-quality, relevant, and personalized professional learning.
8. The number of Georgia districts that meet or exceed the goals of their performance contracts through innovative practices, academic growth, and stakeholder engagement will be increased. (GaDOE, n.d.c)

However, these goals may be difficult to reach if Georgia continues to increase the number of OOF teachers, especially if the data indicate that the latter are less effective than IF teachers. Indeed, teacher certification may have an impact on student achievement and, by extension, on meeting the goals of GaDOE Vision 2020—which has not been updated to outline Georgia’s education goals and objectives for the next 10 years.

Teachers who are certified to teach in a specific field, subject, and/or grade level have successfully completed an approved course of study, typically through an accredited college or university. Program completion leads to the issuance of a teaching certificate by an authorized certification agency—GaPSC in Georgia. Teachers issued an IF certification hold a “standardized base-level of professional knowledge and skills for the

educators working in public schools” (GaPSC, 2014a). Alternatively, a teacher without IF certification may hold an IF certificate but carry a teaching assignment that does not match the field of certification, thus causing them to be labeled as OOF. Teachers holding a provisional, non-renewable, or supplemental induction certificate are considered OOF under both ESSA and GaPSC. Provisional certificates are issued to individuals who are transitioning into education from another career field and to those who meet entry requirements and are hired to teach in Georgia before completing an educator preparation program. A non-renewable certificate may be issued by the GaPSC on a 1-year or 3-year basis. The 1-year non-renewable certificate is issued to:

- Georgia educators who do not meet renewal requirements;
- out-of-state educators who hold or held a professional out-of-state teaching certificate and have a minimum of 3 years teaching experience but have not met Georgia content testing requirements;
- out-of-state educators who hold or held a professional out-of-state service certificate but have not met Georgia content testing requirements; or
- out-of-state educators who have completed an approved out-of-state service field program but have not met Georgia content testing requirements. (GaPSC, 2019c)

The 3-year non-renewable certificate is issued to:

- Georgia educators who hold a valid renewable professional certificate in any field but are assigned to teach in a field in which they do not meet certification requirements;

- individuals who have not met certain requirements for renewable professional certification in a service field, excluding curriculum and instruction, instructional technology, and teacher leadership; or
- individuals assigned to work in a leadership position while completing a GaPSC Tier I or Tier II certification program in educational leadership.
(GaPSC, 2019c)

Supplemental induction certificates are issued to educators who hold a valid induction certificate according to either of the following criteria:

- the educator is assigned to work in an endorsement field not covered by their base certificate field; or
- the educator is assigned to work in a teaching field not covered by their base certificate field. (GaPSC, 2019c)

Additionally, teachers who are hired based on a professional qualification plan are considered OOF under ESSA but IF under GaPSC guidelines. A PQ plan is required for all Georgia districts with an approved charter or strategic-waiver application. The PQ plan reports information on the qualification requirements of teachers, including those who are OOF. The following information is required in PQ plans:

- the school district's intent to waive certification;
- the school district's recipients to be waived for all teachers or for a specific group of teachers;
- minimum qualifications—that is, the minimum professional qualifications required for employment of teachers for whom certification is waived (e.g., bachelor's degree, content assessment, coursework, field experience, etc.).

- a detailed description of the waived subject that includes the following information:
 - subject being waived;
 - education requirements of the teacher(s);
 - experience requirements of the teacher(s);
 - licensure or certification requirements of the teacher(s);
 - testing requirements; and
 - other requirements. (GaDOE, n.d.e)

Conclusion

Based on Georgia's ESSA Plan teachers are divided into two categories based on certification type: in-field or out-of-field. Teachers were categorized as IF teachers if the teacher was teaching the subject/grade level in which they held certification; where as OOF teachers are defined as teachers of subjects/grade levels in which they did not hold certification or if they held non-teaching certificates/degrees. This research was conducted in an effort to determine if student achievement is affected by teacher certification type.

Chapter II

Literature Review

The purpose of this study was to evaluate whether teacher certification had an impact on student achievement. This chapter describes the Every Student Succeeds Act and its impact on teacher certification requirements. The chapter also explores the Georgia Milestone Assessment System and the various routes to teacher certification in Georgia, and reviews earlier research on this topic. Previous studies have examined teacher certification as a determinant for student outcomes, teacher quality based on certification type, challenges of producing effective teachers, and the challenges associated with teaching out-of-field.

Every Student Succeeds Act

President Obama signed the Every Student Succeeds Act on December 10, 2015, replacing the No Child Left Behind Act. Among its key purposes, ESSA:

- advances equity by upholding critical protections for America’s disadvantaged and high-need students;
- requires that all students in the United States be taught to high academic standards that will prepare them to succeed in college and in careers;
- ensures that vital information is provided to educators, families, students, and communities through annual statewide assessments that measure students’ progress toward the high standards;
- helps support evidence-based and place-based interventions; and

- maintains an expectation that there will be accountability and action to effect positive change in the lowest-performing schools. (Baskin, 2019)

The responsibility for and authority over school performance and accountability were shifted from the federal to the state level by ESSA, under which each state is expected to develop a plan approved by its state department of education that addresses mandated standardized testing, an accountability system, and strategies for improving low-performing schools (USDOE, n.d.). Additional authority over and flexibility within each state's education system were restored under ESSA, while the oversight of the U.S. Secretary of Education and the USDOE more generally were scaled back (Woods, 2017). Each state is now responsible for drafting an ESSA plan and submitting it to the USDOE for approval.

The GaDOE's (n.d.e) *Every Student Succeeds Act (ESSA) Professional Qualifications & In-Field Implementation Guide* states that ESSA IF equivalents include degree, coursework, state-approved assessment, or career technical agricultural education (CTAE) credentials. For a teacher to be deemed IF based on the degree requirement, they must hold a bachelor's degree or higher from an accredited, GaPSC-accepted higher education institution in the subject area assigned. To meet the IF coursework requirement, the teacher must have earned a minimum of 21 semester, or 35 quarter, hours in the subject area assigned. In addition, an IF teacher must earn a passing score on a GaPSC-accepted content-area test in the grade level and/or subject area assigned. The state-approved content assessment for Georgia is the Georgia Assessment for Certification of Educators (GACE). The final requirement for obtaining IF teaching status

is that the teacher hold CTAE-equivalent credentials, determined in consultation with Title I Committee of Practitioners, GaPSC, and GaDOE CTAE staff (GaDOE, 2019b).

Georgia Milestone Assessments

The Georgia Milestones Assessment System is a comprehensive summative assessment program that covers Grade 3 through high school. The GMAs measure the knowledge and skills students have acquired during the school year. The Georgia Milestones for the SY 2017 through SY 2019 were tied to the state-adopted content standards in English language arts, mathematics, science, and social studies. Students enrolled in Grades 3 through 8 during the 2017, 2018, and 2019 school years were assessed using an End of Grade (EOG) assessment in English language arts and mathematics, while, during that same period, students in Grades 5 and 8 were also assessed in science and social studies. High school students take End of Course (EOC) assessments in Ninth-Grade Literature and Composition, American Literature and Composition, Coordinate Algebra, Analytic Geometry, Biology, Physical Science, U.S. History, and Economics/Business/Free Enterprise. Features of the GMA System include:

- open-ended items in English language arts and mathematics;
- a writing component at every grade level and course within the English language arts assessment;
- norm-referenced items in all content areas and courses;
- technology-enhanced items, including multiple part/multiple answer, graphing, and drag-and-drop options; and

- online administration, considered the primary mode of administration, with paper-pencil administration as a backup for students with disabilities who have accommodations identified in their IEP. (GaDOE, 2019c)

The purpose of the GMAs is to provide information about how well students are mastering the state-adopted content standards in the core content areas of English language arts, mathematics, science, and social studies. Georgia Milestones are designed to provide students, parents, teachers, administrators, and other stakeholders with critical information related to a student's performance, achievement, and readiness for the next level of learning, whether the next grade level, next course, or postsecondary endeavor such as college or career (GaDOE, 2019c).

The GMAs were designed and developed by the State of Georgia, resulting in a reduction in the number of state-mandated assessments. Prior to the GMA System, students in Georgia completed the Criterion-Referenced Competency Test, EOC assessments, and the Georgia Writing Assessments. Advantages of the GMAs include the following:

- the assessments use open-ended test items in English language arts and mathematics, which allows students to explain their answers;
- the writing portion of the ELA assessments provides students with the opportunity to demonstrate their depth of understanding related to the standards being assessed; and
- the assessment results comprise four levels instead of three, offering a more precise indication of student achievement.

The GMA System provides an accurate view of how students throughout the state are performing and where instruction may need to shift to ensure that all students succeed and can compete with their peers nationally (GaDOE, n.d.d).

End of Grade Milestone Assessments

End of Grade Milestone Assessments are administered to all students in Grades 3 through 8 in ELA and mathematics. Students in Grades 5 and 8 also receive an EOG Milestone Assessment in science and social studies. The purpose of the EOG assessments—which are administered at the end of the school year during the state-designated testing window—is to measure student achievement on the state-adopted content standards. Ideally, the results of the EOG assessment are utilized to improve teaching and learning. After completing the EOG assessments, students receive individualized score reports that provide suggestions for how students can prepare for the next grade level (GaDOE, n.d.b).

The EOG assessment results are reported to schools, districts, and students within 5 days of the closing of the testing window. The released results are reported by scale scores, achievement levels, domain scores, and national percentile range scores. The achievement-level results describe how well students have learned the information related to the content standards in the subject being tested. Results fall under four achievement levels for all subject tests within the EOG assessment: Beginning Learner, Developing Learner, Proficient Learner, and Distinguished Learner. The achievement levels are defined as follows:

- **Beginning Learner:** The student does not yet demonstrate proficiency in the knowledge and skills necessary. Students scoring in the Beginning Learner

level will need substantial academic support to be prepared for the next grade level.

- **Developing Learner:** The student demonstrates partial proficiency in the skills and knowledge necessary at the current grade level. Students who score in the Developing Learner level will need additional academic support to ensure success in the next grade level.
- **Proficient Learner:** The student demonstrates the necessary skills and knowledge at the current grade level. These students are ready to be promoted to the next grade level.
- **Distinguished Learner:** The student demonstrates advanced levels of proficiency in the knowledge and skills necessary at the current grade level. These students are well prepared for the next grade level.

The GaDOE outlines more detailed and content-specific concepts and skills for each grade level, content area, and course. Known as achievement-level descriptors, these concepts are based on the state-adopted content standards and comprise narrative descriptions of the knowledge and skills expected at each of the four achievement levels for the EOG assessments (GaDOE, n.d.b). Appendix A details the EOG/EOC Milestone achievement-level descriptors.

Students in Grade 3 must earn a designation of at or above grade level on the reading section of the EOG English language arts assessments to be promoted to fourth grade. Students in Grades 5 and 8 must earn a designation of at or above grade level on the reading section of the EOG ELA assessments and must also score Developing Learner or higher on the mathematics portion of the EOG assessment to be promoted to

the next grade level. The GaDOE website lists achievement-level descriptors for each content area and grade level (GaDOE, 2019c).

End of Course Milestone Assessments

Prior to SY 2021, the End of Course (EOC) Milestone Assessments were administered to students enrolled in the following courses:

- English language arts
 - Ninth-Grade Literature and Composition
 - American Literature and Composition
- Mathematics
 - Coordinate Algebra or Algebra I
 - Analytic Geometry or Geometry
- Science
 - Biology
 - Physical Science
- Social studies
 - U.S. History
 - Economics/Business/Free Enterprise

The EOC Milestone Assessments are administered at the completion of each course.

State law mandates that the EOC Milestone Assessment serve as the final exam in the course, and it must count for 20% of the student's final course grade. After the student completes the EOC assessment, the school, district, and student receive a score report for the assessment completed (GaDOE, 2019c). Dual enrollment is an option made available to students in Grades 9 through 12, allowing them to enroll in and complete coursework

at a college, university, or technical school while still in high school. These students will earn high school and college credit for the courses completed during their dual enrollment. Dual-enrollment students are exempt from the EOC assessments in the following courses: American Literature and Composition, Physical Science, U.S. History, and Economics. Dual-enrollment students in these courses utilize the final grade in the college course as the EOC score for College and Career Ready Performance Index (CCRPI) calculations.

The assessment reports contain scale scores, achievement levels, domain category scores, and grade conversion scores. The ELA assessments also contain Lexile scores and reading-level scores. The achievement level is based on the student's scale score, and the achievement-level scores are broken into four levels: Beginning Learner, Developing Learner, Proficient Learner, and Distinguished Learner. Achievement levels describe the student's mastery and command of the knowledge and skills outlined in Georgia's content standards. Achievement levels give meaning and context to scale scores by describing the knowledge and skills students must demonstrate to achieve at each level. The definitions of the four achievement levels for the EOC Milestone Assessments are as follows:

- **Beginning Learner:** The student does not yet demonstrate proficiency in the knowledge and skills necessary in the specified course. Students scoring in the Beginning Learner level will need substantial academic support to be prepared for the next course and to be on track for college/career readiness.
- **Developing Learner:** The student demonstrates partial proficiency in the skills and knowledge necessary in the current course. Students who score in the

Developing Learner level will need additional academic support to ensure success in the next course and to be on track for college/career readiness.

- Proficient Learner: The student demonstrates the necessary skills and knowledge in the current course. These students are prepared for the next course and are on track for college/career readiness.
- Distinguished Learner: The student demonstrates advanced levels of proficiency in the knowledge and skills necessary in the current course. These students are well prepared for the next course and are well prepared for college/career.

The GMA System website provides more detailed and content-specific concepts and skills for each of the 10 EOC Milestone Assessments through achievement-level descriptors, which are narrative descriptions of the knowledge and skills expected at each of the four achievement levels (GaDOE, n.d.a).

As stated previously, Georgia's EOC Milestone Assessments serve as the final exam for the 10 EOC courses, and the assessment results contribute to 20% of a student's final course grade. The EOC assessment score reports contain a grade conversion score that teachers are required to use as the final exam score in each corresponding course. The grade conversion score is a two-digit scale score that functions as a percent-correct measure. The EOC assessments provide objective data indicating student mastery that may be used to determine how effective the teacher was at delivering the course material (GaDOE, n.d.a).

Teacher Certification in Georgia

Teacher certification in Georgia is handled by GaPSC, which adopted a tiered certification system in July 2014 to offer teachers who remain in the classroom more opportunities for professional growth. The tiered certification structure is designed to improve student learning by recognizing the unique developmental needs of teachers at every career stage and by encouraging and supporting continuous teacher growth. The tiered structure is intended to support new teachers and those who are becoming teachers while establishing a fair and equitable environment for growth for those already in the profession. Four tiers comprise the new system: pre-service, induction, professional, and advanced and lead professional. Certifications such as non-renewable provisional certificates and permits remain outside the tiered certification system (GaPSC, 2019c).

The first tier in the tiered certification structure is the pre-service certificate, which is intended for individuals who are completing field experiences or student teaching in Georgia public schools. The pre-service certificate is requested on behalf of the educator candidate by the college, university, or other institution providing the educator preparation program (EPP). The requirements for the pre-service certificate are as follows:

- admission to an EPP that leads to an induction certificate in a teaching field;
- completion of a successful criminal record check, conducted by the GaPSC;
- and
- completion of the GACE Educator Ethics Assessment—Program Entry.

The pre-service certificate is valid for 5 years and may be extended at the request of the educator preparation provider. Pre-service certificates are invalidated upon program

completion or if the educator candidate withdraws, transfers, or is removed from the program. Notably, the pre-service certificate is not a professional educator certificate; rather, it only allows the educator candidate to participate in supervised field experiences, clinical practices, student teaching, or residency work in Georgia public schools. Holding a pre-service certificate does not automatically lead to an induction educator certificate, and pre-service certificates are not prerequisites for other Georgia certificates (GaPSC, 2019c).

The next certificate in the tiered certification structure is the induction certificate. Induction certificates can be issued as a 5- or 3-year certificate. The 5-year induction certificate requirements for individuals who have completed a GaPSC-accepted EPP in Georgia or individuals who complete a state-approved, out-of-state program and fulfill their field and clinical experiences in Georgia are as follows:

- earn a passing score on the appropriate GACE content assessment;
- earn a passing score on the Georgia Educator Ethics Assessment—Program Exit;
- earn a passing score on the GaPSC-approved content pedagogy assessment;
- and
- score a grade of B or better in the course pertaining to the identification of and education of exceptional children.

Individuals who complete a state-approved, out-of-state EPP and fulfill field and clinical experiences out-of-state must satisfy the following requirements to obtain a 5-year induction certificate:

- complete a state-approved EPP or possess a professional out-of-state educator certificate;
- earn a passing score on the appropriate GACE content assessment;
- earn a passing score on the Georgia Educator Ethics Assessment—Program Exit; and
- score a grade of B or better in the course pertaining to the identification of and education of exceptional children.

If the educator holds an out-of-state certificate and has less than 3 years of successful experience, they must also meet the preceding requirements to obtain a 5-year induction certificate in Georgia (GaPSC, 2019c).

The induction certification tier also includes a 3-year induction certificate. A Georgia public school system may request a 3-year induction certificate for individuals who hold a 5-year induction certificate but are teaching OOF. Individuals who are currently enrolled in a master's degree program or a GaTAPP program can also receive a 3-year induction certification but will be considered OOF under GaPSC guidelines (GaPSC, 2019c).

The third certificate in the tiered certification structure is the professional certificate. To qualify for a professional certificate, the individual must have at least 3 years of experience and hold a clear renewable or professional certificate, either performance-based or standard. The performance-based professional certificate is issued to educators who have been evaluated for a minimum of 3 years within the Teacher Keys Effectiveness System. Leaders eligible for the performance-based professional certificate have completed a Georgia performance-based educational leadership certificate program.

To obtain a performance-based professional certificate in a teaching field, the individual must have at least 3 years of successful experience within the past 5 years. Additionally, all 3 years must have earned a summative performance rating of “proficient” or “exemplary” on the Teacher Assessment on Performance Standards component of the Teacher Keys Effectiveness System. For leaders to obtain a performance-based professional certificate, they must:

- complete a GaPSC-approved performance-based educational leadership program at the specialist or doctoral-degree level;
- earn a passing score on the GACE Educational Leadership Content Assessment;
- earn a passing score on the Performance Assessment for School Leaders; and
- earn a passing score on the Georgia Educator Ethics Assessment —Program Exit. (GaPSC, 2019c)

The standard professional certificate is issued for all service fields as well as for leaders who have not completed a performance-based program and for teachers who do not have 3 years of Teacher Keys Effectiveness System evaluations. To obtain a standard professional certificate in a teaching field, an individual must have a minimum of 3 years of teaching experience. The requirements for a standard professional certificate in a service field vary for each field. The available service fields/positions include curriculum and instruction, instructional technology, media specialist, school counseling, school nutrition director, school psychologist, school social work, speech and language pathology, and teacher leadership. The standard professional educational leadership certificate is issued to individuals who complete a GaPSC-approved Tier I educational

leadership program, qualifying out-of-state educators applying for initial certification in educational leadership, and Georgia educators who completed a GaPSC-approved educational leadership certification program prior to September 30, 2009 (GaPSC, 2019c).

The fourth certificate in the tiered certification structure is the advanced or lead professional certificate, which is designed for classroom teachers who either demonstrate expert classroom practice or are leaders of their peers. The requirements for the advanced professional certificate include: a minimum of 10 years of acceptable educator experience (of which 3 years must have been earned on a Georgia certificate within the past 5 years), meeting the Georgia Standards of Conduct, and one of the following:

- an advanced degree in a teaching field held by the educator beyond the initial preparation program;
- certificate in curriculum and instruction or instructional technology; or
- National Board for Professional Teaching Standards (NBPTS) certification.

The requirements for the lead professional certificate are as follows:

- possessing a valid advanced professional certificate or at least 5 years of acceptable educator experience (of which 3 years must have been earned on a Georgia certificate within the last 5 years).
- receiving a summative performance evaluation with ratings of “satisfactory,” “proficient,” or “exemplary” while holding a Georgia professional teaching certificate, a passing score on the GACE Teacher Leadership Assessment, and one of the following:

- teacher leadership certification;
- advanced degree in a teaching field beyond the initial preparation program and a Teacher Leader, Coaching, or Teacher Support and Coaching Endorsement; or
- NBPTS certification and a Teacher Leader, Coaching, or Teacher Support and Coaching Endorsement. (GaPSC, 2019c)

The provisional certificate is a non-tiered certificate available to prospective educators in Georgia. The provisional certificate is available as part of the alternative route to certification and is for prospective educators who wish to transition into an education career. These individuals meet entry requirements and are hired to teach in a Georgia school before completing an educator preparation program. Requirements for provisional certification are as follows:

- hold a bachelor’s degree or higher from a GaPSC-accredited institution;
- have a grade point average of 2.5 or higher (on a 4.0 scale);
- meet the assessment requirements, which consist of:
 - a program admissions assessment with a passing score or an exempt status;
 - a content GACE score of 220 or higher (GACE Scale Score Range is 100 to 300); and
 - an ethics entry and exit GACE score of 250 or higher.

To obtain the provisional certificate, the candidate must be employed with a Georgia local educational agency (LEA), which is responsible for applying for the provisional certificate for the candidate. Provisional certificates cannot be issued to anyone who has

previously held a non-renewable provisional certificate in another subject area that was not satisfied. Educators awarded a provisional certificate will be considered OOF regardless of the subject being taught or the educator's degrees (GaPSC, 2020b).

GaPSC also issues permits, which are extendable certificates designed for individuals who qualify to teach in specific fields based on a combination of work experience, education, and assessments. Permits may be issued in the following fields:

- foreign languages;
- art, dance, drama, or music;
- JROTC;
- CTAE specializations;
- engineering and technology; and
- healthcare science.

Permit applicants are required to be employed by a Georgia LEA, which is required to work with the permit candidate to create a professional learning plan detailing professional development that will be completed during the 3-year period the permit is valid (GaPSC, 2020a).

Routes to Initial Certification in Georgia

In Georgia, there are two routes to obtain initial teacher certification: traditional and alternative. The traditional route involves obtaining a bachelor's degree in education through an GaPSC-accredited institution. Alternative certification is gained two possible pathways: a master's in teaching or the GaTAPP. GaTAPP is designed for individuals who wish to transition into teaching from another career path, did not complete a teacher

education program, and have never held a professional teaching certificate (GaPSC, 2019a).

For an individual pursuing the traditional route, it is important to ensure that the chosen bachelor's degree program leads to initial educator certification. The steps for obtaining a teaching certificate in Georgia via the traditional route are as follows:

- Step 1: Identify a grade level
 - Traditional teaching certificates are divided into the following grade or age groups:
 - Birth through kindergarten
 - Elementary education: Pre-kindergarten through fifth grade
 - Middle grades: Grades 4 through 8
 - Secondary education: Grades 6 through 12
 - P–12: Some certificate fields, such as art, music, drama, dance, health, physical education, and special education, cover all grade levels.
- Step 2: Identify a subject area
 - Elementary education teachers typically teach all subjects (i.e., language arts, mathematics, science, reading, and social studies).
 - Middle and secondary education teachers teach one or more specific subject areas:
 - Middle grades have five subject areas: language arts, mathematics, reading, science, and social studies.

- Secondary education consists of more course-specific subject areas than the elementary or middle grades. (e.g., geography and history rather than the broader field of social studies).
- Special education consists of two possible fields: general curriculum and adapted curriculum:
 - General curriculum is for teachers who will work with students with mild disabilities.
 - Adapted curriculum is for teachers who will work with students with moderate to severe disabilities.
 - Special education teachers who deliver content in specific subject areas are required to meet content assessment requirements in those subject areas.
- CTAE fields differ from the other teaching fields; many are based on a combination of occupational work experiences, industry licensing and assessments, and formal study.
 - CTAE encompasses the following teaching fields:
 - Agriculture
 - Business
 - Career and technical specializations
 - Computer science
 - Engineering and technology
 - Family and consumer sciences

- Healthcare science
 - Marketing
 - Step 3: Explore routes to certification
 - Traditional: completing certification requirements and then seeking employment as a teacher.
 - Alternative: meeting minimum requirements, attaining employment as a teacher, and completing certification requirements while teaching.
- (GaPSC, 2019b)

The traditional pathway to certification requires enrollment in a college or university certificate program prior to seeking employment as a teacher. Initial educator certification programs fall into three categories: bachelor's degree programs, advanced degree programs, and certification-only programs. The minimum requirement for all Georgia professional teaching certificates, with the exception of certain CTAE fields, is a bachelor's degree. The first step toward a traditional Georgia professional teaching certificate is to complete a traditional EPP that leads to a bachelor's degree and initial teaching certification from a GaPSC-approved institution (GaPSC, 2019b).

The second category of initial educator certification is the advanced degree program, which allows individuals who already hold a bachelor's degree to pursue a master's degree while completing an educator preparation program. At the master's level, most of the initial certification programs lead to a Master of Arts in Teaching or a Master of Education. If pursuing initial certification through the advanced degree program, it is important to ensure that the program leads to initial educator certification and is approved by the GaPSC. If an educator is obtaining initial certification through an advanced degree

program, it is possible for the educator to teach for up to 3 years while completing the master's degree program (GaPSC, 2019b).

The third category of traditional initial educator certification is the certification-only program. To be considered for certification only, the educator must have earned a bachelor's degree in a certificate-only program from a GaPSC-approved college or university. Certification-only programs typically allow future educators to complete the coursework necessary for obtaining certification and often include fewer courses and requirements than a master's degree program (GaPSC, 2019b).

The alternative pathway to certification is for prospective educators who already have a bachelor's degree in a non-educational field. To be considered for this alternative certification, the candidate must qualify for a provisional certificate. The qualifications for a provisional certificate in a teaching field include:

- a bachelor's degree or higher (if the highest degree is a bachelor's degree and was earned less than 10 years prior to the time of application, the minimum overall GPA is 2.5);
- a passing score on the GACE Program Admission Assessment;
- a passing score on the appropriate GACE content assessment; and
- a passing score on the Georgia Educator Ethics Assessment.

The provisional certificate is a 3-year, non-renewable certificate that allows the educator to teach while completing a certification program. The certificate programs available for the alternative pathway to certification include either a traditional certification-only degree program, a master's degree program, or the GaTAPP program. To qualify for an alternative program, the teacher must be hired as an educator by a local educational

agency in Georgia and meet all the qualifications for the provisional certificate. After meeting these requirements, the educator may then apply for admission to the GaTAPP or another alternative program that works with the LEA. Once the educator completes the program and meets the certification requirements, they can then convert the provisional certificate to an induction or professional certificate (GaPSC, 2019b).

The GaTAPP program is for individuals transitioning into the teaching field who have not completed a teacher education program, and who have never held a professional teaching certificate. To be considered for GaTAPP, the candidate must meet the following requirements:

- have a major or its equivalent in the teaching field or a passing score on the GACE content assessment;
- be employed by a regionally accredited LEA or an approved charter school, accepted into a GaPSC-approved EPP with an intense induction component;
- hold a Georgia provisional certificate or permit; and
- have intense and ongoing coaching and support throughout the program.

The timeline for completing GaTAPP is typically one academic school year. Candidates in the GaTAPP program who are elementary education or special education candidates will require instruction due to the lack of an equivalent degree/major outside the school of education. The framework for the GaTAPP program is as follows:

- candidate support team trained in coaching standards and GaTAPP assessments;
- school-based administrator;
- school-based mentor;

- provider supervisor;
- content specialist;
- individualized based on candidate performance assessment data; and
- job-embedded clinical practice.

The goal of the GaTAPP program is to equip teaching candidates with the necessary skills for initial success in classrooms through concentrated training opportunities. Such training, coupled with quality, on-the-job learning supported by supervisors, mentors, and administrators, establishes an induction program that will nurture teacher candidates' growth (GaPSC, 2019a).

Teacher Certification as a Determinant of Student Outcomes

Teacher certification is based on the type of preparatory education the individual received, whether through a state-approved program associated with a school of education or a degree in a non-educational field. Individuals who become teachers based on a degree from a non-educational field are often referred to as “teachers with emergency credentials,” “non-certified teachers,” or “provisional teachers.” The determination of the certificate type is based on individual state licensure requirements. However, according to Goldhaber and Brewer (2000), there is no guarantee that the requirements for entering teaching are linked to student performance. Very little research has been conducted on the effectiveness of the teacher licensure system and how it relates to student outcomes. The argument is not whether teachers should be fully qualified but, rather, whether conventional routes to licensure are more likely to better prepare teachers.

Licensure is designed to guarantee that a teacher possesses a minimum level of quality or skill in the classroom. Each state has several mechanisms that require

prospective teachers to pass standardized tests or hold a minimum GPA prior to entering a teacher education program. Yet, passing scores on standardized tests or specific GPAs within teacher education programs do not always indicate high performance or the overall effectiveness of a prospective teacher.

Goldhaber and Brewer (2000) found that the type of certification held by a teacher is an important determinant of student outcomes—a result that pertains to teachers who are out-of-field or hold no certificate. The researchers found that students who were taught by teachers with an emergency certificate performed no worse than students taught by those holding traditional certificates. These findings suggest that there is no evidence that teachers with standard certification outperform those with emergency credentials.

Out-of-Field Teaching

Scholars and practitioners have long debated teacher quality as it pertains to elementary and secondary education. Teacher quality is a crucial component for ensuring that students in the United States receive a quality education. Highly qualified teachers may lose their highly qualified status if they are assigned to subjects in which they have no background, education, or training. Moreover, teachers deemed not highly qualified may have a negative impact on student achievement. According to Ingersoll (2000), there has been little to no recognition of this problem at the national level due to an absence of accurate data. Part of the data problem is a lack of consensus around how to define a qualified teacher. There is, however, universal agreement that student learning is affected by teacher qualifications; the disagreement stems from concerns about how much and

which types of education and training teachers should receive and what credentials states should require (Ingersoll, 2000).

Ingersoll (2000) stated that one of the sources of OOF teaching is related to assumptions that OOF teaching is a result of poorly educated teachers. Ingersoll believes that this problem could be remedied by more rigorous standards for teacher education and training. More specifically, this viewpoint assumes that the source of the problem is a lack of academic coursework. However, Ingersoll (2000) collected data showing that an increase in OOF teaching correlates with a lack of fit between teachers' fields of training and their teaching assignments. A second explanation blames the teacher shortage for the increase in OOF teaching. This argument holds that an increase in student enrollment and an aging teacher workforce has caused the shortfall in the number of teachers available. Many school systems have lowered standards to fill teaching openings, thus leading to more OOF teachers (Ingersoll, 2000).

Ingersoll (2000) suggested that the source of OOF teaching is the way school leaders manage and assign teachers rather than deficits in teacher qualifications or the quantity of teachers. Based on data reviewed, Ingersoll noted that the allocation of teaching assignments is the decision of the building-level administration. Oftentimes, school-level administrators find that assigning OOF teachers is more convenient, less expensive, and less time-consuming than the alternatives (Ingersoll, 2000). As Ingersoll's research on OOF teaching suggested, decreasing OOF teaching will require more than simply recruiting and training able candidates. Rather, the way to resolve issues around OOF teaching is to better understand how teachers are managed once on the job.

Teacher Impact on Student Achievement

Teacher quality is a concept promoted at the local, state, and federal levels. Standardized test scores measuring teacher quality have confirmed that some teachers are more effective than others (Opper, 2019). Indeed, effective teachers are critical to optimal student learning. According to Opper (2019), teachers matter more to student achievement than any other school-related factor, including individual characteristics, family, neighborhood, and socioeconomic status, to name only a few. As Opper argued, a teacher has two to three times more student impact than any other school-related influence.

The non-school factors that affect student achievement are largely outside a school's control. Opper (2019) stated, "Effective teachers are best identified by their performance not by their experience, license, or background" (p. 1). That is, the best way to measure a teacher's effectiveness is to focus on their on-the-job performance, including what they do in the classroom and how much progress their students make on achievement tests (Opper, 2019).

Effect of Certification and Preparation on Teacher Quality

The USDOE regulates the teaching profession through teaching certification programs. As discussed earlier, the pathway to becoming a teacher is either traditional or alternative. According to Boyd et al. (2007), the traditional approach involves school districts in the United States hiring graduates of teacher preparation programs operated by schools of education within U.S. colleges and universities. This route to teacher certification is the most common. However, urban and rural schools are often forced to hire uncertified teachers due to limited teacher availability from colleges and university

systems; consequently, these uncertified teachers become concentrated in schools with the lowest performing students (Boyd et al., 2007).

Typically, traditional teacher preparation programs represent the primary source of teachers. These programs are shaped by a combination of state regulations, the criteria of accreditation groups, and choices made by individual programs and institutions. Individuals who complete traditional teacher preparation programs only need to pass the required certification exams to become licensed. Most traditional teacher preparation programs devote significant resources to teaching pedagogy.

Pedagogy is defined as the art, science, or profession of teaching (“Pedagogy,” n.d.) and includes knowledge of instructional methods, learning theories, measurement and testing, and classroom management (Boyd et al., 2007). Resources devoted to teaching pedagogy include teaching the skills that enable teachers to structure material and communicate it to students (Boyd et al., 2007). However, effectively, pedagogy narrows down to teaching methods, such as teaching styles, feedback, and assessment. Educational pedagogy can center on either teacher or student learning. Teacher-centered pedagogy focuses on the teacher providing direct instruction—that is, the knowledge the teacher possess and the knowledge they pass to the students. In teacher-centered learning, student learning is measured through tests and assessments. In student-centered learning, teachers and students participate equally in the learning process; the teacher’s role is to coach and facilitate student learning. Student learning is measured through assessments, group projects, portfolios, and class participation (Cross, 2019).

Educational pedagogy also focuses on students’ learning styles. Educators rely on many theories to determine how each student learns best, yet one of the most widely used

is Gardner's theory of multiple intelligences. According to Gardner (as cited in Cross, 2019), there are eight types of student learners:

- Visual-spatial: These learners are good at puzzles, maps, and directions.
- Linguistic-verbal: These learners are good with words, both spoken and written.
- Intrapersonal: These learners are very reflective and self-evaluative.
- Logical-mathematical: These learners are good with numbers and problem solving.
- Musical: These learners have a talent for rhythm and music.
- Bodily-kinesthetic: These learners are very hands-on and have great hand-eye coordination.
- Naturalistic: These learners are in tune with nature and their environment.

Another prominent pedagogical approach to learning styles is Fleming's visual, aural, reading/writing, and kinesthetic—or VARK—theory. Visual learners learn best by watching someone else complete a task then attempting it themselves, and they function best when referring to charts, graphs, and diagrams. Aural learners learn best through lectures; they need to hear the material and process it. Reading/writing learners learn best by reading the material and taking notes. Kinesthetic learners learn best by trying a task for themselves. The idea behind learning style theory is that no two students learn in exactly the same way. Because each student learns differently, it is the teacher's responsibility to adjust lessons and modes of learning to best meet the needs of all students in their classroom (Cross, 2019).

Cross (2019) maintained that there are five pedagogical approaches to teaching, which can be utilized individually or in conjunction with one another:

- Constructivist approach: Students/learners are actively involved in the learning process.
- Collaborative approach: Multiple students/learners work together to learn the material.
- Inquiry-based approach: The learning is problem based.
- Integrative approach: The learning involves multiple academic disciplines.
- Reflective approach: The teacher reflects on lessons, projects, and assessments to improve them in the future.

Implementing one or more of these pedagogical approaches benefits both students and teachers (Cross, 2019). Pedagogical principles and approaches are taught in traditional teacher preparation programs. However, many OOF teachers miss such pedagogical training because it is not included in alternative routes to certification.

Alternative certification routes allow teachers to enter the classroom by postponing or bypassing many of the criteria of traditional teacher preparation programs. States that allow alternative routes to certification require teachers to hold a bachelor's degree or higher and to demonstrate subject-matter knowledge by completing coursework or passing an exam, or both. Some states and school districts rely heavily on alternative routes as a teacher supply source (Boyd et al., 2007).

Yet, how does one's route to becoming a teacher affect student achievement? According to Boyd et al. (2007), there is insufficient evidence that the certification pathway impacts student achievement. However, the authors did find that highly selective

alternative programs can produce effective teachers who perform about the same as teachers from the traditional certification programs after two years on the job.

Teacher Credentials and Student Achievement

Researchers and policymakers alike agree that teacher quality matters for student achievement. The problem lies with *measuring* teacher quality. One of the most intense debates in education centers on the effect of specific teacher credentials on student achievement. Clotfelter et al.'s (2007) study of teacher credentials and student achievement found clear evidence that teachers with more experience are more effective than those with less experience. They also found that teacher licensure matters: Teachers with provisional or emergency licenses exhibited a statistically significant negative average effect on student achievement. The study results also indicated that teachers with reduced coursework prior to entry often exhibited smaller initial gains than those of other teachers (Clotfelter et al., 2007).

Impact of Teachers on Student Achievement

In 2006, Glazerman et al. studied the impact of an alternative teacher preparation program—Teach For America (TFA)—on student achievement outcomes. Founded in 1989, TFA addresses the educational inequities faced by children in low-income communities by expanding the teacher candidate pool within those communities. The program was designed to attract high academic achievers who do not necessarily follow the traditional route to teaching kindergarten through 12th grade. The TFA program is considered a nontraditional or alternative route to becoming a teacher (Glazerman et al., 2006).

Glazerman et al. (2006) investigated the impact of TFA teachers on student achievement by comparing the achievement of students instructed by TFA teachers with those taught by “control teachers.” The TFA teachers entered the teaching field through the TFA program, while the control teachers entered the field through traditional routes. The study included teachers from the following geographic regions of the United States: Baltimore, Chicago, Los Angeles, Houston, New Orleans, and the Mississippi Delta. The student achievement-level data were collected in the fall (pre-test) and the spring (post-test) utilizing an abbreviated form of the math and reading subtests of the Iowa Test of Basic Skills (ITBS). Teacher participants were also surveyed to measure personal characteristics, teacher preparation, teacher experience, career expectations, professional development, teaching practices, and student behavior (Glazerman et al., 2006).

Glazerman et al. (2006) found that the TFA teachers had a positive impact on their students’ math achievement; however, they did not have an impact on students’ reading achievement. The study also concluded that TFA teachers were more likely to report problems related to student disruptions and physical conflicts than teachers who held a traditional teaching certificate. Based on the results, the researchers concluded that the positive impacts of TFA teachers on achievement scores should not be considered as evidence that traditional teacher preparation programs are inferior to TFA programs (Glazerman et al., 2006).

The Challenge of Providing Effective Teachers for All Children

According to Murnane and Steele (2007), the most urgent problem facing U.S. education is the unequal distribution of high-quality teachers. Poor children and children of color are disproportionately taught by teachers with the least amount of preparation

and the weakest academic backgrounds. The authors focused on the labor market as the source of effective teachers, whom they define as those who are skilled at raising the achievement levels of their students (Murnane & Steele, 2007).

Murnane and Steele (2007) also noted that the demand for teachers has not been affected by the technological changes reshaping the larger economy. Public school enrollments in the United States are on the rise, driven by immigration and a greater number of births. The numbers of children of color and children living in poverty are also increasing. Another impact of teacher demand is class size, or the ratio of students to teachers. Many states are lowering class sizes to improve the quality of education (Murnane & Steele, 2007).

Murnane and Steele (2007) described several policies that have been proposed to increase the supply of effective teachers, including increasing teacher salaries, reducing barriers to entry, and making teacher compensation more flexible. The rationale for increasing salaries is that doing so will draw reserve-pool teachers into classrooms and make the profession more attractive to young people. Yet, the downside to across-the-board salary increases is the likelihood that they will also increase the number of ineffective teachers. Salary increases will only improve the teaching force if schools make wise decisions about who is hired and retained. Another proposal with the goal of increasing the number of individuals who are willing and able to teach at current salary levels is to reduce the restrictions on who is allowed to teach in the classroom. According to Murnane and Steele, in 2005, 47 states offered some form of alternative route to certification, thus allowing individuals to obtain a teaching license quickly and with minimal preparation and expense. Research has indicated that individuals entering the

profession through alternative routes are as effective as those entering through traditional routes. Moreover, alternative routes are more effective than traditional routes at recruiting minority teachers. A third response to the teacher challenge has been to replace the uniform salary schedule with one that rewards only academic degrees and years of experience with more flexible pay structures (e.g., performance or merit pay). In this type of system, teachers' compensation is based on their effectiveness at raising student achievement (Murnane & Steele, 2007).

Murnane and Steele (2007) concluded that it is more important than ever to recruit and retain high-quality teachers. The demand for quality teachers is increasing based on rising enrollment numbers, smaller class sizes, and rapid retirement among the current workforce. The unequal distribution of effective teachers is the most urgent problem facing U.S. education (Murnane & Steele, 2007).

The Challenge of Out-of-Field Teaching

Teacher quality at the elementary and secondary levels has remained a central topic of debate and discussion over the past decade. To meet the demand for quality teachers, many states have adopted tougher licensing standards for teachers and more rigorous academic requirements for teaching candidates. Additionally, many states have launched initiatives and programs to recruit new candidates into the teaching field, including alternative certification programs to entice mid-career professionals from other fields to become teachers (Ingersoll, 1998).

One of the most important issues facing schools today is the staffing of qualified teachers. Many reforms over the past decade have sought to place a qualified teacher in every classroom in the United States. Yet, many of these reforms have fallen short, in

part, because of the lack of data around the subject matter of IF teaching versus OOF teaching (Ingersoll, 1998).

Out-of-field teaching varies greatly across schools, teachers, and classrooms. For example, recently hired teachers are more often assigned to teach subjects out of their field of training than are more experienced teachers. Low-income public schools typically have higher numbers of OOF teachers than schools in more affluent communities. Smaller schools typically have higher numbers of OOF teachers than medium-sized to large schools (Ingersoll, 1998).

Ingersoll (1998) discussed that one of the causes of OOF teaching is an assumption that OOF teachers are poorly educated teachers, and that the problem could be resolved through implementing more rigorous standards for teacher education and training. However, as Ingersoll (1998) noted, “The truth is that almost all teachers in the United States have completed a college education and half of them have graduate degrees. Moreover, ninety-four percent of public school teachers hold regular state-approved teaching certificates” (p. 775). The source of OOF teaching lies in the lack of fit between teachers’ fields of training and their teaching assignments; that is, many teachers are assigned to teach classes that do not match their area of education or training (Ingersoll, 1998).

According to Ingersoll (1998), the implications for reform are clear: The way to ensure qualified teachers in every U.S. classroom is to upgrade the job of teaching. Well-paid and well-respected occupations that offer favorable working conditions rarely have difficulty recruiting and retaining employees. If teaching were treated as a highly valued

profession, one requiring expertise and skill in a specialty, there would be no difficulty attracting and retaining more than enough excellent teachers (Ingersoll, 1998).

Conclusion

The literature review presented in this chapter provided background on the changes in teacher certification requirements with the passage of ESSA, which replaced NCLB. The literature review also detailed teacher certifications available in Georgia and the processes for obtaining the various certificates. As shown, previous studies pertaining to the correlation between teacher certification type and student achievement are limited. This study sought to fill this gap by determining whether—and to what extent—such a relationship between teacher certification type and student achievement exists.

Chapter III

Methodology

This purpose of this study was to assess whether teacher certification type had an impact on student achievement. To address the primary research question—Does teacher certification type have an impact on student achievement?—the researcher proposed the following hypotheses:

- Hypothesis: Students taught by teachers with out-of-field certification will have lower achievement-level scores on Georgia Milestone Assessments than students taught by teachers with in-field certification.
- Null hypothesis: There is no association between teacher certification type and student achievement levels on GMAs.
- Alternate hypothesis: There is an association between teacher certification type and student achievement levels on GMAs.

This chapter details the study's methodology, including an overview of the research design, data utilized for the study, statistical analysis, and the analytic procedures. The study adopted a quantitative approach, with the statistical analysis employing the chi-square test. The data were obtained from a Georgia school district and comprised teacher certification type, student achievement scores on the GMAs, teacher schedules, and student schedules.

Research Design

The goal of this quantitative study was to provide insight into the importance of teacher certification and its impact on student achievement. The results grew out of data received from a school system within the Georgia related to teacher certification type and student achievement scores on GMAs. The researcher chose a quantitative approach for the study since variables were identified and compared to one another to determine if an association was present. Specifically, the researcher hypothesized that students taught by OOF teachers will have lower achievement-level scores on the GMAs than students taught by IF teachers.

According to Creswell (2014), quantitative research is an approach to testing objective theories by examining the relationship(s) among variables. Burns et al. (2015) defined quantitative research as a “formal, objective, systematic process used to describe variables, test relationships between them, and examine cause and effect associations between variables” (p. 510). Quantitative research seeks to test a hypothesis by using objective and impartial scientific methods, namely by drawing a representative sample of participants from a known population, measuring the variables, and testing them utilizing statistical analyses (Bloomfield & Fisher, 2019).

When reviewing the variables of a study, it is important to understand the difference between independent and dependent variables. A dependent variable depends on other factors that are measured, while an independent variable represents the stable and unaffected variable being measured in the research. The dependent variable is believed to be the presumed effect, while the independent variable is presumed to be the cause (University of Southern California, 2020). The quantitative study comprised

descriptive research, and the student sample was only to be measured once, that is, at the end of each school year during the GMA window. The independent variable for this study was teacher certification type (i.e., in-field or out-of-field), and the dependent variable was student achievement scores, as measured by GMAs.

Statistical Analysis

The statistical tool used to analyze the data in this study was the chi-square test of independence. The chi-square test is oftentimes utilized in research as a way to test a hypothesis(es), namely to examine the relationship between or the statistical significance of different variables. Chi-square tests help the researcher determine the difference between data that are observed and data that are expected. Using the chi-square test, the researcher can determine whether to reject or no reject a null hypothesis. The formulaic expression of the chi-square test is

$$x_c^2 = \frac{\Sigma (O_i - E_i)^2}{E_i} ,$$

where x^2 is the value the researcher is trying to determine; the chi-square value, c , is the degrees of freedom; O_i is the value that is observed, and E_i is the expected value.

For the purposes of this study, chi-square testing was utilized to determine the relationship between teacher certification type and student achievement scores on the GMAs and to determine if datasets rejected or failed to reject the null hypothesis. The null hypothesis stated that there is no association between teacher certification type and student achievement levels on the GMAs.

Study Participants and Data Source

The Georgia public school system selected as the data source for this study is a large district located in the northwestern region of the state that comprises 38 schools: 20

elementary schools, eight middle schools, seven high schools, one alternative learning center, and one career academy. District-wide enrollment is about 27,000 students, with elementary enrollment totaling approximately 12,500 students, middle school enrollment about 6,500 students, and high school enrollment about 8,000 students. The school district employs approximately 1,850 teachers: roughly 800 elementary school teachers, 500 middle school teachers, and 550 high school teachers.

This study focused on teacher and student data collected from the selected school system for the 2017, 2018, and 2019 school years. The researcher received an IRB exemption for the study (see Appendix B). The school system reported that, in 2017, it employed an unduplicated total of 48 OOF teachers; of these, 12 were elementary school teachers, 14 were middle school teachers, and 22 were high school teachers. During SY 2018, the district reported an unduplicated total of 146 OOF teachers, of whom 42 were elementary school teachers, 25 were middle school teachers, and 79 were high school teachers. For SY 2019, the district reported an unduplicated total of 174 OOF teachers.

It is important to note that unduplicated total of OOF teachers increased significantly from SY 2017 to SY 2018. This increase corresponded with the timeline around Georgia's ESSA plan, implemented during this period, when the LEAs were continuing to define their professional qualifications (PQs). Prior to the passage of ESSA, teachers were deemed either highly qualified or not highly qualified under NCLB. During the transition from NCLB to ESSA, OOF teachers were not deemed highly qualified, since the guidelines for OOF teachers were much stricter prior to ESSA. By 2018, the LEAs had completed and implemented their PQ plans, thus leading to higher numbers of OOF teachers than in previous years. With the implementation of ESSA and professional

qualifications came a change in certification requirements for special education teachers. Prior to SY 2018, self-contained special education teachers were only required to hold a special education general curriculum certificate. However, after ESSA and PQ plans were implemented, self-contained special education teachers were required to hold a special education adaptive curriculum certificate in addition to a general certificate. This change in certification requirements for special education teachers and the time required to complete the additional certification led to a significant increase in the number of OOF teachers from the 2017 school year to the 2018 school year.

For this study, only teachers who taught GMA courses/subjects were included. For SY 2017, the district reported an unduplicated total of 30 OOF GMA teachers; for SY 2018, 89 OOF GMA teachers; and for SY 2019, 73. Table 1 shows the number of OOF and IF teachers by GMA subject area and school year. It is important to point out that the teacher numbers displayed in Table 1 are not unduplicated; thus, if a teacher taught multiple courses, they were included more than once.

Table 1*Number of Out-of-Field and In-Field Teachers by GMA Subject Area and School Year*

Course Name	2017		2018		2019	
	Number of OOF Teachers	Number of IF Teachers	Number of OOF Teachers	Number of IF Teachers	Number of OOF Teachers	Number of IF Teachers
Grade 3: English Language Arts	1	168	7	155	10	153
Grade 3: Mathematics	1	152	11	146	6	138
Grade 4: English Language Arts	1	138	5	137	7	134
Grade 4: Mathematics	1	131	7	147	7	135
Grade 5: English Language Arts	1	125	6	120	7	122
Grade 5: Mathematics	0	116	8	116	7	122
Grade 5: Science	0	89	6	89	1	99
Grade 5: Social Studies	0	86	6	88	1	88
Grade 6: English Language Arts	6	59	4	62	3	98
Grade 6: Mathematics	1	60	4	57	3	83
Grade 7: English Language Arts	6	70	6	57	2	94
Grade 7: Mathematics	3	58	7	58	1	90
Grade 8: English Language Arts	5	55	3	59	4	73
Grade 8: Mathematics	3	55	6	56	6	80
Grade 8: Science	5	40	7	50	2	55
Grade 8: Social Studies	3	46	5	51	4	76
Ninth-Grade Literature and Composition	8	63	13	57	5	82
American Literature and Composition	10	44	10	52	4	79
Coordinate Algebra or Algebra I	12	62	18	49	7	66
Analytic Geometry or Geometry	12	52	15	47	3	69
Biology	10	50	9	53	5	61
Physical Science	3	43	8	36	3	44
U.S. History	6	47	8	51	8	62
Economics/Business/Free Enterprise	1	43	6	36	4	55

Data Collection

The data analyzed in this research identified IF and OOF teachers as well as students' GMA achievement levels. The data were collected via Microsoft Excel templates. The following list details the data gathered from the school district:

- ESSA IF/OOF teacher list for school years 2017, 2018, and 2019
- Teacher schedule file for school years 2017, 2018, and 2019
- GMA achievement score report by student and content area for school years 2017, 2018, and 2019
- Student schedule files with state course number, course name, and teacher name for school years 2017, 2018, and 2019
- Student demographic files for school years 2017, 2018, and 2019

After creating the data templates, the researcher utilized Microsoft Access to combine the templates into an overall results file, allowing for clear data analysis.

Conclusion

This study is quantitative in nature and provides insight into the importance of teacher certification. The chi-square test of independence was utilized to determine the statistical significance of the various datasets. The study focused on data from the 2017, 2018, and 2019 school years for a school district in the state of Georgia. Data was collected from the school district via Excel templates and combined into an overall file for data analysis using Microsoft Access. In the following chapter the researcher details the results from the study and determines if the null hypothesis is rejected or fails to reject.

Chapter IV

Results

The data from school years 2017, 2018, and 2019 for a Georgia public school system were compiled and analyzed to address the research question: Does teacher certification type have an impact on student achievement? The data were tested for statistical significance using the chi-square test to determine the outcome of the null hypothesis. The hypothesis, null hypothesis, and alternate hypothesis were as follows:

- Hypothesis: Students taught by teachers with out-of-field certification will have lower achievement-level scores on Georgia Milestone Assessments than students taught by teachers with in-field certification.
- Null hypothesis: There is no association between teacher certification type and student achievement levels on Georgia Milestone Assessments.
- Alternate hypothesis: There is an association between teacher certification type and student achievement levels on Georgia Milestone Assessments.

Teacher Data Results

The number and percentage of teachers teaching a tested grade/subject by teacher certification type were reviewed to address the research question and to determine the outcome of the null hypothesis.

Table 2 summarizes the number and percentage of IF and OOF teachers by school year. As the table shows, for school years 2017, 2018, and 2019, a total of 4,688 teachers taught a tested grade level/subject area, the majority of whom were IF. The 2018 school

year saw the highest percentage of OOF teachers, a result of the implementation of the new ESSA guidelines around teacher certification. The ESSA guidelines changed certification requirements for special education teachers. Prior to SY 2018, self-contained special education teachers were only required to have a special education general curriculum certificate; however, ESSA now requires self-contained special education teachers to have a special education adaptive curriculum certificate in addition to a general certificate. This change in the certificate requirements and the time required to complete them led to a significant increase in the number of OOF teachers in SY 2018.

Table 2

Summary of Teachers by Certification Type and School Year

School Year	Number of In-Field Teachers Teaching a Tested Grade/Subject	Number of Out-of-Field Teachers Teaching a Tested Grade/Subject	Total Number of Teachers Teaching a Tested Grade/Subject	Percentage of In-Field Teachers Teaching a Tested Grade/Subject	Percentage of Out-of-Field Teachers Teaching a Tested Grade/Subject
SY 2017	1,496	27	1,523	98.23%	1.77%
SY 2018	1,439	80	1,519	94.73%	5.27%
SY 2019	1,563	83	1,646	94.96%	5.04%
ALL YEARS	4,498	190	4,688	95.95%	4.05%

Tables 3 and 4 provides a breakdown of the 4,688 teachers by assessment title, certification type, and school year. The data are grouped by individual school year (i.e., 2017, 2018, and 2019) and then as a combination of all three years; the table also details the number of IF and OOF teachers by school year. As the table highlights, the assessment with the highest percentage of OOF teachers, at 10%, was

Economics/Business/Free Enterprise. Coordinate Algebra had the largest number of OOF teachers, while Social Studies Grade 5 had the lowest number of OOF teachers. As the grade levels increased, the percentage of OOF teachers also increased, and the End of Course assessments showed higher percentages of OOF than the End of Grade assessments. The elementary grade levels had percentages of OOF teachers equal to or less than 3% on all assessments, the middle school grade levels ranged from 3% to 9%, and the high school assessments range from 4% to 10%.

Table 3*Summary by Assessment Title, Certification Type, and School Year (Numbers)*

Assessment Name/ Content Area Name	Number of In-Field Teachers				Number of Out-of- Field Teachers			
	SY2017	SY2018	SY2019	Total In-Field Teachers	SY2017	SY2018	SY2019	Total Out-of- Field Teachers
English Language Arts Grade 03	151	130	133	414	0	3	9	12
English Language Arts Grade 04	120	118	111	349	0	1	5	6
English Language Arts Grade 05	110	94	98	302	0	3	5	8
English Language Arts Grade 06	47	50	60	157	3	1	3	7
English Language Arts Grade 07	51	44	62	157	4	6	2	12
English Language Arts Grade 08	43	44	49	136	3	1	4	8
Mathematics Grade 03	138	130	125	393	0	5	5	10
Mathematics Grade 04	115	124	107	346	0	2	5	7
Mathematics Grade 05	101	98	100	299	0	4	5	9
Mathematics Grade 06	49	48	47	144	0	1	3	4
Mathematics Grade 07	48	46	59	153	3	5	1	9
Mathematics Grade 08	43	42	43	128	2	2	5	9
Science Grade 05	73	69	80	222	0	1	1	2
Science Grade 08	28	33	33	94	4	3	2	9
Social Studies Grade 05	65	67	71	203	0	1	0	1
Social Studies Grade 08	36	38	39	113	1	3	4	8
Ninth Grade Lit & Comp	46	42	58	146	0	7	3	10
American Lit & Comp	33	35	55	123	1	4	3	8
Coordinate Algebra	43	42	56	141	3	7	3	13
Analytic Geometry	40	38	47	125	1	2	2	5
Biology	39	31	34	104	2	5	3	10
Physical Science	24	20	25	69	0	4	2	6
United States History	32	32	43	107	0	5	4	9
Economics	21	24	28	73	0	4	4	8

Table 4*Summary by Assessment Title, Certification Type, and School Year (Percentages)*

Assessment Name/ Content Area Name	Percent of In-Field Teachers				Percent of Out-of-Field Teachers			
	SY2017	SY2018	SY2019	Total In-Field Teachers	SY2017	SY2018	SY2019	Total Out-of-Field Teachers
English Language Arts Grade 03	100%	98%	94%	97%	0%	2%	6%	3%
English Language Arts Grade 04	100%	99%	96%	98%	0%	1%	4%	2%
English Language Arts Grade 05	100%	97%	95%	97%	0%	3%	5%	3%
English Language Arts Grade 06	94%	98%	95%	96%	6%	2%	5%	4%
English Language Arts Grade 07	93%	88%	97%	93%	7%	12%	3%	7%
English Language Arts Grade 08	93%	98%	92%	94%	7%	2%	8%	6%
Mathematics Grade 03	100%	96%	96%	98%	0%	4%	4%	2%
Mathematics Grade 04	100%	98%	96%	98%	0%	2%	4%	2%
Mathematics Grade 05	100%	96%	95%	97%	0%	4%	5%	3%
Mathematics Grade 06	100%	98%	94%	97%	0%	2%	6%	3%
Mathematics Grade 07	94%	90%	98%	94%	6%	10%	2%	6%
Mathematics Grade 08	96%	95%	90%	93%	4%	5%	10%	7%
Science Grade 05	100%	99%	99%	99%	0%	1%	1%	1%
Science Grade 08	88%	92%	94%	91%	13%	8%	6%	9%

Assessment Name/ Content Area Name	Percent of In-Field Teachers				Percent of Out-of-Field Teachers			
	SY2017	SY2018	SY2019	Total In-Field Teachers	SY2017	SY2018	SY2019	Total Out-of-Field Teachers
Social Studies Grade 05	100%	99%	100%	100%	0%	1%	0%	0%
Social Studies Grade 08	97%	93%	91%	93%	3%	7%	9%	7%
Ninth Grade Literature & Composition	100%	86%	95%	94%	0%	14%	5%	6%
American Literature & Composition	97%	90%	95%	94%	3%	10%	5%	6%
Coordinate Algebra	93%	86%	95%	92%	7%	14%	5%	8%
Analytic Geometry	98%	95%	96%	96%	2%	5%	4%	4%
Biology	95%	86%	92%	91%	5%	14%	8%	9%
Physical Science	100%	83%	93%	92%	0%	17%	7%	8%
United States History	100%	86%	91%	92%	0%	14%	9%	8%
Economics/Business/Free Enterprise	100%	86%	88%	90%	0%	14%	13%	10%

Student Data Results

To address the research question and determine if the null hypothesis was rejected or not rejected, the researcher disaggregated the percentage of students tested by assessment and by teacher certification type (Table 5). A review of the “All Years” data in Table 5 indicates that, regardless of school level, all 24 assessments reported rates of students tested by teachers holding OOF certification. The assessment with the highest

percentage of students taught by OOF teachers was Coordinate Algebra, at 12%. The assessment with the lowest percentage of students taught by OOF teachers was Social Studies Grade 5, at 0.03%.

Table 5

Students Tested by Assessment and by Teacher Certification Type

Assessment Name	2017 Percent Tested by In-Field Teachers	2018 Percent Tested by In-Field Teachers	2019 Percent Tested by In-Field Teachers	All Years Combined Percent Tested by In-Field Teachers	2017 Percent Tested by Out-of-Field Teachers	2018 Percent Tested by Out-of-Field Teachers	2019 Percent Tested by Out-of-Field Teachers	All Years Combined Percent Tested by Out-of-Field Teachers
English Language Arts Grade 03	100%	100%	92%	97%	0%	0%	8%	3%
English Language Arts Grade 04	100%	100%	93%	98%	0%	0%	7%	2%
English Language Arts Grade 05	100%	100%	91%	97%	0%	0%	9%	3%
English Language Arts Grade 06	99%	99%	96%	98%	1%	1%	4%	2%
English Language Arts Grade 07	98%	93%	95%	96%	2%	7%	5%	4%
English Language Arts Grade 08	97%	98%	87%	94%	3%	2%	13%	6%
Mathematics Grade 03	100%	99%	96%	98%	0%	1%	4%	2%
Mathematics Grade 04	100%	100%	98%	99%	0%	0%	2%	1%
Mathematics Grade 05	100%	97%	98%	98%	0%	3%	2%	2%
Mathematics Grade 06	100%	99%	91%	96%	0%	1%	9%	4%
Mathematics Grade 07	98%	90%	97%	95%	2%	10%	3%	5%

Assessment Name	2017 Percent Tested by In-Field Teachers	2018 Percent Tested by In-Field Teachers	2019 Percent Tested by In-Field Teachers	All Years Combined Percent Tested by In-Field Teachers	2017 Percent Tested by Out-of-Field Teachers	2018 Percent Tested by Out-of-Field Teachers	2019 Percent Tested by Out-of-Field Teachers	All Years Combined Percent Tested by Out-of-Field Teachers
Mathematics Grade 08	98%	97%	86%	94%	2%	3%	14%	6%
Science Grade 05	100%	100%	99%	100%	0%	0%	1%	0%
Science Grade 08	93%	92%	98%	94%	7%	8%	2%	6%
Social Studies Grade 05	100%	100%	100%	100%	0%	0%	0%	0%
Social Studies Grade 08	100%	89%	91%	93%	0%	11%	9%	7%
Ninth Grade Literature & Composition	100%	89%	95%	94%	0%	11%	5%	6%
American Literature & Composition	100%	85%	88%	90%	0%	15%	12%	10%
Coordinate Algebra	97%	84%	85%	88%	3%	16%	15%	12%
Analytic Geometry	100%	94%	96%	96%	0%	6%	4%	4%
Biology	100%	83%	89%	91%	0%	17%	11%	9%
Physical Science	100%	80%	90%	90%	0%	20%	10%	10%
United States History	100%	87%	86%	91%	0%	13%	14%	9%
Economics/ Business/ Free Enterprise	100%	84%	94%	91%	0%	16%	6%	9%

Statistical Analysis of Data

The chi-square test was used to determine the statistical significance of the study's various datasets. The chi-square test is used to determine whether an association

between two qualitative variables is statistically significant. The formula for the chi-square test is:

$$x_c^2 = \frac{\sum (O_i - E_i)^2}{E_i}$$

The study’s first chi-square test used the results from all Georgia Milestone Assessments during school years 2017, 2018, and 2019. The calculations and findings are reported in this section. The null and alternate hypotheses were as follows:

- Null hypothesis (H₀): There is no association between teacher certification type and student achievement levels on Georgia Milestone Assessments.
- Alternate hypothesis (H_a): There is an association between teacher certification type and student achievement levels on Georgia Milestone Assessments.

Table 6

Chi-Square Observed Data Table

	Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner	Row Total
In-Field Teachers	62,780.00	77,593.00	56,869.00	14,119.00	211,361.00
Out-of-Field Teachers	3,063.00	3,360.00	2,770.00	666.00	9,859.00
Column Total	65,843.00	80,953.00	59,639.00	14,785.00	221,220.00

The chi-square observed data table reflects the data results for the All Georgia Milestone Assessments administered during the 2017, 2018, and 2019 school years combined dataset. The numbers from Table 6 are used in the calculations for the expected data table. The calculation for the expected value table is: (Row Total) * (Column Total) / Total Number of Observations. Table 7 depicts the expected values calculated for the chi-

square test of the All Georgia Milestone Assessments administered during the 2017, 2018, and 2019 school years combined dataset.

Table 7

Chi-Square Expected Data Table

	Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner	Row Total
In-Field Teachers	62,908.61	77,345.21	56,981.10	14,126.08	211,361.00
Out-of-Field Teachers	2,934.39	3,607.79	2,657.90	658.92	9,859.00
Column Total	65,843.00	80,953.00	59,639.00	14,785.00	221,220.00

With the observed data and expected data tables completed the chi-square calculations can be completed. The chi-square equation calculation is (observed value minus the expected value) squared and then divided by expected data. The results of the chi-square equation for the All Georgia Milestone Assessments administered during the 2017, 2018, and 2019 school years combined dataset is shown in Table 8 below.

Table 8

Chi-Square Data Table

	Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
In-Field Teachers	0.2629	0.7939	0.2205	0.0036
Out-of-Field Teachers	5.6366	17.0189	4.7278	0.0762

To calculate the chi-squared value the researcher must sum all of the values in the chi-square data table together, this calculation totals 28.7404. Next step in the chi-square test is to calculate the degrees of freedom; the calculation for degrees of freedom is (Table’s Number of Columns – 1) multiplied by the (Table’s Number of Rows – 1). For

this data set the degrees of freedom is equal to 3. With the calculation of all these values the P Value can be determined. For this study, the researcher utilized an online chi-square calculator to calculate the p value (Social Science Statistics, 2025). Utilizing the online calculator the researcher determined the P Value to be .000002 and the alpha level is .05. Since the p value was less than the alpha level, the dataset was determined to be statistically significant, and the null hypothesis for the dataset was rejected. Based on the p value, the result was significant and the chi-square test proved that the variables were dependent. The chi-square test indicated significant evidence of an association between teacher certification type and student achievement levels on Georgia Milestone Assessments. Based on the chi-square test of all GMAs administered during school years 2017, 2018, and 2019, the null hypothesis was rejected.

The chi-square test was used on a total of 42 datasets for this study. The datasets were divided into groups according to school level, school year, subject area, grade level, and grade level and subject area combined. The following list contains the datasets tested using the chi-square test.

- Overall Data Set
 - All Georgia Milestone Assessments administered in 2017, 2018, and 2019
- By School Level Data Sets
 - All Elementary-Level GMAs administered in 2017, 2018, and 2019
 - All Middle School-Level GMAs administered in 2017, 2018, and 2019
 - All High School GMAs administered in 2017, 2018, and 2019

- By School Year Data Sets
 - All GMAs administered in 2017
 - All GMAs administered in 2018
 - All GMAs administered in 2019
- By Subject Area Data Sets
 - All English Language Arts GMAs administered in 2017, 2018, and 2019
 - All Mathematics GMAs administered in 2017, 2018, and 2019
 - All Science GMAs administered in 2017, 2018, and 2019
 - All Social Studies GMAs administered in 2017, 2018, and 2019
- By Grade Level Data Sets
 - All Grade 3 GMAs administered in 2017, 2018, and 2019
 - All Grade 4 GMAs administered in 2017, 2018, and 2019
 - All Grade 5 GMAs administered in 2017, 2018, and 2019
 - All Grade 6 GMAs administered in 2017, 2018, and 2019
 - All Grade 7 GMAs administered in 2017, 2018, and 2019
 - All Grade 8 GMAs administered in 2017, 2018, and 2019
 - All High School (Grades 9–12) GMAs administered in 2017, 2018, and 2019
- By Grade Level and Subject Area Data Sets
 - Grade 3 English Language Arts GMA administered in 2017, 2018, and 2019

- Grade 4 English Language Arts GMA administered in 2017, 2018, and 2019
- Grade 5 English Language Arts GMA administered in 2017, 2018, and 2019
- Grade 6 English Language Arts GMA administered in 2017, 2018, and 2019
- Grade 7 English Language Arts GMA administered in 2017, 2018, and 2019
- Grade 8 English Language Arts GMA administered in 2017, 2018, and 2019
- Ninth-Grade Literature and Composition GMA administered in 2017, 2018, and 2019
- American Literature and Composition GMA administered in 2017, 2018, and 2019
- Grade 3 Mathematics GMA administered in 2017, 2018, and 2019
- Grade 4 Mathematics GMA administered in 2017, 2018, and 2019
- Grade 5 Mathematics GMA administered in 2017, 2018, and 2019
- Grade 6 Mathematics GMA administered in 2017, 2018, and 2019
- Grade 7 Mathematics GMA administered in 2017, 2018, and 2019
- Grade 8 Mathematics GMA administered in 2017, 2018, and 2019
- Coordinate Algebra GMA administered in 2017, 2018, and 2019
- Analytic Geometry GMA administered in 2017, 2018, and 2019
- Grade 5 Science GMA administered in 2017, 2018, and 2019

- Grade 8 Science GMA administered in 2017, 2018, and 2019
- Biology GMA administered in 2017, 2018, and 2019
- Physical Science GMA administered in 2017, 2018, and 2019
- Grade 5 Social Studies GMA administered in 2017, 2018, and 2019
- Grade 8 Social Studies GMA administered in 2017, 2018, and 2019
- U.S. History GMA administered in 2017, 2018, and 2019
- Economics/Business/Free Enterprise GMA administered in 2017, 2018, and 2019

The results of the chi-square tests and findings for each of the preceding 42 datasets are reported in Table 9. For each chi-square test, the degrees of freedom was 3 and the alpha level was 0.05. The chi-square test solves for the chi-square value and the p value. The chi-square statistic compares the observed values with the expected values and measures how far the observed counts are from the expected counts. The chi-square statistic provides information on whether the difference between the observed values and the expected values are statistically significant. The p value is used to determine whether the null hypothesis is rejected or not rejected. The p value is a number, calculated during a statistical test, that describes the likelihood of finding a particular set of observations if the null hypothesis is true. The p value provides insight into the expectation of seeing a test statistic as extreme or more extreme than the one calculated by the statistical test if the null hypothesis is true. The p value becomes smaller as the test statistic calculated from the study data gets further from the range of test statistics predicted by the null hypothesis.

Table 9*Chi-Square Test Results and Findings*

Dataset Name	Chi-Square Test Results			
	Chi-Square Value	P Value	Statistically Significant?	Null Hypothesis Status
All GMAs administered in 2017, 2018, & 2019	28.747	0.000002	Yes	Reject
By School Level				
All Elementary-Level GMAs	12.4181	0.00608	Yes	Reject
All Middle School Grade-Level GMAs	53.0297	< 0.00001	Yes	Reject
All High School GMAs	52.1752	< 0.00001	Yes	Reject
By School Year				
All GMAs administered during 2017	211.0024	< 0.00001	Yes	Reject
All GMAs administered during 2018	28.35505	< 0.00001	Yes	Reject
All GMAs administered during 2019	39.6647	< 0.00001	Yes	Reject
By Subject				
All English Language Arts GMAs	142.5358	< 0.00001	Yes	Reject
All Mathematics GMAs	96.5914	< 0.00001	Yes	Reject
All Science GMAs	16.3985	0.000939	Yes	Reject
All Social Studies GMAs	30.5706	< 0.00001	Yes	Reject
By Grade Level				
All Grade 3 GMAs	3.6846	0.297603	No	Fail to Reject
All Grade 4 GMAs	20.3223	0.000146	Yes	Reject
All Grade 5 GMAs	9.015	0.029092	Yes	Reject
All Grade 6 GMAs	16.0874	0.001088	Yes	Reject
All Grade 7 GMAs	108.0676	< 0.00001	Yes	Reject
All Grade 8 GMAs	26.7601	< 0.00001	Yes	Reject
All High School GMAs (Grades 9–12)	52.1752	< 0.00001	Yes	Reject
By Grade Level and Subject				
Grade 3 English Language Arts GMA	9.7524	0.020792	Yes	Reject

Dataset Name	Chi-Square Test Results			
	Chi-Square Value	P Value	Statistically Significant?	Null Hypothesis Status
Grade 4 English Language Arts GMA	22.2053	0.000059	Yes	Reject
Grade 5 English Language Arts GMA	17.3185	0.000608	Yes	Reject
Grade 6 English Language Arts GMA	6.592	0.086104	No	Fail to Reject
Grade 7 English Language Arts GMA	37.3775	< 0.00001	Yes	Reject
Grade 8 English Language Arts GMA	30.641	< 0.00001	Yes	Reject
Ninth Grade Literature & Composition GMA	33.2782	< 0.00001	Yes	Reject
American Literature & Composition GMA	148.414	< 0.00001	Yes	Reject
Grade 3 Mathematics GMA	3.2595	0.353321	No	Fail to Reject
Grade 4 Mathematics GMA	25.4494	0.000012	Yes	Reject
Grade 5 Mathematics GMA	4.0182	0.259505	No	Fail to Reject
Grade 6 Mathematics GMA	9.3727	0.024725	Yes	Reject
Grade 7 Mathematics GMA	65.2819	< 0.00001	Yes	Reject
Grade 8 Mathematics GMA	29.923	< 0.00001	Yes	Reject
Coordinate Algebra GMA	123.0077	< 0.00001	Yes	Reject
Analytic Geometry GMA	63.0336	< 0.00001	Yes	Reject
Grade 5 Science GMA	3.3455	0.341355	No	Fail to Reject
Grade 8 Science GMA	3.803	0.283539	No	Fail to Reject
Biology GMA	14.3932	0.002416	Yes	Reject
Physical Science GMA	17.4439	0.000573	Yes	Reject
Grade 5 Social Studies GMA	1.0201	0.7964	No	Fail to Reject
Grade 8 Social Studies GMA	19.0103	0.000272	Yes	Reject
U.S. History GMA	44.0086	< 0.00001	Yes	Reject
Economics/Business/Free Enterprise GMA	31.305	< 0.00001	Yes	Reject

Statistical Significance Findings

Overall, analysis of the 42 datasets using chi-square tests showed a statistically significant relationship between teacher certification type and student achievement levels. Of the 42 datasets analyzed, 35 showed statistical significance—that is, the variables in the dataset were dependent, and there was strong evidence of an association between teacher certification type and student achievement levels on GMAs. The below lists contains the datasets that were found to show statistical significance:

- All GMAs administered during 2017, 2018, and 2019
- Elementary-Level GMAs administered during 2017, 2018, and 2019
- Middle Grade-Level GMAs administered during 2017, 2018, and 2019
- High School GMAs administered during 2017, 2018, and 2019
- GMAs administered during school year 2017
- GMAs administered during school year 2018
- GMAs administered during school year 2019
- English Language Arts GMAs administered during 2017, 2018, and 2019
- Mathematics GMAs administered during 2017, 2018, and 2019
- Science GMAs administered during 2017, 2018, and 2019
- Social Studies GMAs administered during 2017, 2018, and 2019
- Grade 4 GMAs administered during 2017, 2018, and 2019
- Grade 5 GMAs administered during 2017, 2018, and 2019
- Grade 6 GMAs administered during 2017, 2018, and 2019
- Grade 7 GMAs administered during 2017, 2018, and 2019
- Grade 8 GMAs administered during 2017, 2018, and 2019

- High School (Grades 9–12) GMAs administered during 2017, 2018, and 2019
- Grade 3 English Language Arts GMA administered during 2017, 2018, and 2019
- Grade 4 English Language Arts GMA administered during 2017, 2018, and 2019
- Grade 5 English Language Arts GMA administered during 2017, 2018, and 2019
- Grade 7 English Language Arts GMA administered during 2017, 2018, and 2019
- Grade 8 English Language Arts GMA administered during 2017, 2018, and 2019
- Ninth-Grade Literature and Composition GMA administered during 2017, 2018, and 2019
- American Literature and Composition GMA administered during 2017, 2018, and 2019
- Grade 4 Mathematics GMA administered during 2017, 2018, and 2019
- Grade 6 Mathematics GMA administered during 2017, 2018, and 2019
- Grade 7 Mathematics GMA administered during 2017, 2018, and 2019
- Grade 8 Mathematics GMA administered during 2017, 2018, and 2019
- Coordinate Algebra GMA administered during 2017, 2018, and 2019
- Analytic Geometry GMA administered during 2017, 2018, and 2019
- Biology GMA administered during 2017, 2018, and 2019
- Physical Science GMA administered during 2017, 2018, and 2019

- Grade 8 Social Studies GMA administered during 2017, 2018, and 2019
- U.S. History GMA administered during 2017, 2018, and 2019
- Economics/Business/Free Enterprise GMA administered during 2017, 2018, and 2019

However, seven of the datasets tested using chi-square test did not show statistical significance; that is, the variables were independent, and there was insufficient evidence of an association between teacher certification type and student achievement levels on GMAs. The below list of datasets are those that did not show statistical significance:

- Grade 3 GMAs administered during 2017, 2018, and 2019
- Grade 6 English Language Arts GMA administered during 2017, 2018, and 2019
- Grade 3 Mathematics GMA administered during 2017, 2018, and 2019
- Grade 5 Mathematics GMA administered during 2017, 2018, and 2019
- Grade 5 Science GMA administered during 2017, 2018, and 2019
- Grade 8 Science GMA administered during 2017, 2018, and 2019
- Grade 5 Social Studies GMA administered during 2017, 2018, and 2019

Overall Results

To address the research question—Does teacher certification type have an impact on student achievement?—and determine the status of the null hypothesis, the following data were collected from a public school system in Georgia for school years 2017, 2018, and 2019: GaPSC in-field/out-of-field teacher lists, teacher schedule files, student schedule files, and Georgia Milestone Assessment results by student. To complete the data analysis, the researcher used Microsoft Access to combine the various datasets into

one file. The final data file contained school year designation, teacher and student rosters with teacher certification type, assessment name, assessment subject area, and student achievement levels. The data were organized by teacher type and student achievement scores; all school years and subject areas were grouped to provide an overall view of the data (Table 10).

Table 10

Georgia Milestone Assessment Scores by Teacher Type

School Year	Teacher Type	Student Score Level			
		Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
All Years	In-Field Teachers	29.70%	36.71%	26.91%	6.68%
	Out-of-Field Teachers	31.07%	34.08%	28.10%	6.76%

The data were also organized by school year, teacher type, and student achievement scores (Table 11).

Table 11

Georgia Milestone Assessment Scores by School Year and Teacher Type

School Year	Teacher Type	Student Score Level			
		Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
2017	In-Field Teachers	30.28%	36.90%	26.53%	6.30%
	Out-of-Field Teachers	58.23%	33.76%	6.96%	1.05%
2018	In-Field Teachers	29.56%	37.32%	26.46%	6.65%
	Out-of-Field Teachers	32.90%	34.29%	26.79%	6.02%
2019	In-Field Teachers	29.26%	35.92%	27.73%	7.09%
	Out-of-Field Teachers	26.88%	33.93%	31.24%	7.95%

The data were also organized and analyzed by assessment name, teacher type, and achievement level scores; in this view, the data for all years were combined. Table 12 shows the results of this data analysis.

Table 12

Georgia Milestone Assessment Scores by Teacher Type and Assessment Name (School Years 2017, 2018, and 2019 Combined)

Content Area Name	Teacher Type	Student Score Level			
		Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
English Language Arts Grade 3	In-Field Teachers	39.98%	31.87%	11.52%	16.63%
	Out-of-Field Teachers	32.59%	34.19%	25.88%	7.35%
English Language Arts Grade 4	In-Field Teachers	32.79%	32.94%	13.47%	20.80%
	Out-of-Field Teachers	19.44%	40.48%	26.59%	13.49%
English Language Arts Grade 5	In-Field Teachers	29.22%	37.15%	12.21%	21.41%
	Out-of-Field Teachers	34.64%	27.09%	32.96%	5.31%
English Language Arts Grade 6	In-Field Teachers	36.40%	31.01%	12.96%	19.63%
	Out-of-Field Teachers	40.10%	34.30%	19.32%	6.28%
English Language Arts Grade 7	In-Field Teachers	38.49%	34.20%	9.68%	17.63%
	Out-of-Field Teachers	37.86%	24.51%	19.90%	17.72%
English Language Arts Grade 8	In-Field Teachers	39.01%	41.75%	5.85%	13.39%
	Out-of-Field Teachers	37.35%	36.36%	18.43%	7.86%
Mathematics Grade 3	In-Field Teachers	26.12%	37.93%	15.35%	20.59%
	Out-of-Field Teachers	26.91%	32.74%	27.80%	12.56%
Mathematics Grade 4	In-Field Teachers	22.86%	41.19%	14.31%	21.65%
	Out-of-Field Teachers	31.46%	20.22%	31.46%	16.85%

Content Area Name	Teacher Type	Student Score Level			
		Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
Mathematics Grade 5	In-Field Teachers	30.15%	40.11%	13.00%	16.74%
	Out-of-Field Teachers	24.54%	43.87%	17.10%	14.50%
Mathematics Grade 6	In-Field Teachers	24.72%	41.51%	13.07%	20.70%
	Out-of-Field Teachers	23.35%	49.10%	21.26%	6.29%
Mathematics Grade 7	In-Field Teachers	25.09%	40.03%	15.10%	19.78%
	Out-of-Field Teachers	26.61%	27.42%	26.21%	19.76%
Mathematics Grade 8	In-Field Teachers	30.96%	43.66%	9.34%	16.04%
	Out-of-Field Teachers	42.80%	38.35%	14.83%	4.03%
Science Grade 5	In-Field Teachers	34.87%	30.16%	14.86%	20.11%
	Out-of-Field Teachers	33.33%	45.83%	16.67%	4.17%
Science Grade 8	In-Field Teachers	48.42%	29.49%	8.72%	13.37%
	Out-of-Field Teachers	52.48%	26.40%	4.04%	17.08%
Social Studies Grade 5	In-Field Teachers	25.37%	47.63%	11.27%	15.72%
	Out-of-Field Teachers	50.00%	50.00%	0.00%	0.00%
Social Studies Grade 8	In-Field Teachers	28.66%	37.98%	13.10%	20.27%
	Out-of-Field Teachers	25.29%	39.93%	13.81%	20.97%
Ninth-Grade Literature & Composition	In-Field Teachers	15.70%	35.72%	18.76%	29.81%
	Out-of-Field Teachers	15.67%	32.14%	19.64%	32.54%
American Literature & Composition	In-Field Teachers	22.63%	38.89%	15.53%	22.95%
	Out-of-Field Teachers	13.05%	26.37%	32.90%	27.68%
Coordinate Algebra	In-Field Teachers	27.10%	40.86%	12.11%	19.93%
	Out-of-Field Teachers	35.46%	49.26%	9.02%	6.26%

Content Area Name	Teacher Type	Student Score Level			
		Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
Analytic Geometry	In-Field Teachers	29.34%	36.43%	13.89%	20.34%
	Out-of-Field Teachers	49.11%	34.52%	7.47%	8.90%
Biology	In-Field Teachers	31.16%	24.75%	18.52%	25.58%
	Out-of-Field Teachers	32.21%	26.20%	19.47%	22.12%
Physical Science	In-Field Teachers	21.06%	32.18%	19.06%	27.69%
	Out-of-Field Teachers	25.58%	35.66%	14.53%	24.22%
U.S. History	In-Field Teachers	25.66%	35.42%	16.29%	22.64%
	Out-of-Field Teachers	33.42%	37.03%	15.51%	14.04%
Economics/ Business/ Free Enterprise	In-Field Teachers	33.28%	33.32%	17.07%	16.33%
	Out-of-Field Teachers	40.90%	21.06%	10.22%	27.81%

After reviewing the data, the researcher applied the chi-square test to determine statistical significance within the different datasets. The chi-square test is a statistical hypothesis test for determining if variables are likely to be related. After the observed values, expected values, chi-square statistic, degrees of freedom, alpha level, and p value have been calculated/determined, the statistical significance of the dataset can be determined. If the p value is less than or equal to the alpha level, the dataset is determined to be statistically significant; thus, the null hypothesis would be rejected. For this study, if the p value was less than or equal to the alpha level, the chi-square test indicated significant evidence of an association between teacher certification type and student achievement levels on Georgia Milestone Assessments. When the p value was greater than the alpha level, the dataset did not indicate statistical significance, and the null

hypothesis was not rejected. In this study, if the p value was greater than the alpha level, the chi-square test indicated insufficient evidence in the dataset of an association between teacher certification type and student achievement levels on GMAs. To address the research question and determine the status of the null hypothesis, the chi-square test was performed on all the datasets. For testing purposes, the datasets were grouped as follows: (1) all GMAs administered in 2017, 2018, and 2019; (2) school-level groupings: elementary, middle and high school; (3) school-year groupings: 2017, 2018, and 2019; (4) subject-area groupings: English language arts, mathematics, science, and social studies; (5) grade-level groupings: Grade 3, 4, 5, 6, 7, 8, and high school assessments; and (6) grade-level and subject-area groupings. The “All GMAs administered in 2017, 2018, and 2019” grouping was the overall group for the study, and the chi-square test results associate with this grouping helped address the research question. This group comprised the results of all GMAs administered during school years 2017, 2018, and 2019. The results were disseminated by teacher certification type and student achievement level scores on the GMAs. Table 13 shows the results for all GMAs administered during the 2017, 2018, and 2019 school years.

Table 13*Georgia Milestone Assessment Results by Teacher Type and Achievement Levels*

Student Totals by Achievement Levels for In-Field Teachers			
Number of Students Scoring Beginning Learner	Number of Students Scoring Developing Learner	Number of Students Scoring Proficient Learner	Number of Students Scoring Distinguished Learner
62,780	77,593	56,869	14,119
Student Totals by Achievement Levels for Out-of-Field Teachers			
Number of Students Scoring Beginning Learner	Number of Students Scoring Developing Learner	Number of Students Scoring Proficient Learner	Number of Students Scoring Distinguished Learner
3,063	3,360	2,770	666

The numbers in the preceding table are the observed numbers used in the chi-square test. The chi-square test performed on this dataset yielded the following results:

- Null hypothesis (H_0): There is no association between teacher certification type and student achievement levels on Georgia Milestone Assessments.
- Alternate hypothesis (H_a): There is an association between teacher certification type and student achievement levels on Georgia Milestone Assessments.
- Chi-square value = 28.747
- Degrees of freedom = 3
- P value = .000002
- Alpha level = .05

Since the p value of .000002 was lower than the alpha level of .05, the null hypothesis was rejected. There was significant evidence of an association between teacher

certification type and student achievement levels on GMAs. Based on the chi-square test on all GMAs administered during school years 2017, 2018, and 2019, there was enough evidence to conclude that teacher certification type has an impact on student achievement.

The chi-square test was performed on the three datasets comprising the school-level groupings: (1) all elementary grade-level GMAS administered during 2017, 2018, and 2019; (2) all middle school grade-level GMAs administered during 2017, 2018, and 2019; and (3) all high school-level GMAs administered during 2017, 2018, and 2019. Table 14 shows the observed numbers and the results of the chi-square test for each of these datasets. Based on the chi-square test results, the researcher determined that all three datasets in the school-level group rejected the null hypothesis, thus concluding that teacher certification type has an impact on student achievement.

Table 14*School-Level Datasets, Observed Values and Chi-Square Test Results*

Dataset Name	Teacher Type	Student Totals by Achievement Level				Chi-Square Test Results					
		Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner	Chi-Square Value	Degrees of Freedom	P Value	Alpha Level	Statistically Significant?	Null Hypothesis Status
All Elementary-Level GMAs	In-Field Teachers	28,210	35,297	23,980	6,925	12.4181	3	0.00608	0.05	Yes	Reject
	Out-Of-Field Teachers	438	527	436	129						
All Middle School Grade-Level GMAs	In-Field Teachers	20,646	23,315	14,763	3,517	53.0297	3	< 0.00001	0.05	Yes	Reject
	Out-Of-Field Teachers	1,124	1,126	726	275						
All High School GMAs	In-Field Teachers	13,924	18,981	18,126	3,677	52.1752	3	< 0.00001	0.05	Yes	Reject
	Out-Of-Field Teachers	1,501	1,707	1,608	262						

The school-year grouping comprised three datasets: (1) all GMAs administered during the 2017 school year; (2) all GMAs administered during the 2018 school year; and (3) all GMAs administered during the 2019 school year. Table 15 shows the observed numbers and the results of the chi-square test for each of the datasets in the school-year group. The table shows that when the GMAs were grouped by year, each year of assessments was statistically significant and rejected the null hypothesis. These results

led the researcher to conclude that teacher certification type does have an impact on student achievement.

Table 15

School-Year Datasets, Observed Values and Chi-Square Test Results

Dataset Name	Teacher Type	Student Totals by Achievement Level				Chi-Square Test Results					
		Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner	Chi-Square Value	Degrees of Freedom	P Value	Alpha Level	Statistically Significant?	Null Hypothesis Status
All GMAs administered during 2017	In-Field Teachers	21,523	26,230	18,860	4,478	211.0024	3	< 0.00001	0.05	Yes	Reject
	Out-Of-Field Teachers	276	160	33	5						
All GMAs administered during 2018	In-Field Teachers	20,663	26,084	18,496	4,649	28.35505	3	< 0.00001	0.05	Yes	Reject
	Out-Of-Field Teachers	1,444	1,505	1,176	264						
All GMAs administered during 2019	In-Field Teachers	20,594	25,279	19,513	4,992	39.6647	3	< 0.00001	0.05	Yes	Reject
	Out-Of-Field Teachers	1,343	1,695	1,561	397						

The grouping of GMAs by subject/content area comprised four datasets: (1) all English language arts GMAs administered during 2017, 2018, and 2019; (2) all mathematics GMAs administered during 2017, 2018, and 2019; (3) all science GMAs administered during 2017, 2018, and 2019; and (4) all social studies GMAs administered during 2017, 2018, and 2019. Table 15 displays the observed values and chi-square test

results for the subject/content-area datasets. As the table shows, all four subject/content areas demonstrated statistical significance and rejected the null hypothesis; thus, the researcher concluded that teacher certification type has an impact on student achievement.

Table 16

Subject/Content-Area Datasets, Observed Values and Chi-Square Test Results

Dataset Name	Teacher Type	Student Totals by Achievement Level				Chi-Square Test Results					
		Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner	Chi-Square Value	Degrees of Freedom	P Value	Alpha Level	Statistically Significant?	Null Hypothesis Status
All English Language Arts GMAs	In-Field Teachers	23,857	25,961	20,148	4,350	142.5358	3	< 0.00001	0.05	Yes	Reject
	Out-Of-Field Teachers	845	990	1,126	258						
All Mathematics GMAs	In-Field Teachers	21,863	32,854	21,569	5,549	96.5914	3	< 0.00001	0.05	Yes	Reject
	Out-Of-Field Teachers	1,038	1,251	623	194						
All Science GMAs	In-Field Teachers	9,333	7,859	8,042	2,109	16.3985	3	0.000939	0.05	Yes	Reject
	Out-Of-Field Teachers	577	498	532	87						
All Social Studies GMAs	In-Field Teachers	7,727	10,919	7,110	2,111	30.5706	3	< 0.00001	0.05	Yes	Reject
	Out-Of-Field Teachers	603	621	489	127						

The grouping of GMAs by grade level comprised seven datasets: (1) all Grade 3 GMAs administered during the 2017, 2018, and 2019 school years; (2) all Grade 4 GMAs administered during the 2017, 2018, and 2019 school years; (3) all Grade 5 GMAs administered during the 2017, 2018, and 2019 school years; (4) all Grade 6 GMAs administered during the 2017, 2018, and 2019 school years; (5) all Grade 7 GMAs administered during the 2017, 2018, and 2019 school years; (6) all Grade 8 GMAs administered during the 2017, 2018, and 2019 school years; and (7) all high school (Grades 9–12) GMAs administered during the 2017, 2018, and 2019 school years.

When reviewing the chi-square results of the datasets within the grade-level grouping (Table 17), all but one of the datasets rejected the null hypothesis. The dataset for all Grade 3 GMAs administered during the 2017, 2018, and 2019 school years had a p value of .297603, which is higher than the alpha level of .05; therefore, the null hypothesis was not rejected. The dataset for Grade 3 GMAs administered during the 2017, 2018, and 2019 school years was not statistically significant, meaning there was not significant evidence of an association between teacher certification type and student achievement. The other six datasets within the grade-level groupings were statistically significant and rejected the null hypothesis, leading the researcher to conclude that, in these datasets, teacher certification type had an impact on student achievement. The six datasets in the grade-level grouping that rejected the null hypothesis were: (1) all Grade 4 GMAs administered during the 2017, 2018, and 2019 school years; (2) all Grade 5 GMAs administered during the 2017, 2018, and 2019 school years; (3) all Grade 6 GMAs administered during the 2017, 2018, and 2019 school years; (4) all Grade 7 GMAs administered during the 2017, 2018, and 2019 school years; (5) all Grade 8 GMAs

administered during the 2017, 2018, and 2019 school years; and (6) all high school (Grades 9–12) GMAs administered during the 2017, 2018, and 2019 school years.

Table 17

Grade-Level Datasets, Observed Values and Chi-Square Test Results

Dataset Name	Teacher Type	Student Totals by Achievement Level				Chi-Square Test Results					
		Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner	Chi-Square Value	Degrees of Freedom	P Value	Alpha Level	Statistically Significant?	Null Hypothesis Status
All Grade 3 GMAs	In-Field Teachers	8,225	8,879	6,391	1,784	3.6846	3	0.297603	0.05	No	Fail to Reject
	Out-Of-Field Teachers	162	180	153	41						
All Grade 4 GMAs	In-Field Teachers	7,325	10,167	7,365	2,151	20.3223	3	0.000146	0.05	Yes	Reject
	Out-Of-Field Teachers	77	120	95	49						
All Grade 5 GMAs	In-Field Teachers	12,660	16,251	10,224	2,990	9.015	3	0.029092	0.05	Yes	Reject
	Out-Of-Field Teachers	199	227	188	39						
All Grade 6 GMAs	In-Field Teachers	5,542	6,538	4,827	1,169	16.0874	3	0.001088	0.05	Yes	Reject
	Out-Of-Field Teachers	161	235	124	21						
All Grade 7 GMAs	In-Field Teachers	5,647	6,568	4,223	1,277	108.0676	3	< 0.00001	0.05	Yes	Reject
	Out-Of-Field Teachers	288	237	243	140						
	In-Field Teachers	9,457	10,209	5,713	1,071	26.7601	3	< 0.00001	0.05	Yes	Reject

Dataset Name	Teacher Type	Student Totals by Achievement Level				Chi-Square Test Results					
		Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner	Chi-Square Value	Degrees of Freedom	P Value	Alpha Level	Statistically Significant?	Null Hypothesis Status
All 8th Grade GMAs	Out-Of-Field Teachers	675	654	359	114						
All High School GMAs (Grades 9 - 12)	In-Field Teachers	13,924	18,981	18,126	3,677	52.1752	3	< 0.00001	0.05	Yes	Reject
	Out-Of-Field Teachers	1,501	1,707	1,608	262						

The chi-square results within the grade-level datasets showed that all but one rejected the null hypothesis. The dataset for all Grade 3 GMAs administered during the 2017, 2018, and 2019 school years had a p value of .297603, which was higher than the alpha level of .05; therefore, the null hypothesis was not rejected. The dataset for the Grade 3 GMAs administered during the 2017, 2018, and 2019 school years was not statistically significant, meaning there was not significant evidence of an association between teacher certification type and student achievement. The other six datasets within the grade-level grouping were statistically significant and rejected the null hypothesis, leading to the conclusion that, within these datasets, teacher certification type had an impact on student achievement. The six datasets in the grade-level grouping that rejected the null hypothesis were: (1) all Grade 4 GMAs administered during the 2017, 2018, and 2019 school years; (2) all Grade 5 GMAs administered during the 2017, 2018, and 2019 school years; (3) all Grade 6 GMAs administered during the 2017, 2018, and 2019 school years; (4) all Grade 7 GMAs administered during the 2017, 2018, and 2019 school years;

(5) all Grade 8 GMAs administered during the 2017, 2018, and 2019 school years; and
(6) all high school (Grades 9–12) GMAs administered during the 2017, 2018, and 2019 school years.

The last datasets tested and analyzed were grouped by grade level and subject area and comprised of 24 datasets: (1) Grade 3 English Language Arts GMA; (2) Grade 4 English Language Arts GMA; (3) Grade 5 English Language Arts GMA; (4) Grade 6 English Language Arts GMA; (5) Grade 7 English Language Arts GMA; (6) Grade 8 English Language Arts GMA; (7) Ninth-Grade Literature and Composition GMA; (8) American Literature and Composition GMA; (9) Grade 3 Mathematics GMA; (10) Grade 4 Mathematics GMA; (11) Grade 5 Mathematics GMA; (12) Grade 6 Mathematics GMA; (13) Grade 7 Mathematics GMA; (14) Grade 8 Mathematics GMA; (15) Coordinate Algebra GMA; (16) Analytic Geometry GMA; (17) Grade 5 Science GMA; (18) Grade 8 Science GMA; (19) Biology GMA; (20) Physical Science GMA; (21) Grade 5 Social Studies GMA; (22) Grade 8 Social Studies GMA; (23) U.S. History GMA; and (24) Economics/Business/Free Enterprise GMA. Table 18 shows the observed data and chi-square results for the 24 datasets comprising the grade-level and subject-area group.

Table 18*Grade-Level and Subject-Area Datasets, Observed Values and Chi-Square Results*

Dataset Name	Teacher Type	Student Totals by Achievement Level				Chi-Square Test Results					
		Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner	Chi-Square Value	Degrees of Freedom	P Value	Alpha Level	Statistically Significant?	Null Hypothesis Status
Grade 3 English Language Arts GMA	In-Field Teachers	4,677	3,728	2,359	934	9.7524	3	0.020792	0.05	Yes	Reject
	Out-Of-Field Teachers	102	107	81	23						
Grade 4 English Language Arts GMA	In-Field Teachers	3,802	3,819	2,874	1,100	22.2053	3	0.000059	0.05	Yes	Reject
	Out-Of-Field Teachers	49	102	67	34						
Grade 5 English Language Arts GMA	In-Field Teachers	3,181	4,044	2,983	677	17.3185	3	0.000608	0.05	Yes	Reject
	Out-Of-Field Teachers	124	97	118	19						
Grade 6 English Language Arts GMA	In-Field Teachers	3,347	2,852	2,527	470	6.592	3	0.086104	0.05	No	Fail to Reject
	Out-Of-Field Teachers	83	71	49	4						
Grade 7 English Language Arts GMA	In-Field Teachers	3,454	3,069	2,144	307	37.3775	3	< 0.00001	0.05	Yes	Reject
	Out-Of-Field Teachers	156	101	123	32						
Grade 8 English Language Arts GMA	In-Field Teachers	2,427	2,597	1,135	62	30.641	3	< 0.00001	0.05	Yes	Reject
	Out-Of-Field Teachers	152	148	92	15						

Dataset Name	Teacher Type	Student Totals by Achievement Level				Chi-Square Test Results					
		Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner	Chi-Square Value	Degrees of Freedom	P Value	Alpha Level	Statistically Significant?	Null Hypothesis Status
Ninth-Grade Literature & Composition GMA	In-Field Teachers	1,347	3,065	3,693	475	33.2782	3	< 0.00001	0.05	Yes	Reject
	Out-Of-Field Teachers	79	162	204	59						
American Literature & Composition GMA	In-Field Teachers	1,622	2,787	2,433	325	148.414	3	< 0.00001	0.05	Yes	Reject
	Out-Of-Field Teachers	100	202	392	72						
Grade 3 Mathematics GMA	In-Field Teachers	3,548	5,151	4,032	850	3.2595	3	0.353321	0.05	No	Fail to Reject
	Out-Of-Field Teachers	60	73	72	18						
Grade 4 Mathematics GMA	In-Field Teachers	3,523	6,348	4,491	1,051	25.4494	3	0.000012	0.05	Yes	Reject
	Out-Of-Field Teachers	28	18	28	15						
Grade 5 Mathematic GMA	In-Field Teachers	4,334	5,766	3,297	977	4.0182	3	0.259505	0.05	No	Fail to Reject
	Out-Of-Field Teachers	66	118	66	19						
Grade 6 Mathematic GMA	In-Field Teachers	2,195	3,686	2,300	699	9.3727	3	0.024725	0.05	Yes	Reject
	Out-Of-Field Teachers	78	164	75	17						
Grade 7 Mathematics GMA	In-Field Teachers	2,193	3,499	2,079	970	65.2819	3	< 0.00001	0.05	Yes	Reject

Dataset Name	Teacher Type	Student Totals by Achievement Level				Chi-Square Test Results					
		Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner	Chi-Square Value	Degrees of Freedom	P Value	Alpha Level	Statistically Significant?	Null Hypothesis Status
	Out-Of-Field Teachers	132	136	120	108						
Grade 8 Mathematics GMA	In-Field Teachers	2,131	3,005	1,527	220	29.923	3	< 0.00001	0.05	Yes	Reject
	Out-Of-Field Teachers	202	181	78	11						
Coordinate Algebra GMA	In-Field Teachers	1,911	2,881	1,903	356	123.0077	3	< 0.00001	0.05	Yes	Reject
	Out-Of-Field Teachers	334	464	141	3						
Analytic Geometry GMA	In-Field Teachers	2,028	2,518	1,940	426	63.0336	3	< 0.00001	0.05	Yes	Reject
	Out-Of-Field Teachers	138	97	43	3						
Grade 5 Science GMA	In-Field Teachers	3,178	2,749	2,458	729	3.3455	3	0.341355	0.05	No	Fail to Reject
	Out-Of-Field Teachers	8	11	4	1						
Grade 8 Science GMA	In-Field Teachers	2,632	1,603	1,039	162	3.803	3	0.283539	0.05	No	Fail to Reject
	Out-Of-Field Teachers	169	85	55	13						
Biology GMA	In-Field Teachers	2,557	2,031	2,779	840	14.3932	3	0.002416	0.05	Yes	Reject
	Out-Of-Field Teachers	268	218	295	51						

Dataset Name	Teacher Type	Student Totals by Achievement Level				Chi-Square Test Results					
		Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner	Chi-Square Value	Degrees of Freedom	P Value	Alpha Level	Statistically Significant?	Null Hypothesis Status
Physical Science GMA	In-Field Teachers	966	1,476	1,766	378	17.4439	3	0.000573	0.05	Yes	Reject
	Out-Of-Field Teachers	132	184	178	22						
Grade 5 Social Studies GMA	In-Field Teachers	1,967	3,692	1,486	607	1.0201	3	0.7964	0.05	No	Fail to Reject
	Out-Of-Field Teachers	1	1	0	0						
Grade 8 Social Studies GMA	In-Field Teachers	2,267	3,004	2,012	627	19.0103	3	0.000272	0.05	Yes	Reject
	Out-Of-Field Teachers	152	240	134	75						
U.S. History GMA	In-Field Teachers	1,914	2,642	2,312	592	44.0086	3	< 0.00001	0.05	Yes	Reject
	Out-Of-Field Teachers	250	277	200	21						
Economics GMA	In-Field Teachers	1,579	1,581	1,300	285	31.305	3	< 0.00001	0.05	Yes	Reject
	Out-Of-Field Teachers	200	103	155	31						

The grade-level and subject-area group contained a total of 24 datasets: 18 datasets rejected the null hypothesis, while six datasets failed to reject the null hypothesis. The six datasets that failed to reject the null hypothesis were: (1) Grade 6 English Language Arts GMA; (2) Grade 3 Mathematics GMA; (3) Grade 5 Mathematics

GMA; (4) Grade 5 Science GMA; (5) Grade 8 Science GMA, and (6) Grade 5 Social Studies GMA. These six datasets did not show significant evidence of an association between teacher certification and student achievement. In the case of the Grade 5 Social Studies GMA, it is important to note the size (n) of the dataset was small enough to warrant exclusion from chi-square testing and data review. The n for students taught by OOF teachers was two, while the n for OOF teachers was one. The Grade 5 Science GMA also had a small n for students taught by OOF teachers, at 24, and the n for OOF teachers was two. The 18 datasets within the grade-level and subject-area group that rejected the null hypothesis showed that there was significant evidence of an association between teacher certification type and student achievement; those datasets were: (1) Grade 3 English Language Arts GMA; (2) Grade 4 English Language Arts GMA; (3) Grade 5 English Language Arts GMA; (4) Grade 7 English Language Arts GMA; (5) Grade 8 English Language Arts GMA; (6) Ninth-Grade Literature and Composition GMA; (7) American Literature and Composition GMA; (8) Grade 4 Mathematics GMA; (9) Grade 6 Mathematics GMA; (10) Grade 7 Mathematics GMA; (11) Grade 8 Mathematics GMA; (12) Coordinate Algebra GMA; (13) Analytic Geometry GMA; (14) Biology GMA; (15) Physical Science GMA; (16) Grade 8 Social Studies GMA; (17) U.S. History GMA; and (18) Economics/Business/Free Enterprise GMA.

Overall, a total of 42 datasets were reviewed and tested using the chi-square test. Of these, 35 rejected the null hypothesis, since in each case the p value was lower than the alpha value. By rejecting the null hypothesis, these datasets showed significant evidence of an association between teacher certificate type and student achievement. The below is a list of the 35 datasets rejecting the null hypothesis:

- All GMAs administered in 2017, 2018, and 2019
- All Elementary-Level GMAs
- All Middle School Grade-Level GMAs
- All High School GMAs
- All GMAs administered during 2017
- All GMAs administered during 2018
- All GMAs administered during 2019
- All English Language Arts GMAs
- All Mathematics GMAs
- All Science GMAs
- All Social Studies GMAs
- All Grade 4 GMAs
- All Grade 5 GMAs
- All Grade 6 GMAs
- All Grade 7 GMAs
- All Grade 8 GMAs
- All High School GMAs (Grades 9–12)
- Grade 3 English Language Arts GMA
- Grade 4 English Language Arts GMA
- Grade 5 English Language Arts GMA
- Grade 7 English Language Arts GMA
- Grade 8 English Language Arts GMA
- Ninth-Grade Literature & Composition GMA

- American Literature & Composition GMA
- Grade 4 Mathematics GMA
- Grade 6 Mathematics GMA
- Grade 7 Mathematics GMA
- Grade 8 Mathematics GMA
- Coordinate Algebra GMA
- Analytic Geometry GMA
- Biology GMA
- Physical Science GMA
- Grade 8 Social Studies GMA
- U.S. History GMA
- Economics GMA

Seven datasets failed to reject the null hypothesis, meaning there was no significant evidence of an association between teacher certification type and student achievement.

The list below details the datasets that failed to reject the null hypothesis:

- All Grade 3 GMAs
- Grade 6 English Language Arts GMA
- Grade 3 Mathematics GMA
- Grade 5 Mathematics GMA
- Grade 5 Science GMA
- Grade 8 Science GMA
- Grade 5 Social Studies GMA

Conclusion

The purpose of this study was to determine whether teacher certification type had an impact on student achievement. The overall dataset for the study consisted of all Georgia Milestone Assessments administered during the 2017, 2018, and 2019 school years. Based on review of data and chi-square testing, the findings indicates that teacher certification does have an impact on student achievement.

Chapter V

Discussion

The results of this study suggest that teacher certification type has an impact on student achievement. The study analyzed student achievement results on Georgia Milestone Assessments by teacher certification type (in-field or out-of-field) from a school district in Georgia for the 2017, 2018, and 2019 school years. This chapter offers a summary of the study purpose and methodology and discusses the findings.

Study Purpose

The purpose of this study was to determine if teacher certification type had an impact on student achievement. The research question, hypothesis, and null hypothesis were as follows:

- Research Question: Does teacher certification type have an impact on student achievement?
- Hypothesis: Students taught by teachers with out-of-field certification will have lower achievement-level scores on Georgia Milestone Assessments than students who were taught by teachers with in-field certification.
- Null hypothesis: There is no association between teacher certification type and student achievement levels on Georgia Milestone Assessments.
- Alternate hypothesis: There is an association between teacher certification type and student achievement levels on Georgia Milestone Assessments.

In this study, teachers were organized into two groups based on certification type: in-field and out-of-field. To qualify as IF, the teacher was required to teach the subject/grade level in which they held certification. Teachers were categorized as OOF if they taught subjects/grade levels in which they did not hold certification or if they held non-teaching certificates/degrees. In Georgia, educator certification requirements are established by the Georgia Professional Standards Commission, which determines teacher certification classification based on data reported by each public school district.

Students included in this study were organized into groups based on whether their teachers were classified as IF or OOF and on their achievement-level score on the GMAs. The achievement levels—Beginning Learner, Developing Learner, Proficient Learner, and Distinguished Learner—are used to classify students based on how well they perform on the GMAs. The Beginning Learner achievement level indicates the student has not yet demonstrated proficiency in the knowledge and skills necessary at the current grade level or in the current subject area. The Developing Learner achievement level indicates that the student demonstrates partial proficiency in the skills and knowledge necessary at the current grade level or in the subject area. A student in the Proficient Learner achievement level demonstrates the necessary skills and knowledge at the current grade level or in the subject area. The Distinguished Learner achievement level demonstrates advanced levels of proficiency in the knowledge and skills necessary at the current grade level or in the subject area. A student's achievement level is determined by their scale score on the GMAs. Scale score ranges vary by school year, subject area, and grade level. Appendix C includes the test score ranges and cut scores for the GMAs.

The GMAs provide information on how well students are mastering the state-adopted content standards by assessing core content areas such as English language arts, mathematics, science, and social studies. The GMA system consists of end-of-grade measures for students in Grades 3 through 8 enrolled in English Language Arts and Mathematics. Students in Grade 5 and Grade 8 are also assessed in Science and Social Studies. The GMAs also assess high school students enrolled in specific courses utilizing end-of-course measures. The end-of-course assessments are administered at the completion of the course regardless of the student's grade level. The end-of-course assessments are administered in the following courses: Ninth-Grade Literature and Composition, American Literature and Composition, Coordinate Algebra, Analytic Geometry, Biology, Physical Science, U.S. History, and Economics/Business/Free Enterprise.

Review of the Methodology

This study analyzed data from a Georgia public school district pertaining to teacher certification type and student achievement scores on the GMAs for school years 2017, 2018, and 2019. This study utilized a quantitative research approach since it examined the relationship between teacher certification type and student achievement scores. The study data were collected in Microsoft Excel format from the school district. The researcher received the following Excel data templates:

- In-field/out-of-field report
 - School year, staff number, course name, course department, and certificate status (in-field or out-of-field)

- Teacher schedules
 - School year, teacher staff number, course number, section number, course name, course department, and number of students enrolled
- Student schedules
 - School year, student ID number, student grade level, course number, section number, course name, course department, and teacher staff number
- Georgia Milestone Achievement scores
 - School year, student ID number, student grade level, assessment name/content area, student scale score, and student achievement level earned

Once the data templates were received, the researcher used Microsoft Access to combine the data files to create a database for data analysis. During the data analysis, the researcher divided the data into different datasets by school level, school year, subject area, grade level, and by grade level and subject area combined. The analysis led to the creation of 42 datasets.

The researcher applied the chi-square test to each of the 42 datasets to determine statistical significance. The chi-square test provided the researcher with information pertaining to the association between teacher certification type and student achievement scores. Of the 42 datasets tested with the chi-square test, 35 showed statistical significance; that is, 35 of the datasets demonstrated significant evidence of an association between teacher certification type and student achievement levels on GMAs. Seven of the 42 datasets did not show statistical significance, meaning that there was

insufficient evidence of an association between teacher certification type and student achievement levels on GMAs.

Discussion of Findings

This study aimed to determine whether teacher certification type had an impact on student achievement. Teacher certification type was divided into two types: in-field and out-of-field. Teachers are considered in-field if they teach subjects and/or grade levels in the area in which they hold certification. Teachers are considered out-of-field if they teach subjects and/or grade levels in which they do not hold certification; teachers are also considered out-of-field if they hold non-teaching certificates. For the purpose of this study, student achievement was measured by the student's score on the GMAs, which comprise four achievement levels: Beginning Learner, Developing Learner, Proficient Learner, and Distinguished Learner. The meaning of each achievement level is defined below:

- Beginning Learner: learners scoring in this range do not yet demonstrate proficiency in the knowledge and skills necessary at this grade level/course of learning, as specified in Georgia's content standards.
- Developing Learner: learners scoring in this range demonstrate partial proficiency in the knowledge and skills necessary at this grade level/course of learning, as specified in Georgia's content standards.
- Proficient Learner: learners scoring in this range demonstrate proficiency in the knowledge and skills necessary at this grade level/course of learning, as specified in Georgia's content standards.

- Distinguished Learner: learners scoring in this range demonstrate advanced proficiency in the knowledge and skills necessary at this grade level/course of learning, as specified in Georgia’s content standards.

The GMAs comprise assessments by subject area and grade level. The GMAs administered during school years 2017, 2018, and 2019 included the following:

- End of Grade Milestones (Elementary and Middle School Assessments)
 - Grade 3 English Language Arts
 - Grade 3 Mathematics
 - Grade 4 English Language Arts
 - Grade 4 Mathematics
 - Grade 5 English Language Arts
 - Grade 5 Mathematics
 - Grade 5 Science
 - Grade 5 Social Studies
 - Grade 6 English Language Arts
 - Grade 6 Mathematics
 - Grade 7 English Language Arts
 - Grade 7 Mathematics
 - Grade 8 English Language Arts
 - Grade 8 Mathematics
 - Grade 8 Science
 - Grade 8 Social Studies

- End of Course Milestones (High School Assessments)
 - Ninth-Grade Literature and Composition
 - American Literature and Composition
 - Coordinate Algebra or Algebra I
 - Analytic Geometry or Geometry
 - Biology
 - Physical Science
 - U.S History
 - Economics/Business/Free Enterprise

To analyze the data and address the study’s research question, the researcher grouped the results into a total of 42 datasets. The dataset groupings were as follows:

- Overall: a dataset comprising all GMAs administered during the 2017, 2018, and 2019 school years.
- School level: comprising three datasets divided into groups based on grade level:
 - Elementary school grade-level GMAs administered in 2017, 2018, and 2019
 - Middle school grade-level GMAs administered in 2017, 2018, and 2019
 - High school grade-level GMAs administered in 2017, 2018, and 2019
- School year: comprising three datasets divided into groups based on the school year of administration:

- All GMAs administered during school year 2017
- All GMAs administered during school year 2018
- All GMAs administered during school year 2019
- Subject area: comprising four datasets divided into groups based on subject area:
 - All English language arts GMAs administered in 2017, 2018, and 2019
 - All mathematics GMAs administered in 2017, 2018, and 2019
 - All science GMAs administered in 2017, 2018, and 2019
 - All social studies GMAs administered in 2017, 2018, and 2019
- Grade level: comprising seven datasets divided into groups based on grade level:
 - All Grade 3 GMAs administered in 2017, 2018, and 2019
 - All Grade 4 GMAs administered in 2017, 2018, and 2019
 - All Grade 5 GMAs administered in 2017, 2018, and 2019
 - All Grade 6 GMAs administered in 2017, 2018, and 2019
 - All Grade 7 GMAs administered in 2017, 2018, and 2019
 - All Grade 8 GMAs administered in 2017, 2018, and 2019
 - All high school-level GMAs administered in 2017, 2018, and 2019
- Grade level and subject area: comprising 24 datasets divided into groups by grade level and assessment subject:
 - Grade 3 English Language Arts GMA administered in 2017, 2018, and 2019

- Grade 4 English Language Arts GMA administered in 2017, 2018, and 2019
- Grade 5 English Language Arts GMA administered in 2017, 2018, and 2019
- Grade 6 English Language Arts GMA administered in 2017, 2018, and 2019
- Grade 7 English Language Arts GMA administered in 2017, 2018, and 2019
- Grade 8 English Language Arts GMA administered in 2017, 2018, and 2019
- Ninth-Grade Literature and Composition GMA administered in 2017, 2018, and 2019
- American Literature and Composition GMA administered in 2017, 2018, and 2019
- Grade 3 Mathematics GMA administered in 2017, 2018, and 2019
- Grade 4 Mathematics GMA administered in 2017, 2018, and 2019
- Grade 5 Mathematics GMA administered in 2017, 2018, and 2019
- Grade 6 Mathematics GMA administered in 2017, 2018, and 2019
- Grade 7 Mathematics GMA administered in 2017, 2018, and 2019
- Grade 8 Mathematics GMA administered in 2017, 2018, and 2019
- Coordinate Algebra GMA administered in 2017, 2018, and 2019
- Analytic Geometry GMA administered in 2017, 2018, and 2019
- Grade 5 Science GMA administered in 2017, 2018, and 2019

- Grade 8 Science GMA administered in 2017, 2018, and 2019
- Biology GMA administered in 2017, 2018, and 2019
- Physical Science GMA administered in 2017, 2018, and 2019
- Grade 5 Social Studies GMA administered in 2017, 2018, and 2019
- Grade 8 Social Studies GMA administered in 2017, 2018, and 2019
- U.S. History GMA administered in 2017, 2018, and 2019
- Economics GMA administered in 2017, 2018, and 2019

The chi-square test was applied to the preceding datasets to determine the status of the null hypothesis. Of the 42 datasets tested, 35 rejected the null hypothesis, while seven failed to reject the null hypothesis. The following datasets rejected the null hypothesis:

- All GMAs administered in 2017, 2018, and 2019
- Elementary school grade-level GMAs administered in 2017, 2018, and 2019
- Middle school grade-level GMAs administered in 2017, 2018, and 2019
- High school grade-level GMAs administered in 2017, 2018, and 2019
- All GMAs administered during school year 2017
- All GMAs administered during school year 2018
- All GMAs administered during school year 2019
- All English language arts GMAs administered in 2017, 2018, and 2019
- All mathematics GMAs administered in 2017, 2018, and 2019
- All science GMAs administered in 2017, 2018, and 2019
- All social studies GMAs administered in 2017, 2018, and 2019
- All Grade 4 GMAs administered in 2017, 2018, and 2019
- All Grade 5 GMAs administered in 2017, 2018, and 2019

- All Grade 6 GMAs administered in 2017, 2018, and 2019
- All Grade 7 GMAs administered in 2017, 2018, and 2019
- All Grade 8 GMAs administered in 2017, 2018, and 2019
- All high school-level GMAs administered in 2017, 2018, and 2019
- Grade 3 English Language Arts GMA administered in 2017, 2018, and 2019
- Grade 4 English Language Arts GMA administered in 2017, 2018, and 2019
- Grade 5 English Language Arts GMA administered in 2017, 2018, and 2019
- Grade 7 English Language Arts GMA administered in 2017, 2018, and 2019
- Grade 8 English Language Arts GMA administered in 2017, 2018, and 2019
- Ninth-Grade Literature and Composition GMA administered in 2017, 2018, and 2019
- American Literature and Composition GMA administered in 2017, 2018, and 2019
- Grade 4 Mathematics GMA administered in 2017, 2018, and 2019
- Grade 6 Mathematics GMA administered in 2017, 2018, and 2019
- Grade 7 Mathematics GMA administered in 2017, 2018, and 2019
- Grade 8 Mathematics GMA administered in 2017, 2018, and 2019
- Coordinate Algebra GMA administered in 2017, 2018, and 2019
- Analytic Geometry GMA administered in 2017, 2018, and 2019
- Biology GMA administered in 2017, 2018, and 2019
- Physical Science GMA administered in 2017, 2018, and 2019
- Grade 8 Social Studies GMA administered in 2017, 2018, and 2019

- U.S. History GMA administered in 2017, 2018, and 2019
- Economics GMA administered in 2017, 2018, and 2019

The 35 datasets rejecting the null hypothesis proved that there is an association between teacher certification type and student achievement.

The seven datasets that failed to reject the null hypothesis were:

- All Grade 3 GMAs administered in 2017, 2018, and 2019
- Grade 6 English Language Arts GMA administered in 2017, 2018, and 2019
- Grade 3 Mathematics GMA administered in 2017, 2018, and 2019
- Grade 5 Mathematics GMA administered in 2017, 2018, and 2019
- Grade 5 Science GMA administered in 2017, 2018, and 2019
- Grade 8 Science GMA administered in 2017, 2018, and 2019
- Grade 5 Social Studies GMA administered in 2017, 2018, and 2019.

The failure of these seven datasets to reject the null hypothesis suggests that there is not an association between teacher certification type and student achievement.

To determine why these seven datasets failed to reject the null hypothesis, the researcher reviewed the chi-square test calculations. In the dataset for all Grade 3 GMAs, the chi-square value was 3.6846; degrees of freedom were equal to 3; the p value was .2976, and the alpha level was .05. The “All Grade 3 GMAs” dataset failed to reject the null hypothesis based on a low calculated chi-square statistic, which indicates little to no difference between observed and expected frequencies. The dataset for the Grade 6 English Language Arts GMA also failed to reject the null hypothesis due to a low calculated chi-square statistic, with a chi-square value of 6.592, degrees of freedom equaling 3, a p value of .0861, and an alpha level equal to .05. The chi-square calculated

results for the Grade 3 Mathematics GMA were: chi-square value equal to 3.2595, degrees of freedom equal to 3, p value equal to .35332, and alpha level equal to .05. The low calculated chi-square value for the Grade 3 Mathematics GMA led to the dataset failing to reject the null hypothesis. Likewise, the Grade 5 Mathematics GMA dataset failed to reject the null hypothesis due to a low calculated chi-square statistic: chi-square value equal to 4.0182, degrees of freedom equal to 3, p value equal to .25951, and alpha level equal to .05. The dataset for the Grade 5 Science GMA failed to reject the null hypothesis because one of the expected values for OOF teachers was less than 5 and due to a low calculated chi-square statistic. Table 19 displays the observed data for the Grade 5 Science GMA dataset, and Table 20 showed the expected data.

Table 19

Observed Data for the Grade 5 Science GMA

Teacher Certification	Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
In-Field Teachers	3,178	2,749	2,458	729
Out-of-Field Teachers	8	11	4	1

Table 20

Expected Data for the Grade 5 Science GMA

Teacher Certification	Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
In-Field Teachers	3,178	2,753	2,456	728
Out-of-Field Teachers	8	7	6	2

The calculations for the Grade 5 Science GMA dataset were as follows: chi-square value equal to 3.3455, degrees of freedom equal to 3, p value equal to .34136, and

alpha level equal to .05. The Grade 8 Science GMA dataset failed to reject the null hypothesis due to a low calculated chi-square statistic: chi-square value equal to 3.803, degrees of freedom equal to 3, p value equal to .28354, and alpha level equal to .05. The Grade 5 Social Studies GMA dataset failed to reject the null hypothesis due to several factors, including a low n for OOF teachers, expected values for OOF teachers being less than 5, and a low chi-square statistic. In the dataset for the Grade 5 Social Studies GMA, the total n for IF teachers was 7,752, and the total n for OOF teachers was 2. The observed data for the Grade 5 Social Studies GMA dataset are shown in Table 21, and the expected data are shown in Table 22. The chi-square calculations for the Grade 5 Social Studies GMA dataset were as follows: chi-square value equal to 1.0201, degrees of freedom equal to 3, p value equal to .7964, and alpha level equal to .05.

Table 21

Observed Data for the Grade 5 Social Studies GMA

Teacher Certification	Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
In-Field Teachers	1,967	3,692	1,486	607
Out-of-Field Teachers	1	1	0	0

Table 22

Expected Data for the Grade 5 Social Studies GMA

Teacher Certification	Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
In-Field Teachers	1,967	3,692	1,486	607
Out-of-Field Teachers	1	1	0	0

After determining the statistical reasons for why these seven datasets failed to reject the null hypothesis, the researcher considered other potential reasons for the failure to reject. For instance, the dataset for the Grade 3 GMAs administered in 2017, 2018, and 2019 may have failed to reject the null hypothesis because of collaborative planning among the third-grade teachers. Collaborative grade-level planning can lead to professional development and can serve as a mentoring opportunity between IF and OOF teachers. Collaborative planning can improve instruction, helping both IF and OOF teachers to ensure that lesson plans and teaching strategies are aligned with grade-level standards. Collaborative planning can contribute to higher achievement scores on the GMAs, thus causing the dataset to fail to reject the null hypothesis. Higher achievement levels on Grade 3 GMAs may have been the result of coaching and/or mentoring of OOF teachers by IF teachers at the school or district level, resulting in the development of OOF teacher content knowledge or pedagogical skills. The failure of the Grade 3 GMAs dataset to reject the null hypothesis could also be associated with the content taught in the third grade; that is, the Grade 3 content could be less specific and easier than the content in higher grade levels. Third-grade teachers typically teach all subject areas (English language arts, mathematics, science, and social studies) instead of specializing in a specific area like middle school and high school teachers, thus leading to differences in the schedule structure, time constraints for instruction by subject area, and curriculum knowledge needed for each subject. The content taught in Grade 3 is more baseline than the content taught, for instance, in Ninth-Grade Literature and Composition or Analytic Geometry.

Another dataset that failed to reject the null hypothesis was the Grade 3 Mathematics GMA. During the 2017, 2018, and 2019 school years, Georgia third-grade mathematics was based on common core standards. The Grade 3 Mathematics standards focused on four areas: (1) multiplication and division, (2) fractions, (3) rectangular arrays and area, and (4) two-dimensional shapes. The Grade 3 Mathematics GMA dataset may have failed to reject the null hypothesis due to the ease of the content standards taught; that is, the standards may be such that anyone with a mathematics background could teach Grade 3 Mathematics with ease.

The only Grade 5 datasets to reject the null hypothesis were those for all Grade 5 GMAs and the Grade 5 English Language Arts GMA. The Grade 5 Mathematics, Science, and Social Studies datasets failed to reject the null hypothesis, thus indicating no association between teacher certification type and student achievement. The Grade 5 Mathematics dataset might have failed to reject the null hypothesis for the same or similar reasons why the Grade 3 Mathematics dataset failed to reject the null hypothesis. The curriculum standards covered in Grade 5 Mathematics during the 2017, 2018, and 2019 school years focused on (1) whole numbers, (2) decimals, (3) fractions, (4) measurement, and (5) patterns. In Grade 5 Mathematics, the standards for whole numbers include students learning to add, subtract, multiply, and divide multi-digit whole numbers. The standards for decimals within the Grade 5 Mathematics curriculum involve students learning to perform all operations with decimals to the hundredths place and to divide by powers of 10. The Grade 5 Mathematics standards for fractions focus on students learning how to add, subtract, multiply, and divide fractions and mixed numbers. The measurement standards teach students how to measure time, objects, and volume.

The standards for patterns in the Grade 5 Mathematics curriculum involve learning how to analyze patterns and relationships. The content standards taught in Grade 5 Mathematics are standards that most, if not all, individuals with a college degree would be expected to know. Another factor leading to the failure of the Grade 3 and Grade 5 Mathematics datasets to reject the null hypothesis could relate to common planning for grade-level and subject-area teachers. Common planning by grade level and subject area supports more quality peer-to-peer mentoring, lesson planning, and development of teaching strategies.

The Grade 5 Science dataset also failed to reject the null hypothesis. One of the main factors contributing to this failure to reject was the small n for students taught by out-of-field teachers. Another reason could relate to the OOF teachers' basic knowledge of the Grade 5 Science standards and curriculum, which focus on (1) identifying causes of Earth's surface features, (2) explaining the difference between a physical change and a chemical change, (3) investigating electricity, magnetism, and the relationship between the two, (4) using scientific procedures to classify organisms, (5) understanding the differences in behaviors and traits, (6) contrasting parts of animal cells and plant cells, and (6) learning how microorganisms can be beneficial and/or harmful to other organisms. The researcher argues that the main reason the Grade 5 Science dataset failed to reject the null hypothesis was due to the small number of OOF Grade 5 Science teachers during the 2017, 2018, and 2019 school years.

The last elementary-level dataset that failed to reject the null hypothesis was Grade 5 Social Studies. The n for the Grade 5 Social Studies dataset was so small that neither a true comparison nor a statistical analysis could be performed. The small n was

likely the primary reason the Grade 5 Social Studies dataset failed to reject the null hypothesis, leading to the conclusion that, for this GMA, there was not an association between teacher certification type and student achievement.

The other two datasets that failed to reject the null hypothesis were Grade 6 English Language Arts and Grade 8 Science. The standards of Grade 6 English Language Arts GMA center on the student's ability to read, write, and analyze text. The reading standards focus on the student's ability to (1) analyze literature, nonfiction books, articles, primary sources, and secondary courses, (2) comprehend and analyze text, and (3) utilize evidence from the text to support claims. The writing standard focuses on the student's ability to write essays that demonstrate effective argumentation, show an understanding of author bias, and tailor prose for maximum impact. The analysis of text standards focus on the student's ability to (1) integrate information from multiple texts on the same topic and (2) explain how the author utilizes reasons and evidence to support points within the text. The researcher believes that the reasons the Grade 6 English Language Arts dataset failed to reject the null hypothesis were more student based than teacher based. In Grade 6 English Language Arts, students are first introduced to the standards related to analysis of text as well as the integration of information from multiple texts on the same topic. Comparing students' achievement-level scores on the Grade 6 English Language Arts GMA with student scores on the Grade 5 English Language Arts GMA, showed that the percentage of students scoring at the Beginning Learner level was larger for Grade 6 English Language Arts than Grade 5 ELA. The ability of students to analyze text correctly could be the reason why the Grade 5 ELA dataset failed to reject the null hypothesis.

The seventh dataset to fail to reject the null hypothesis was the Grade 8 Science GMA. This failure to reject could be attributable to the fact that a majority of the eighth-grade students were enrolled in high school physical science courses instead of Grade 8 Science. The researcher believes that the students enrolled in the Grade 8 science courses are typically lower-level learners such as students with disabilities and/or English language learners. Lower achievement scores in the Grade 8 Science dataset may have been a result of student enrollment in the Physical Science course. All eighth-grade students were required to take the Grade 8 Science GMA even though they were taught physical science course standards throughout the school year. The standards taught in Grade 8 Science and assessed on the Grade 8 Science GMA focus on obtaining, evaluating, and communicating information about (1) the structure and properties of matter; (2) the law of conservation of energy to develop arguments that energy can transform from one form to another within a system; (3) cause and effect relationships between force, mass, and the motion of objects; (4) supporting the claim that electromagnetic (light) waves behave differently than mechanical (sound) waves; and (5) gravity, electricity, and magnetism as major natural forces. The standards taught in high school physical science courses and assessed on the Physical Science GMA focus on obtaining, evaluating, and communicating information that explains or supports (1) the Periodic Table regarding the relative properties of elements based on patterns of atomic structure; (2) how atoms bond to form stable compounds; (3) the Law of Conservation of Matter; (4) the changes in nuclear structure as a result of fission, fusion, and radioactive decay; (5) the phases of matter as it relates to atomic and molecular motion; (6) the properties of solutions; (7) transformations and flow of energy within a system; (7) the

relationships among force, mass, and motion; (8) the properties of waves; and (9) the properties of and relationships between electricity and magnetism. The differences between the course content and standards for Grade 8 Science and High School Physical Science are enough to cause eighth-grade students to score lower on the Grade 8 Science GMA regardless of teacher certification type—thus providing no evidence of a relationship between teacher certification type and student achievement.

Notably, none of the seven datasets that failed to reject the null hypothesis was a high school-level GMA: All seven were associated with elementary and middle school grade levels. All the high school grade-level assessments showed an association between teacher certification type and student achievement. The researcher believes that all the high school GMAs rejected the null hypothesis because of a direct correlation with teacher certification type. Teachers pursuing certification through a teaching program obtain the skills, knowledge, and experience needed to impact student achievement. Education degrees earned from universities, content-specific advanced degrees, or certificated through the Georgia TAPS Program are designed to prepare teachers for content mastery and to teach/communicate that content to students. Teacher preparatory programs help teachers learn how to provide differentiated instruction based on learner types, classroom management skills, and skills necessary to monitor student achievement. When conducting the study, the researcher expected all 42 datasets to reject the null hypothesis, thus making it easy to prove that teacher certification type is important to student achievement.

Conclusion

The results of the study indicate that teacher certification type does in fact have an impact on student achievement. The data was grouped together in various ways in effort to determine if the status of the null hypothesis. The study contained a total of 42 datasets, of which 35 rejected the null hypothesis and seven failed to reject the null hypothesis. The researcher expected all 42 datasets to reject the null hypothesis. The seven that failed to reject did so for several reasons: from low calculated chi-square statistics to low n for OOF teachers. Of the seven datasets that failed to reject the null hypothesis none were high school-level GMAs; five were elementary-level and two were middle-level. Chapter VI discusses the limitations of the study, recommendations for future research, and overall study conclusions.

Chapter VI

Limitations, Recommendations, and Conclusions

This final chapter describes the study's limitations, proposes recommendations for future research, and offers concluding thoughts. The purpose of this study was to determine if teacher certification type—that is, in-field versus out-of-field certification—had an impact on student achievement. To address the research question set forth in this study, data were collected from a public school district in Georgia for school years 2017, 2018, and 2019. Student achievement scores on the Georgia Milestone Assessments were analyzed by teacher certification type to determine if certification type impacted achievement scores.

Limitations of the Study

Several limitations to the current study must be acknowledged. The first limitation was related to sample size. As noted, the study data came from a single school district in Georgia; thus, the results of the study may not be generalizable to the entire state of Georgia or to the United States. Limiting the research to one school district limited the some variables, such as district size, student demographics, teacher demographics, location/region, and district type (rural, suburban, metro, etc.).

As a second limitation of the study, the only teachers who taught courses assessed by Georgia Milestone Assessments were included in the research. Based on the school years analyzed in the study, only teachers teaching the following grade levels and content areas were included:

- Grade 3 English Language Arts
- Grade 3 Mathematics
- Grade 4 English Language Arts
- Grade 4 Mathematics
- Grade 5 English Language Arts
- Grade 5 Mathematics
- Grade 5 Science
- Grade 5 Social Studies
- Grade 6 English Language Arts
- Grade 6 Mathematics
- Grade 7 English Language Arts
- Grade 7 Mathematics
- Grade 8 English Language Arts
- Grade 8 Mathematics
- Grade 8 Science
- Grade 8 Social Studies
- Ninth-Grade Literature and Composition
- American Literature and Composition
- Coordinate Algebra or Algebra I
- Analytic Geometry or Geometry
- Biology
- Physical Science

- U.S. History
- Economics/Business/Free Enterprise

Future research related to student achievement and teacher certification type should explore instruments and diagnostics for measuring student achievement by teacher type across all grade levels and content areas.

A third study limitation was the inability to encompass the student demographics and learning levels that might have affected achievement level more than teacher type. Thus, future research could focus on student demographics such as type of learner, race/ethnicity, gender, and socioeconomic status. The type of learner refers to whether the student is identified as a gifted learner, an English language learner, and/or a student with disabilities (including the severity of the disability). All these factors could have impacted students' earned achievement level more than the teacher certification type.

Recommendations for Future Research

This study aimed to address the question pertaining to the impact of teacher certification type on student achievement. Due to the limitations of the research and available data, this study's findings offer insights and directions for future research. One such potential area of focus is the experience level of the teacher. Another consideration could be the amount of training, mentoring, and support teachers receive during the school year regardless of certification type. It would also be important to note whether OOF teachers receive the same training, mentoring, and support as IF teachers. The quality of training, mentoring, and support is an additional factor that could play a role in teacher effectiveness.

Future research should also examine the mechanisms for measuring teachers and the impact that improvements in teaching have on student achievement. Regarding teacher improvement, future research should investigate whether certification type plays a role in the level of improvement/achievement. Lastly, an important area of future research is the impact of the COVID-19 pandemic on student achievement. Other studies have detailed significant learning loss as a result of the pandemic. However, investigating this pandemic-related learning loss in tandem with teacher certification type could further the discussion around whether teacher certification is a factor at all.

Conclusion

This study was structured around the research question, Does teacher certification type have an impact on student achievement? To address this question, data from a public school system in Georgia were collected, analyzed, and tested. Teachers in the study were categorized as in-field or out-of-field. An IF teacher is defined as a teacher who teaches a subject/grade level in which they hold certification, while an OOF teacher teaches a subject/grade levels in which they do not hold certification or they hold a non-teaching certificate/degree. To measure student achievement, the study relied on data regarding student achievement levels on the Georgia Milestone Assessments.

The researcher obtained the following data from the Georgia school system for school years 2017, 2018, and 2019: GaPSC in-field/out-of-field teacher lists, teacher schedule files, student schedule files, and GMA results by student. The different data files were combined using Microsoft Access to produce an overall file with teacher certificate ID, teacher certification type, course name, student ID, and GMA achievement level for the specified course/subject. Using the overall file, the data were evaluated, calculated,

and tested using chi-square tests. A chi-square test was performed on 42 different datasets, 35 of which rejected the null hypothesis and seven of which failed to reject the null hypothesis. Table 23 details the 42 datasets and their null hypothesis status.

Table 23

Datasets, with Null Hypothesis Status

Dataset Group	Dataset Name	Null Hypothesis Status
All	All GMAs administered in 2017, 2018, & 2019	Reject
School Level	All elementary-level GMAs	Reject
School Level	All middle school grade-level GMAs	Reject
School Level	All high school GMAs	Reject
School Year	All GMAs administered during 2017	Reject
School Year	All GMAs administered during 2018	Reject
School Year	All GMAs administered during 2019	Reject
Subject	All English language arts GMAs	Reject
Subject	All mathematics GMAs	Reject
Subject	All science GMAs	Reject
Subject	All social studies GMAs	Reject
Grade Level	All Grade 3 GMAs	Fail to Reject
Grade Level	All Grade 4 GMAs	Reject
Grade Level	All Grade 5 GMAs	Reject
Grade Level	All Grade 6 GMAs	Reject
Grade Level	All Grade 7 GMAs	Reject
Grade Level	All Grade 8 GMAs	Reject
Grade Level	All high school GMAs (Grades 9–12)	Reject
Grade Level and Subject	Grade 3 English Language Arts GMA	Reject
Grade Level and Subject	Grade 4 English Language Arts GMA	Reject
Grade Level and Subject	Grade 5 English Language Arts GMA	Reject
Grade Level and Subject	Grade 6 English Language Arts GMA	Fail to Reject

Dataset Group	Dataset Name	Null Hypothesis Status
Grade Level and Subject	Grade 7 English Language Arts GMA	Reject
Grade Level and Subject	Grade 8 English Language Arts GMA	Reject
Grade Level and Subject	Ninth-Grade Literature & Composition GMA	Reject
Grade Level and Subject	American Literature & Composition GMA	Reject
Grade Level and Subject	Grade 3 Mathematics GMA	Fail to Reject
Grade Level and Subject	Grade 4 Mathematics GMA	Reject
Grade Level and Subject	Grade 5 Mathematics GMA	Fail to Reject
Grade Level and Subject	Grade 6 Mathematics GMA	Reject
Grade Level and Subject	Grade 7 Mathematics GMA	Reject
Grade Level and Subject	Grade 8 Mathematics GMA	Reject
Grade Level and Subject	Coordinate Algebra GMA	Reject
Grade Level and Subject	Analytic Geometry GMA	Reject
Grade Level and Subject	Grade 5 Science GMA	Fail to Reject
Grade Level and Subject	Grade 8 Science GMA	Fail to Reject
Grade Level and Subject	Biology GMA	Reject
Grade Level and Subject	Physical Science GMA	Reject
Grade Level and Subject	Grade 5 Social Studies GMA	Fail to Reject
Grade Level and Subject	Grade 8 Social Studies GMA	Reject
Grade Level and Subject	U.S. History GMA	Reject
Grade Level and Subject	Economics/Business/Free Enterprise GMA	Reject

The overall dataset for the study was the conglomerative set of achievement-level results by teacher certification type for all GMAs administered for the Georgia school district during the 2017, 2018, and 2019 school years. This conglomeration of data rejected the null hypothesis since the p value of .000002 was lower than the alpha level of .05. This dataset shows significant evidence of an association between teacher certification type and student achievement.

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Appendix A:

EOG/EOC Milestone Assessment Achievement-Level Descriptors

Appendix Table 1

Grade 3: Achievement-Level Descriptors for English Language Arts and Mathematics

	Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
English Language Arts	<p>In general, your child can:</p> <ul style="list-style-type: none"> • read texts below grade level • write simple narrative, opinion, or informative/explanatory pieces • conduct simple, short research projects 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • read and explain texts near grade level • write loosely organized narrative, opinion, or informative/explanatory pieces with limited details or reasons • conduct simple, short research projects, building limited knowledge about topics 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • read and explain complex texts at grade level • write narrative, opinion, or informative/explanatory pieces with supporting details or reasons and clear organization that links information together • conduct short research projects, building knowledge about topics 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • read and analyze complex texts at grade level or above • write multi-paragraph narrative, opinion, or informative/explanatory pieces using effective details or reasons • conduct complex research projects, building extensive knowledge about topics
Mathematics	<p>In general, your child can:</p> <ul style="list-style-type: none"> • add and subtract whole numbers • solve one-step word problems using addition and subtraction • find the next number in a pattern • understand place value • tell and write time to the nearest 5 minutes • recognize quadrilaterals and partition shapes into halves • recognize standard units of measure • recognize fractions as part of a whole 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • add and subtract numbers to 1,000 • solve one-step problems using addition, subtraction, and multiplication • extend number patterns • tell and write time to the minute • measure length to the whole unit • identify features of two-dimensional objects • represent unit fractions as equal parts of a whole • interpret data in picture and bar graphs to solve problems • find the area and perimeter of rectangles with given side lengths • recognize that shapes fit into different categories • partition shapes into equal parts 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • add and subtract fluently • multiply whole numbers by multiples of ten • solve two-step word problems using addition, subtraction, multiplication, and division • find unknowns in multiplication and division equations • use place value relationships to round numbers • compare fractions with the same numerator or denominator • measure length to the nearest quarter of a unit • create bar graphs, pictographs, and line plots from given data • categorize shapes 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • identify arithmetic patterns with multiple rules • recognize that each place value, left to right, is ten times the one before it • multiply multiples of ten by each other • understand fractions that are equal, compare fractions, and add and subtract fractions • measure elapsed time • measure and estimate length, volume, and mass • interpret line plots • recognize patterns between area and perimeter • recognize characteristics of two-dimensional objects

Note. Source: GaDOE (2020).

Appendix Table 2

Grade 4: Achievement-Level Descriptors for English Language Arts and Mathematics

	Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
English Language Arts	<p>In general, your child can:</p> <ul style="list-style-type: none"> • read texts below grade level • write simple narrative, opinion, or informative/explanatory pieces • conduct research, providing irrelevant evidence or categorizing evidence incorrectly 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • read and explain texts near grade level • write loosely organized narrative, opinion, or informative/explanatory pieces using limited facts, details, or reasons • conduct research, providing and categorizing some evidence correctly 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • read and explain complex texts at grade level • write opinion and informative/explanatory pieces that clearly link ideas, facts, or reasons • write narratives with developed characters and descriptive details • conduct short research projects, categorizing relevant evidence into provided categories 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • read and analyze complex texts at grade level or above • write multi-paragraph opinion and informative/explanatory pieces with many relevant facts, reasons, or details • write engaging narratives with effective details and a strong sense of closure • conduct short research projects, analyzing and categorizing relevant evidence into proper categories
Mathematics	<p>In general, your child can:</p> <ul style="list-style-type: none"> • add and subtract up to three digits • solve simple, one-step word problems by adding, subtracting, or multiplying • find all factor pairs up to 24 • read and write numbers using place value • distinguish between larger and smaller units of measure • compare fractions with like denominators • identify data in line plots • recognize angles • draw points and line segments • identify two-dimensional shapes • recognize shapes with symmetry 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • add and subtract fluently • solve one-step word problems by multiplying and dividing • find all factor pairs up to 48 • find two-digit, whole number quotients • compare numbers using place value • read and write numbers in expanded form • add and subtract fractions with like denominators • convert units of measurement by multiplying • find area of rectangles • draw line plots to show data • draw and identify points, lines, and angles • classify two-dimensional shapes • identify lines of symmetry 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • add, subtract, and multiply fluently • solve multistep word problems • find factor pairs • interpret remainders when dividing • find rules of number and shape patterns • use place value to order and compare numbers • solve word problems involving fractions, angles, converting measurement, or using data • find equivalent fractions • compare two decimals • draw and recognize parallel and perpendicular lines in shapes • draw lines of symmetry 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • add, subtract, multiply, and divide fluently • create number and shape patterns that follow a given rule • recognize remainders as fractional parts • write numbers in expanded form • explain number patterns • round to specific place value • understand, represent, order, and compare fractions • add and subtract mixed numbers with like denominators • order decimals • solve multistep problems in measurement conversion and interpretation of data • recognize right triangles

Note. Source: GaDOE (2020).

Appendix Table 3

Grade 5: Achievement-Level Descriptors for English Language Arts and Mathematics

	Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
English Language Arts	<p>In general, your child can:</p> <ul style="list-style-type: none"> read texts below grade level write simple narrative, opinion, and informative/explanatory pieces using irrelevant facts, reasons, or details conduct research using two sources to investigate a topic 	<p>In general, your child can:</p> <ul style="list-style-type: none"> summarize texts near grade level write loosely organized opinion and informative/explanatory pieces using limited facts, reasons, or details write narratives with simple characters and few details conduct research using several sources to investigate a topic 	<p>In general, your child can:</p> <ul style="list-style-type: none"> determine a theme or main ideas and summarize complex, grade-level texts write opinion and informative/explanatory pieces that clearly link ideas, reasons, facts, or details write narratives with descriptive details and developed characters conduct short research projects to investigate different aspects of a topic 	<p>In general, your child can:</p> <ul style="list-style-type: none"> determine a theme or main ideas and summarize complex, above-grade-level texts write multiparagraph opinion and informative/explanatory pieces with effectively supportive ideas, reasons, facts, or details write well-developed narratives that convey characters, experiences, and events precisely conduct research projects using several sources to analyze information and provide evidence supporting different aspects of a topic
Mathematics	<p>In general, your child can:</p> <ul style="list-style-type: none"> identify the next number in a pattern write one-step numerical expressions recognize place value names add and subtract decimals add and subtract fractions with like denominators perform simple measurement conversions of length find volume of rectangular prisms by counting unit cubes plot points on the coordinate plane identify two-dimensional figures 	<p>In general, your child can:</p> <ul style="list-style-type: none"> identify patterns write simple numerical expressions use grouping symbols read, write, and compare decimals to the tenths multiply multidigit numbers add, subtract, and multiply decimals add and subtract fractions with unlike denominators multiply a fraction by a whole create line plots find volume of rectangular prisms identify ordered pairs create line plots classify shapes 	<p>In general, your child can:</p> <ul style="list-style-type: none"> create a pattern from a rule evaluate numerical expressions graph ordered pairs read, write, and compare decimals to the thousandths multiply and divide multidigit numbers add and subtract mixed numbers add, subtract, multiply, and divide decimals find the area of rectangles with fractional sides divide unit fractions and whole numbers calculate simple conversions of time, volume, and mass interpret line plots classify shapes by hierarchy 	<p>In general, your child can:</p> <ul style="list-style-type: none"> explain patterns and relationships solve multistep word problems involving numerical expressions, adding and subtracting fractions, finding area of rectangles, multiplying mixed numbers, and dividing fractions round decimals fluently add, subtract, multiply, and divide decimals calculate multistep conversions of time, length, volume, and mass find side lengths, given volume graph and interpret real-world data in the first quadrant

Note. Source: GaDOE (2020).

Appendix Table 4

Grade 5: Achievement-Level Descriptors for Social Studies and Science

	Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
Social Studies	In general, your child can: <ul style="list-style-type: none"> • identify key figures from major events in American history (1860-present) • locate important physical features • recognize some citizens' rights and responsibilities • identify some elements of a personal budget • define some economic concepts 	In general, your child can: <ul style="list-style-type: none"> • identify the causes and origins of major events in American history (1860-present) • identify the economic impact of important physical features • describe how a citizen's rights are protected by the Constitution • describe the elements of a personal budget • illustrate historical events using economic concepts 	In general, your child can: <ul style="list-style-type: none"> • describe the consequences of major events in American history (1860-present) • describe important physical features and explain their impact on economics • explain due process in protecting citizens' rights • explain spending and saving decisions as they relate to a personal budget • explain historical events and interactions among consumers, businesses, and government using economic concepts 	In general, your child can: <ul style="list-style-type: none"> • explain and analyze the causes and consequences of major events in American history (1860-present) • analyze the economic impact of important physical features • evaluate spending and saving decisions as they relate to a personal budget • analyze historical events and interactions among consumers, businesses, and government using economic concepts
Science	In general, your child can: <ul style="list-style-type: none"> • identify surface features of Earth • recognize a physical change in a substance • recognize that common objects are made of smaller parts • identify static electricity and recognize that magnets attract and repel • identify an object as a conductor or an insulator • recognize that organisms can be grouped as plants or animals • identify a cell • recognize that offspring can resemble parents • record observations, analyze numeric data and analyze simple scientific experiments 	In general, your child can: <ul style="list-style-type: none"> • differentiate between constructive and destructive processes • identify characteristics of physical and chemical changes • investigate properties of electricity and magnetism • recognize that living things can be classified by similarities • recognize a cell as the basic unit of life and recognize some parts of the cell • understand that microorganisms can be both harmful and beneficial • recognize inherited traits • record scientific investigations, analyze investigations and communicate information 	In general, your child can: <ul style="list-style-type: none"> • identify surface features of Earth formed by constructive and destructive processes • explain the differences between physical and chemical changes • identify properties of electricity and magnetism and their relationship to each other • classify organisms by characteristics and similarities • recognize learned and inherited traits • label parts of plants and cells • explain differences in single- and multi-celled organisms • explain why microorganisms can be harmful and beneficial • accurately record and analyze data and use reasoning to explain observations of scientific events 	In general, your child can: <ul style="list-style-type: none"> • analyze the formation of surface features • recognize mass as the sum of an object's parts • analyze the differences between physical and chemical changes before, during, and after a change • compare, contrast, and explain the relationship between electricity and magnetism • provide supporting evidence when classifying organisms • recognize the role of genes in inherited traits • compare cells and cellular parts • describe how microorganisms benefit or harm other organisms • describe observations using various methods

Note. Source: GaDOE (2020).

Appendix Table 5

Grade 6: Achievement-Level Descriptors for English Language Arts and Mathematics

	Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
English Language Arts	In general, your child can: <ul style="list-style-type: none"> determine a theme or central idea and provide a limited summary of below-grade-level text write simple narrative, argumentative, and informative/explanatory pieces using minimally relevant ideas, reasons, evidence, or details conduct basic research projects to answer simple questions 	In general, your child can: <ul style="list-style-type: none"> describe a theme or central idea and summarize near-grade-level text write argumentative and informative/explanatory pieces, clarifying relationships between effective claims, reasons, ideas, and concepts write narrative pieces using some effective techniques and details conduct basic research projects utilizing several sources 	In general, your child can: <ul style="list-style-type: none"> determine a theme or central idea and summarize grade-level text write argumentative and informative/explanatory pieces that provide conclusions in support of the arguments, information, or explanations presented while establishing and maintaining a formal style write narrative pieces using effective techniques, descriptive details, and a naturally unfolding event sequence conduct short research projects, refocusing the inquiry when appropriate 	In general, your child can: <ul style="list-style-type: none"> analyze a theme or central idea and provide objective summaries of complex, above-grade-level text write argumentative pieces with strong relationships among precise claims and reasons write informative/explanatory pieces using highly relevant content to convey complex ideas and information write narrative pieces using highly effective techniques conduct short research projects to answer complex questions using high-quality sources
Mathematics	In general, your child can: <ul style="list-style-type: none"> identify ratios as fractions, percentages, and rates order positive numbers on a number line identify common multiples read and write expressions with variables add, subtract, and multiply multidigit numbers identify points in the first quadrant solve word problems to find the area of rectangles and the surface area and volume of cubes display data in line plots and histograms 	In general, your child can: <ul style="list-style-type: none"> identify ratios as equivalent fractions divide fractions using visual models fluently add, subtract, and multiply whole numbers identify common factors and multiples of two numbers order positive and negative numbers using a number line read, write, and evaluate expressions with variables solve one-step equations solve word problems to find the area of rectangles and triangles and the surface area and volume of prisms identify 3-D figures represented as nets create box plots 	In general, your child can: <ul style="list-style-type: none"> understand ratios as numerical comparisons divide with decimals divide fractions by fractions find least common multiples and greatest common factors order rational numbers plot points in all four quadrants evaluate expressions with variables and exponents write simple inequalities solve word problems involving area, surface area, and volume find the length of the sides of a polygon in the coordinate plane relate measures of center and measures of spread 	In general, your child can: <ul style="list-style-type: none"> use ratio and proportional reasoning to solve problems divide fractions by decimals and fractions analyze multidigit computation in real-world contexts compare expressions with variables and exponents interpret expressions, equations, and inequalities in real-world contexts solve multistep, real-world problems with polygon areas and volume of 3-D figures determine and explain the appropriate measure of center or variability based on the shape of data and the context of the problem

Note. Source: GaDOE (2020).

Appendix Table 6

Grade 7: Achievement-Level Descriptors for English Language Arts and Mathematics

	Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
English Language Arts	<p>In general, your child can:</p> <ul style="list-style-type: none"> identify a theme or central idea and provide a limited summary of below-grade-level text write arguments with basic reasons to support a claim write basic informative/explanatory pieces using relevant facts or examples write narratives with appropriate details conduct short research projects to answer a question utilizing a source 	<p>In general, your child can:</p> <ul style="list-style-type: none"> describe a theme or central idea and summarize near-grade-level text write arguments with reasons and evidence to support a claim write general informative/explanatory pieces using concrete details write narratives with descriptive details and a naturally unfolding event sequence conduct short research projects utilizing multiple sources and generating additional related questions 	<p>In general, your child can:</p> <ul style="list-style-type: none"> determine multiple themes or central ideas and summarize complex, grade-level text write arguments with clear reasons and relevant evidences, acknowledging alternate or opposing claims write informational texts with analysis of relevant facts and examples write well-structured narratives with relevant details conduct short research projects, generating additional related, focused questions to investigate 	<p>In general, your child can:</p> <ul style="list-style-type: none"> evaluate complex themes or central ideas and provide thorough summaries of above-grade-level text write thoughtful arguments evaluating alternate or opposing claims write precise, well-developed informational texts with analysis of relevant facts and examples write elaborate narratives using a variety of effective techniques conduct short research projects, generating higher-level questions for investigation
Mathematics	<p>In general, your child can:</p> <ul style="list-style-type: none"> identify proportional relationships between equivalent ratios and percentages solve one-step word problems with positive fractions and decimals write a one-step equation to solve a word problem combine like terms in an expression draw and describe polygons identify the vertices, edges, and faces of a rectangular prism understand that a sample set can be used to gain information about a population 	<p>In general, your child can:</p> <ul style="list-style-type: none"> determine proportional relationships in tables and graphs compute and identify unit rates add and subtract rational numbers using visual models add, subtract, multiply, and divide integers convert a fraction to a decimal use properties of operations to create linear expressions solve two-step word problems construct simple geometric figures (such as a line, polygon, circle, or solid) describe surface area of a rectangular prism use formulas to find the area and circumference of circles calculate simple probability 	<p>In general, your child can:</p> <ul style="list-style-type: none"> compare unit rates and recognize equivalent ratios use constant of proportionality to write equations fluently use all four operations with rational numbers solve problems with percentages, absolute value, and properties of operations solve two-step equations and inequalities describe the two-dimensional cross section of a figure solve problems with area, angle measures, surface area, and volume find the probability of compound events 	<p>In general, your child can:</p> <ul style="list-style-type: none"> solve complex and multistep problems using rates and ratios solve multistep, real-world problems using fractions and decimals interchangeably solve multistep word problems with equations and inequalities create and compare geometric figures based on their properties solve multistep problems using angle measures, area, surface area, and volume of composite figures use multiple samples to draw inferences about a population

Note. Source: GaDOE (2020).

Appendix Table 7

Grade 8: Achievement-Level Descriptors for English Language Arts and Mathematics

	Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
English Language Arts	<p>In general, your child can:</p> <ul style="list-style-type: none"> • identify a theme or central idea and provide a summary of below-grade-level text • write basic arguments to support a claim • write basic informational texts to examine a topic and convey information • write simple narratives with vague details • conduct short research projects to answer a question 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • attempt to follow the development of a theme or central idea and provide an objective summary of near-grade-level text • write general arguments to support a claim with reasons and evidence • write general informational texts with relevant facts and examples • write narratives with simple events and limited details • generate additional questions to investigate while conducting short research projects 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • determine a theme or central idea in complex, grade-level text and analyze its development • write arguments and address counterclaims, using clear reasons and relevant evidence • write informational texts with analysis of relevant facts and examples • write structured narratives with descriptive details and well-structured event sequences • generate additional questions to investigate while conducting short research projects 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • assess the strength of ideas that support the central idea and provide a thorough summary of complex, above-grade-level text • write conclusive arguments and address counterclaims with facts and reasoned arguments • write precise, well-developed informational texts with analysis of relevant facts and examples • write descriptive narratives with well-chosen details and precise language • conduct sustained research projects to answer questions or solve problems
Mathematics	<p>In general, your child can:</p> <ul style="list-style-type: none"> • recognize irrational numbers • calculate with a negative-whole-number exponent • represent multiples of ten in scientific notation • identify equivalent ratios • distinguish between relations that are/are not functions • distinguish between congruent and similar figures • recognize single translations, reflections, rotations, and dilations • find the hypotenuse of a right triangle • recognize associations between two sets of data 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • approximate irrational numbers to the nearest whole • express numbers in scientific notation • find the slope of a line • solve simple equations with two variables • identify and define linear functions and use them to model relationships • recognize similarity and congruence and identify a series of transformations • apply Pythagorean Theorem in 2-D figures • describe associations between two sets of data 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • interpret irrational numbers • apply properties of integer exponents and scientific notation • solve linear equations and systems of equations • determine the meaning of the slope of a line • solve linear equation word problems with two variables • evaluate and compare functions • describe a sequence of transformations • apply Pythagorean Theorem and its converse in 2-D figures • find the volume of 3-D figures • investigate associations between two sets of data 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • approximate irrational numbers • interpret properties of integer exponents and scientific notation • solve complex, multistep word problems with systems of linear equations • model relationships using functions • apply Pythagorean Theorem in 3-D figures • analyze congruency and similarity • find volume in real-world problems • analyze patterns of association between two sets of data

Note. Source: GaDOE (2020).

Appendix Table 8

Grade 8: Achievement-Level Descriptors for Social Studies and Science

	Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
Social Studies	<p>In general, your child can:</p> <ul style="list-style-type: none"> • identify significant social, economic, and political developments in Georgia history • locate some important physical features of Georgia • identify some key people and events in Georgia's history • identify the three branches of state or local government under the Georgia constitution • identify some rights of Georgia's juvenile offenders 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • describe significant social, economic, and political developments in Georgia history • locate important physical features of Georgia and identify their impact • describe some key people and events in Georgia's history • describe the three branches of state or local government under the Georgia constitution • identify the rights of Georgia's juvenile offenders and describe consequences for behavior 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • explain significant social, economic, and political developments in Georgia history • describe the impact of important physical features of Georgia • explain the role of key people and events in Georgia's history • explain the organization of state and local governments and the rights and roles of Georgia citizens • describe the rights of Georgia's juvenile offenders and explain consequences for behavior 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • draw connections between significant social, economic, and political developments in Georgia history • analyze the impact of important physical features of Georgia • analyze the role of key people and events in Georgia's history • evaluate and analyze the organization of state and local governments and the rights and roles of Georgia citizens • explain and analyze the rights of Georgia's juvenile offenders and consequences for behavior
Science	<p>In general, your child can:</p> <ul style="list-style-type: none"> • identify solids, liquids, and gases • recognize that elements have different properties • recognize different forms of energy • identify different parts of a wave • determine necessary components to complete an electric circuit • identify the effects of gravity on objects on Earth • use the metric system in scientific investigations • recognize the effect magnets have on each other and other objects • use data to create a simple graph, chart, table, or diagram • recognize safety precautions during scientific investigations 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • identify an atom and a molecule • identify particle arrangements for each phase of matter • explain what a physical and chemical property is • recognize that some elements have similar properties • identify the Law of Conservation of Matter • identify the characteristics of different forms of energy • identify properties of sound • identify types of wave behavior • describe velocity and acceleration • convert measurements into different units • use appropriate tools in scientific investigations • identify scientific information given in graphs and diagrams 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • describe the movement of particles in different states of matter • distinguish between physical and chemical properties of matter • use the Periodic Table of Elements to predict properties of elements • demonstrate the Law of Conservation of Matter • identify electromagnetic and mechanical waves • describe the characteristics and behaviors of waves • compare different forms of energy • recognize that every object exerts gravitational force on other objects • evaluate a scientific claim 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • describe the difference between pure substances and mixtures • explain energy transformations in terms of the Law of Conservation of Energy • explain the relationship between potential and kinetic energy • describe how light waves are manipulated, causing reflection, refraction, diffraction, and absorption • evaluate claims based on scientific observations • calculate metric conversions using dimensional analysis • provide alternate explanations for a scientific observation

Note. Source: GaDOE (2020).

Appendix Table 9

EOC Achievement-Level Descriptors for Ninth-Grade Literature and Composition

	Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
End-of-Course Ninth Grade Literature and Composition	<p>In general, your child can:</p> <ul style="list-style-type: none"> • demonstrate limited reading comprehension of near grade-level texts • determine themes or central ideas in a text • provide a limited summary of a text • write argumentative pieces that establish relationships among claims, reasons, and evidence • write informative/explanatory pieces that loosely organize ideas using some relevant facts, details, or other information • write narratives that demonstrate simple development of real or imagined experiences • conduct short research projects to answer questions or solve problems 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • demonstrate limited reading comprehension of grade-level texts • determine themes or central ideas and describe their development over the course of a text • provide a simple summary of a text • write argumentative pieces that establish relationships among claims, counterclaims, reasons, and evidence • write informative/explanatory pieces that generally organize ideas using relevant facts, details, or other information • write narratives that develop real or imagined experiences using some effective techniques, details, and event sequences • conduct sustained research projects to answer questions, including self-generated questions, or solve problems 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • demonstrate reading comprehension of moderately complex grade-level texts • determine themes or central ideas and analyze their development over the course of a text • provide an objective summary of a text • write argumentative pieces that establish clear relationships among claims, counterclaims, reasons, and evidence • write informative/explanatory pieces that clearly organize complex ideas using well-chosen facts, details, or other information • write narratives that develop real or imagined experiences using effective techniques, well-chosen details, and well-structured event sequences • conduct sustained research projects, synthesizing multiple sources 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • demonstrate reading comprehension of highly complex grade-level texts • critique themes or central ideas and analyze in detail their development over the course of a text • provide a thorough, objective summary of a text • write argumentative pieces that strategically establish clear, strong relationships among claims, counterclaims, reasons, and evidence • write informative/explanatory pieces that strategically organize complex ideas using well-chosen facts, details, or other information • write narratives that completely develop real or imagined experiences using highly effective techniques, strategically well-chosen details, and clear event sequences • conduct sustained research projects, demonstrating thorough understanding of the subjects under investigation

Note. Source: GaDOE (2020).

Appendix Table 10

EOC Achievement Level Descriptors for American Literature and Composition

	Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
End-of-Course American Literature and Composition	<p>In general, your child can:</p> <ul style="list-style-type: none"> demonstrate limited reading comprehension of near grade-level texts determine two themes or central ideas and describe their development over the course of a text provide a simple summary of a text delineate reasoning in important U.S. texts write argumentative pieces that loosely sequence claims, counterclaims, reasons, and evidence write informative/explanatory pieces that loosely organize ideas using some relevant facts, details, or other information write narratives that demonstrate simple development of real or imagined experiences conduct short research projects to answer questions or solve problems 	<p>In general, your child can:</p> <ul style="list-style-type: none"> demonstrate limited reading comprehension of grade-level texts determine two themes or central ideas and analyze their development over the course of a text provide a simple, objective summary of a text evaluate reasoning in important U.S. texts write argumentative pieces that generally sequence claims, counterclaims, reasons, and evidence write informative/explanatory pieces that organize ideas using relevant facts, details, or other information write narratives that develop real or imagined experiences using some effective techniques, details, and event sequences conduct sustained research projects to answer questions, including self-generated questions, or solve problems 	<p>In general, your child can:</p> <ul style="list-style-type: none"> demonstrate reading comprehension of moderately complex grade-level texts analyze how multiple themes or central ideas interact and build on one another provide an objective summary of a text write argumentative pieces that logically sequence claims, counterclaims, reasons, and evidence write informative/explanatory pieces that clearly organize complex ideas using the most relevant facts, details, or other information write narratives that develop real or imagined experiences using effective techniques, well-chosen details, and well-structured event sequences conduct sustained research projects, synthesizing multiple sources 	<p>In general, your child can:</p> <ul style="list-style-type: none"> demonstrate reading comprehension of highly complex grade-level texts analyze how multiple implied themes or central ideas interact and build on one another provide a thorough, objective summary of a text expound on reasoning in important U.S. texts write argumentative pieces that strategically sequence claims, counterclaims, reasons, and evidence write informative/explanatory pieces that strategically organize complex ideas using relevant facts, details, or other information write narratives that completely develop real or imagined experiences using highly effective techniques and clearly structured event sequences conduct sustained research projects, demonstrating through understanding of the subjects under investigation

Note. Source: GaDOE (2020).

Appendix Table 11

EOC Achievement Level Descriptors for Coordinate Algebra

	Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
End-of-Course Coordinate Algebra	<p>In general, your child can:</p> <ul style="list-style-type: none"> • use numbers and units of measure to solve problems • identify and solve one-variable linear equations • identify and define a function • recognize angles, circles, perpendicular lines, parallel lines, and line segments • represent data on a single variable 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • reason with units of measure to solve problems • solve and graph systems of equations • use function notation • build functions from models • compare linear and exponential models • represent transformations in the coordinate plane • represent and interpret data on a single variable 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • convert units of measure to solve problems • create equations that describe numbers or relationships • solve and graph equations, inequalities, and systems of equations • interpret and analyze functions • solve real-world problems using functions • build functions from existing functions • construct linear and exponential models • compare and describe transformations in the coordinate plane • represent and interpret data on two variables 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • analyze and interpret units of measure to solve problems • solve and graph multistep equations and inequalities with one or two variables • solve systems of equations in real-world contexts • build and test functions • analyze linear and exponential models • interpret transformations in the coordinate plane to analyze congruence • use coordinates to prove geometric theorems algebraically

Note. Source: GaDOE (2020).

Appendix Table 12

EOC Achievement Level Descriptors for Analytic Geometry

	Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
End-of-Course Analytic Geometry	<p>In general, your child can:</p> <ul style="list-style-type: none"> • identify rational and irrational numbers • add, subtract, multiply, and divide expressions • identify and classify functions • identify similar figures • use the Pythagorean Theorem • calculate the circumference and area of a circle • identify the center and radius of a circle from graph • calculate volume • represent quantitative data using a scatter plot • calculate the probability of independent events 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • rewrite expressions with square roots • create equations to describe relationships • identify solutions to systems of equations graphically • build functions that model simple relationships • compare linear, quadratic, and exponential models • use transformations to understand congruence • apply geometric theorems • use trigonometric ratios to solve simple problems with right triangles • find simple arc lengths and areas of sectors of a circle • identify the center and radius of a circle from an equation • use volume formulas to solve problems • visualize 2-D and 3-D objects • calculate the probabilities of independent and dependent events 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • interpret and use properties of rational and irrational numbers • write expressions to solve problems • solve equations and inequalities with one variable • solve systems of equations • interpret and analyze functions • construct and compare linear, quadratic, and exponential models • prove geometric theorems • define trigonometric ratios • understand and apply circle theorems • use coordinates to prove simple geometric theorems algebraically • explain the use of volume formulas • apply geometric concepts to model a situation • represent and interpret data on two categorical and quantitative variables • compute probabilities of compound events 	<p>In general, your child can:</p> <ul style="list-style-type: none"> • explain properties of rational and irrational numbers • use arithmetic operations on polynomials • analyze and create equations that describe relationships • solve multistep equations and inequalities • analyze and represent functions using different representations • build a function that models a complex relationship • analyze linear, quadratic, and exponential models and solve problems in context • use geometric constructions to solve problems • solve multistep problems involving right triangles • use circle theorems in context • use volume formulas to solve complex problems • interpret independence and conditional probability

Note. Source: GaDOE (2020).

Appendix Table 13

EOC Achievement Level Descriptors for Biology

	Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
End-of-Course Biology	<p>In general, your child can:</p> <ul style="list-style-type: none"> recognize that macromolecules provide organisms with different nutrients recognize the structure and function of DNA recognize that organisms can be grouped into six kingdoms based on similarities recognize that some human activities affect the environment recognize that investigators control the conditions of their experiments use standard laboratory tools 	<p>In general, your child can:</p> <ul style="list-style-type: none"> identify the functions of each of the four major macromolecules (carbohydrates, proteins, lipids, and nucleic acids) distinguish between osmosis and diffusion compare hypertonic, hypotonic, and isotonic solutions distinguish between RNA and DNA compare structures among the six kingdoms of life explain human activities that affect the environment recognize the role of natural selection in the development of the theory of evolution describe the appropriate use of tools for scientific investigations describe characteristics of living things and viruses 	<p>In general, your child can:</p> <ul style="list-style-type: none"> explain the role of cell organelles identify enzymes as catalysts explain the effect water has on life processes identify factors that can alter DNA use Mendel's law to explain the role of meiosis describe the processes of photosynthesis and respiration recognize biological factors that influence reproductive differences identify differences in the structure and function of the six kingdoms of life recognize the basis of modern classification systems identify the relationships between biological communities explain the flow of matter and energy using a food chain compare amounts of energy using an energy pyramid relate natural selection to changes in organisms describe biological resistance describe evidence supporting evolution 	<p>In general, your child can:</p> <ul style="list-style-type: none"> apply homeostasis given a real-world scenario describe how changing the genetic code of an organism can result in advantageous traits analyze how genetic manipulation changes the genetic frequency of traits explain the advantages and disadvantages of the different types of reproduction analyze the relationships between different cellular processes analyze the need for cycling essential elements draw conclusions from data explain how successful species evolve

Note. Source: GaDOE (2020).

Appendix Table 14

EOC Achievement Level Descriptors for Physical Science

	Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
End-of-Course Physical Science	In general, your child can: <ul style="list-style-type: none"> recognize the differences between atoms and molecules locate metals, nonmetals, and metalloids in the Periodic Table of Elements describe the movement of particles in solids, liquids, gases, and plasmas describe the Law of Conservation of Matter explain the parts and characteristics of waves describe energy transformations identify simple machines that make work easier determine what produces electricity recognize that data provides support for scientific claims 	In general, your child can: <ul style="list-style-type: none"> recognize and label the structure of an atom recognize that the Periodic Table of Elements arranges elements by properties recognize similarities and differences among solids, liquids, gases, and plasmas describe the three types of energy transfer (radiation, conduction, and convection) recognize factors that affect the rate at which objects dissolve identify energy transformations describe electromagnetic and mechanical waves use data to support scientific claims 	In general, your child can: <ul style="list-style-type: none"> examine the structure of an atom recognize different atomic bonds explain radioactive decay recognize the forces that affect gases use math to analyze data use the Periodic Table of Elements to predict properties of elements apply the Law of Conservation of Matter in a chemical reaction compare acids and bases recognize reflection, refraction, interference, and diffraction apply Newton's three laws of motion to everyday situations identify AC and DC currents describe an electromagnet 	In general, your child can: <ul style="list-style-type: none"> describe nuclear energy describe the elements of radiation compare solutions in terms of concentration and conductivity describe molecular motion explain magnetism and its relationship to the movement of electrical charges compare and contrast characteristics of electromagnetic and mechanical (sound) waves recognize the relationship between specific heat capacity and change in temperature determine which machine would have the greatest advantage calculate the velocity of a falling object predict outcomes given series and parallel circuits

Note. Source: GaDOE (2020).

Appendix Table 15

EOC Achievement Level Descriptors for U.S. History

	Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
End-of-Course United States History	<p>In general, your child can:</p> <ul style="list-style-type: none"> recognize that Europeans settled in North America during the seventeenth century identify mercantilism identify the U.S. Constitution identify primary causes of the American Revolution identify key events relating to causes of the Civil War identify Reconstruction identify the Great Depression identify Franklin D. Roosevelt and the New Deal identify the origins of U.S. involvement in World War I identify the major developments of World War II identify the Cold War identify the Civil Rights Movement 	<p>In general, your child can:</p> <ul style="list-style-type: none"> describe the Middle Passage and growth of the African-American population identify growing north-south divisions in the United States and westward expansion describe the primary causes of the American Revolution identify key events and issues relating to the causes and course of the Civil War describe Reconstruction identify the Progressive Era identify the impact of U.S. involvement in World War I identify some causes and consequences of the Great Depression describe Franklin D. Roosevelt's New Deal identify the domestic impact of World War II identify the domestic impact of the Cold War identify dimensions of the Civil Rights Movement, 1945-1970 	<p>In general, your child can:</p> <ul style="list-style-type: none"> explain the way the economy of British North America developed explain the primary causes of the American Revolution describe key events and ideas that brought about the adoption and implementation of the U.S. Constitution describe the relationship between growing north-south divisions and westward expansion identify key individuals related to the Civil War identify legal, political, and social dimensions of Reconstruction identify major efforts to reform American society and politics in the Progressive Era describe the origins and impact of U.S. involvement in World War I describe the causes and consequences of the Great Depression describe the domestic impact of World War II describe the domestic and international impact of the Cold War 	<p>In general, your child can:</p> <ul style="list-style-type: none"> trace the ways the economy of British North America developed, including the trans-Atlantic trade, the Middle Passage, and the Great Awakening explain key events and ideas that brought about the adoption and implementation of the U.S. Constitution explain the relationship between growing north-south divisions and westward expansion explain major efforts to reform American society and politics in the Progressive Era explain the origins and impact of U.S. involvement in World War I explain the causes and consequences of the Great Depression explain the domestic and international impact of the Cold War

Note. Source: GaDOE (2020).

Appendix Table 16

EOC Achievement Level Descriptors for Economics/Business/Free Enterprise

	Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
End-of-Course Economics	<p>In general, your child can:</p> <ul style="list-style-type: none"> define specialization recognize rational decisions relating to spending, saving, and investing recognize that government has a role in the economy identify productivity, economic growth, and standard of living define the circular flow of goods and services define fiscal policy define exchange rate identify different types of businesses identify law of demand and law of supply recognize factors that cause a change in demand and a change in supply identify types of financial institutions identify types of insurance recognize ways a worker can improve his/her earnings 	<p>In general, your child can:</p> <ul style="list-style-type: none"> recognize the four types of productive resources (land, labor, capital, and entrepreneurship) identify how an individual or business specializes identify the three types of economic systems (command, market, and mixed) identify the roles of the government in a market economy describe productivity, economic growth, and standard of living identify the flow of goods and services between individuals and businesses on a circular flow diagram describe how buyers and sellers interact in a market label supply and demand on a graph identify sole proprietorship, partnership, and corporation as types of business organizations list the ways in which the government controls fiscal policy explain why currency exchange happens identify savings/financial options define types of insurance use charts and/or tables to describe the relationship between education and earnings 	<p>In general, your child can:</p> <ul style="list-style-type: none"> identify ways in which productive resources are allocated and define opportunity cost describe the three types of economic systems (command, market, and mixed) describe how individuals and/or businesses are better off when they specialize identify an example of government regulation of an individual or business describe how prices act as an incentive in a market economy use a graph to show how a change in a given factor affects supply and/or demand use a circular flow diagram to describe how money flows between individuals, businesses, and the government in exchange for goods, services, and resources describe how a change in monetary policy affects the interest rate identify examples of fiscal policy describe how a change in fiscal policy affects consumer spending describe how individuals select one option over another for financial planning explain why people buy insurance explain the costs and benefits of using different credit options 	<p>In general, your child can:</p> <ul style="list-style-type: none"> use an example to explain the opportunity cost of choosing one alternative over another use an example to explain how government regulation impacts both businesses and individuals explain how changes in demand and/or supply affect equilibrium price and quantity describe how an increase in investment leads to an increase in economic growth use a diagram of a business cycle to determine the various phases and explain how decisions by businesses, consumers, and the government impact the business cycle describe how a change in monetary policy impacts prices, unemployment, and economic growth describe how a change in exchange rates impacts monetary and fiscal policy describe how to develop a savings/financial plan describe how a change in monetary policy and fiscal policy changes consumers' saving and spending describe how education/training and skill development impact the supply of and/or demand for workers

Note. Source: GaDOE (2020).

Appendix B:
IRB Protocol Exemption Report



**Institutional Review Board (IRB)
For the Protection of Human Research Participants**

PROTOCOL EXEMPTION REPORT

Protocol Number: 04317-2022

Responsible Researcher(s): Tracy F. Bishop

Supervising Faculty: Terry Sapp

Project Title: *A Study of the Efficacy of Teachers Holding Out-of-Field Certification.*

INSTITUTIONAL REVIEW BOARD DETERMINATION:

This research protocol is **exempt** from Institutional Review Board (IRB) oversight under 45 CFR 46.101(b) of the federal regulations, **category 4**. If the nature of the research changes such that exemption criteria no longer apply, please consult with the IRB Administrator (irb@valdosta.edu) before continuing your research study.

ADDITIONAL COMMENTS:

- *Upon completion of the research study, all collected data (e.g. data set, name, titles, etc.) must be securely maintained and accessible only by the researcher(s) for a minimum of 3 years. **At the end of the required time, collected data must be permanently destroyed.***

If this box is checked, please submit any documents you revise to the IRB Administrator at irb@valdosta.edu to ensure an updated record of your exemption.

Elizabeth Ann Olphie *01.09.2023*

Elizabeth Ann Olphie, IRB Administrator

*Thank you for submitting an IRB application.
Please direct questions to irb@valdosta.edu or 229-253-2947.*

Revised: 06.02.16

Appendix C:

Test Score Ranges and Cut Scores for Georgia Milestone Assessments

Appendix Table 17

2016–2017 Test Score Ranges and Cut Scores Georgia Milestones End of Grade

Assessments

Content Area	Grade	Scale Score Ranges			
		Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
English Language Arts	3	180 to 474	475 to 524	525 to 580	581 to 830
	4	210 to 474	475 to 524	525 to 573	574 to 775
	5	210 to 474	475 to 524	525 to 586	587 to 760
	6	140 to 474	475 to 524	525 to 598	599 to 820
	7	165 to 474	475 to 524	525 to 591	592 to 785
	8	225 to 474	475 to 524	525 to 580	581 to 730
Mathematics	3	290 to 474	475 to 524	525 to 579	580 to 705
	4	270 to 474	475 to 524	525 to 584	585 to 715
	5	265 to 474	475 to 524	525 to 579	580 to 725
	6	285 to 474	475 to 524	525 to 579	580 to 700
	7	265 to 474	475 to 524	525 to 579	580 to 740
	8	275 to 474	475 to 524	525 to 578	579 to 755
Science	5	160 to 474	475 to 524	525 to 594	595 to 780
	8	165 to 474	475 to 524	525 to 592	593 to 785
Social Studies	5	290 to 474	475 to 524	525 to 554	555 to 665
	8	240 to 474	475 to 524	525 to 571	572 to 715

Note. Source: GaDOE (2016).

Appendix Table 18

2016-2017 Test Score Ranges and Cut Scores Georgia Milestones End-of-Course

Assessments

Course	Beginning Learner		Developing Learner		Proficient Learner		Distinguished Learner	
	Scale Score Range	Grade Conversion Score Range	Scale Score Range	Grade Conversion Score Range	Scale Score Range	Grade Conversion Score Range	Scale Score Range	Grade Conversion Score Range
Ninth Grade Literature and Composition	220 to 474	0 to 67	475 to 524	68 to 79	525 to 586	80 to 91	587 to 735	92 to 100
American Literature and Composition	190 to 474	0 to 67	475 to 524	68 to 79	525 to 589	80 to 91	590 to 750	92 to 100
Coordinate Algebra	215 to 474	0 to 67	475 to 524	68 to 79	525 to 593	80 to 91	594 to 790	92 to 100
Analytic Geometry	185 to 474	0 to 67	475 to 524	68 to 79	525 to 595	80 to 91	596 to 810	92 to 100
Algebra I	200 to 474	0 to 67	475 to 524	68 to 79	525 to 593	80 to 91	594 to 785	92 to 100
Geometry	180 to 474	0 to 67	475 to 524	68 to 79	525 to 595	80 to 91	596 to 815	92 to 100
Biology	140 to 474	0 to 67	475 to 524	68 to 79	525 to 608	80 to 91	609 to 820	92 to 100
Physical Science	145 to 474	0 to 67	475 to 524	68 to 79	525 to 603	80 to 91	604 to 815	92 to 100
U.S. History	215 to 474	0 to 67	475 to 524	68 to 79	525 to 589	80 to 91	590 to 765	92 to 100
Economics/ Business/ Free Enterprise	140 to 474	0 to 67	475 to 524	68 to 79	525 to 609	80 to 91	610 to 830	92 to 100

Note. Source: GaDOE (2016).

Appendix Table 19

2017–2018 Test Score Ranges and Cut Scores Georgia Milestones End of Grade

Assessments

Content Area	Grade	Scale Score Ranges			
		Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
English Language Arts	3	180 to 474	475 to 524	525 to 580	581 to 830
	4	210 to 474	475 to 524	525 to 573	574 to 775
	5	210 to 474	475 to 524	525 to 586	587 to 760
	6	140 to 474	475 to 524	525 to 598	599 to 820
	7	165 to 474	475 to 524	525 to 591	592 to 785
	8	225 to 474	475 to 524	525 to 580	581 to 730
Mathematics	3	290 to 474	475 to 524	525 to 579	580 to 705
	4	270 to 474	475 to 524	525 to 584	585 to 715
	5	265 to 474	475 to 524	525 to 579	580 to 725
	6	285 to 474	475 to 524	525 to 579	580 to 700
	7	265 to 474	475 to 524	525 to 579	580 to 740
	8	275 to 474	475 to 524	525 to 578	579 to 755
Science	5	160 to 474	475 to 524	525 to 594	595 to 780
	8	165 to 474	475 to 524	525 to 592	593 to 785
Social Studies	5	290 to 474	475 to 524	525 to 554	555 to 665
	8	240 to 474	475 to 524	525 to 571	572 to 715

Note. Source: GaDOE (2018).

Appendix Table 20

2017–2018 Test Score Ranges and Cut Scores Georgia Milestones End of Course

Assessments

Course	Beginning Learner		Developing Learner		Proficient Learner		Distinguished Learner	
	Scale Score Range	Grade Conversion Score Range	Scale Score Range	Grade Conversion Score Range	Scale Score Range	Grade Conversion Score Range	Scale Score Range	Grade Conversion Score Range
Ninth Grade Literature and Composition	220 to 474	0 to 67	475 to 524	68 to 79	525 to 586	80 to 91	587 to 735	92 to 100
American Literature and Composition	190 to 474	0 to 67	475 to 524	68 to 79	525 to 589	80 to 91	590 to 750	92 to 100
Coordinate Algebra	215 to 474	0 to 67	475 to 524	68 to 79	525 to 593	80 to 91	594 to 790	92 to 100
Analytic Geometry	185 to 474	0 to 67	475 to 524	68 to 79	525 to 595	80 to 91	596 to 810	92 to 100
Algebra I	200 to 474	0 to 67	475 to 524	68 to 79	525 to 593	80 to 91	594 to 785	92 to 100
Geometry	180 to 474	0 to 67	475 to 524	68 to 79	525 to 595	80 to 91	596 to 815	92 to 100
Biology	140 to 474	0 to 67	475 to 524	68 to 79	525 to 608	80 to 91	609 to 820	92 to 100
Physical Science	145 to 474	0 to 67	475 to 524	68 to 79	525 to 603	80 to 91	604 to 815	92 to 100
U.S. History	215 to 474	0 to 67	475 to 524	68 to 79	525 to 589	80 to 91	590 to 765	92 to 100
Economics/ Business/ Free Enterprise	140 to 474	0 to 67	475 to 524	68 to 79	525 to 609	80 to 91	610 to 830	92 to 100

Note. Source: GaDOE (2018).

Appendix Table 21

2018–2019 Test Score Ranges and Cut Scores Georgia Milestones End of Grade

Assessments

Content Area	Grade	Scale Score Ranges			
		Beginning Learner	Developing Learner	Proficient Learner	Distinguished Learner
English Language Arts	3	180 to 474	475 to 524	525 to 580	581 to 830
	4	210 to 474	475 to 524	525 to 573	574 to 775
	5	210 to 474	475 to 524	525 to 586	587 to 760
	6	140 to 474	475 to 524	525 to 598	599 to 820
	7	165 to 474	475 to 524	525 to 591	592 to 785
	8	225 to 474	475 to 524	525 to 580	581 to 730
Mathematics	3	290 to 474	475 to 524	525 to 579	580 to 705
	4	270 to 474	475 to 524	525 to 584	585 to 715
	5	265 to 474	475 to 524	525 to 579	580 to 725
	6	285 to 474	475 to 524	525 to 579	580 to 700
	7	265 to 474	475 to 524	525 to 579	580 to 740
	8	275 to 474	475 to 524	525 to 578	579 to 755
Science	5	160 to 474	475 to 524	525 to 594	595 to 780
	8	165 to 474	475 to 524	525 to 592	593 to 785
Social Studies	5	290 to 474	475 to 524	525 to 554	555 to 665
	8	240 to 474	475 to 524	525 to 571	572 to 715

Note. Source: GaDOE (2019a).

Appendix Table 22

2018–2019 Test Score Ranges and Cut Scores Georgia Milestones End-of-Course

Assessments

Course	Beginning Learner		Developing Learner		Proficient Learner		Distinguished Learner	
	Scale Score Range	Grade Conversion Score Range	Scale Score Range	Grade Conversion Score Range	Scale Score Range	Grade Conversion Score Range	Scale Score Range	Grade Conversion Score Range
Ninth Grade Literature and Composition	220 to 474	0 to 67	475 to 524	68 to 79	525 to 586	80 to 91	587 to 735	92 to 100
American Literature	190 to 474	0 to 67	475 to 524	68 to 79	525 to 589	80 to 91	590 to 750	92 to 100
Coordinate Algebra	215 to 474	0 to 67	475 to 524	68 to 79	525 to 593	80 to 91	594 to 790	92 to 100
Analytic Geometry	185 to 474	0 to 67	475 to 524	68 to 79	525 to 595	80 to 91	596 to 810	92 to 100
Algebra I	200 to 474	0 to 67	475 to 524	68 to 79	525 to 593	80 to 91	594 to 785	92 to 100
Geometry	180 to 474	0 to 67	475 to 524	68 to 79	525 to 595	80 to 91	596 to 815	92 to 100
Biology	140 to 474	0 to 67	475 to 524	68 to 79	525 to 608	80 to 91	609 to 820	92 to 100
Physical Science	145 to 474	0 to 67	475 to 524	68 to 79	525 to 603	80 to 91	604 to 815	92 to 100
U.S. History	215 to 474	0 to 67	475 to 524	68 to 79	525 to 589	80 to 91	590 to 765	92 to 100
Economics/Business/ Free Enterprise	140 to 474	0 to 67	475 to 524	68 to 79	525 to 609	80 to 91	610 to 830	92 to 100

Note. Source: GaDOE (2019a).