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The Relative Age Effect: Ensuring Student Success Regardless of Birth Month

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THE RELATIVE AGE EFFECT: ENSURING STUDENT SUCCESS REGARDLESS OF BIRTH MONTH

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A DISSERTATION

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UNIVERSITY OF MAINE GRADUATE SCHOOL LAND ACKNOWLEDGMENT

The University of Maine recognizes that it is located on Marsh Island in the homeland of Penobscot people, where issues of water and territorial rights, and encroachment upon sacred sites, are ongoing. Penobscot homeland is connected to the other Wabanaki Tribal Nations— the Passamaquoddy, Maliseet, and Micmac—through kinship, alliances, and diplomacy. The University also recognizes that the Penobscot Nation and the other Wabanaki Tribal Nations are distinct, sovereign, legal and political entities with their own powers of self-governance and self-determination.

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Dissertation Advisor: Dr. Maria Frankland

An Abstract of the Dissertation Presented
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This mixed methods study examines the degree to which relative age impacts school performance and achievement for students in Scarborough Public Schools. The relative age effect refers to the impact differences in age among students in the same grade can have on performance in school. Students who turn five in the days just prior to the eligibility date for starting Kindergarten, October 15 in Maine, are nearly one year younger than those who are born in the days immediately after October 15. In addition, some parents choose to delay their child's enrollment in Kindergarten for one year, a decision called redshirting, which enlarges the age range in a given grade beyond one year. The quantitative part of this study examines the impact of relative age with regard to student achievement, special education identification, high school enrollment in the most rigorous courses of study, and prevalence of redshirting among parents enrolling their child in Kindergarten. The qualitative part of the study attempts to understand parental decision-making around kindergarten readiness and whether or not a child's age relative to their peers is a factor. This is done through an analysis of responses to a parent survey disseminated among all Scarborough parents with students in the K-2 primary schools. When comparing school performance as measured by MEA scaled scores and special education identification, no significant differences were found between the oldest and youngest students in

a given grade. However, high school students enrolled in at least one Advanced Placement course were, on average, a full year older than their grade level classmates. With regard to the parent survey, a child's age relative to their peers, even far into the future, is important to a parent's decision-making around kindergarten readiness. Social and emotional adjustment were prioritized over academic readiness. Parents shared economic challenges to redshirting, citing the high cost of daycare and preschool. Findings from this study support the efficacy of keeping students together in classrooms of mixed ability. Educators and policy-makers would benefit from expanding this study to include student data from other school districts to determine if a similar relative age impact exists when students are streamed into the most academically rigorous courses in high school. There are greater opportunities for admission to selective colleges and universities as well as collegiate credits to be earned through completing Advanced Placement courses in high school. The relative age effect, an embedded advantage to the oldest students in a grade, impedes equitable opportunity for all students. The findings from this study confirm the impact of relative age at the high school level and on parental decisions regarding their children's readiness for school.

DEDICATION

This dissertation is dedicated to my father, Gordon Bruno, Ed.D. He served as a teacher, principal, superintendent of schools, and the first executive director for the Connecticut Center for School Change, now Partners for Educational Leadership, located in West Hartford. Dad was an innovative educational leader, a visionary who believed educators must strive to serve all kids across urban, suburban, and rural communities. He believed resources for education must reflect the needs of our communities equitably to provide opportunity for all students. Dad passed away peacefully on December 19th, 2023. His life and legacy will continue to impact me professionally and personally, as I know it has for so many other educational leaders he has developed and nurtured, as well as the kids, families, and communities he had the opportunity to serve.

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I would first like to acknowledge my wife and life partner, Melissa Bruno. Without her love, partnership, and support, none of my personal or professional accomplishments are possible. Next, I'd like to acknowledge my four children, Hallie, Sophie, Cassidy, and Presley Bruno, who along with Melissa, remind me every day how lucky I am to share all of life's adventures and challenges with a loving family. In writing this dissertation, I would like to acknowledge Dr. Maria Frankland, who has served as my faculty advisor and mentor over the last three years. She has guided me through multiple revisions, responded promptly with clear and concise feedback, and developed my skills as a scholarly practitioner. I would also like to acknowledge Dr. Catharine Biddle, Dr. Ian Mette, and Dr, Richard Ackerman, who have effectively shaped my development as a doctoral student, inspiring the research and analysis that went into completing this dissertation. I would like to thank all of my fellow colleagues and students in our cohort, most notably readers Eric Hutchins and Heather Manchester, who collectively served as critical minds and supportive souls as we embarked on this professional journey together. Finally, I would like to share my appreciation for the Scarborough Board of Education and community of Scarborough for supporting my doctoral journey and playing a part in my research on the impact of relative age in the classroom.

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CHAPTER 1: INTRODUCTION

All schools in the United States (US), and in most educational systems in countries across the globe, a minimum age standard for schooling is established, with a specific calendar date identified to determine eligibility (Bedard & Dhuey, 2006). In Maine, minimum age eligibility is written into state law. Maine General Laws Section 5201 of Chapter 213 on student eligibility reads, "the following are minimum ages necessary for enrollment in a school administrative unit. A person who will be at least five years old on October 15th of the school year may enroll in school." (MGL sec 5201, Ch 213, 1993). All children residing in Maine, who have reached the age of five by October 15, are eligible to enroll in public Kindergarten.

Once enrolled, the majority of students in public schools advance from one grade to the next in their grade level cohort, determined by their age relative to the established eligibility date (Martin et al., 2004). In Maine, the youngest students in a grade level will be those born in the days and months just prior to October 15: August, September, and the first half of October. The oldest students in a grade will be those born in the days and months just after October 15: the second half of October, November, and December. Two children born two days apart, one on October 14, and the other on October 16, would be sorted into different grades. The child born on October 14 would be able to enroll in Kindergarten having just turned five. The child born on October 16, would need to wait almost a full year until he or she was a day shy of turning six. Some parents, often those with children born in late summer or early fall, choose to keep their child out of school for an additional year, and enroll at age six, to avoid having them be among the youngest in the grade, a decision called *redshirting* (Katz, 2000).

The impact of sorting children into grades based on a child's age relative to an established eligibility date leads to a *relative age effect* where the oldest in the grade have

embedded advantages leading to better educational outcomes, while the youngest in the grade face grater challenges and are less successful in school (Barnsley, 1988; Bedard & Dhuey, 2006; Dougan & Pijanowski, 2011). To further exacerbate this effect, parents in recent decades have held their child back one year, starting them in Kindergarten at age six, a decision called redshirting (Dougan & Pijanowski, 2011; Katz, 2000). This means that in some classrooms the range in age among students can be as high as two years. Researchers have also examined the socioeconomic impact of redshirting. Socioeconomic Status (SES) can be a significant factor in school achievement and can impact the decision to redshirt. Families from upper middle-class households are much more likely to delay school entry for their child than families in socioeconomically disadvantaged areas (Dougan & Pijanowski, 2011; Larsen et al., 2021).

In this study, I examine the degree to which relative age impacts school performance and achievement in primary, middle, and high school in Scarborough, Maine. I also examine parental decision-making around Kindergarten readiness. I attempt to understand a parent's thought process around when their child is ready to start Kindergarten, and if relative age is a factor in deciding when to enroll. It is critical for educators to understand how developmental maturity and age differences impact a child's experience in the classroom. Younger students face additional challenges in a classroom setting when compared to older peers in the same class. Younger students are more likely to require additional academic intervention and support (Dhuey & Lipscomb, 2010; Martin et al., 2004), are more often referred for a specific learning disability (Martin et al., 2004), and are more readily identified as requiring special education services (Dhuey & Lipscomb, 2010; Martin et al., 2004). Conversely, older students in the same grade find greater success in the classroom (Bedard & Dhuey, 2006), outperform younger peers on achievement measures (Bedard & Dhuey, 2006; Larsen et al., 2021), and are more likely to be

streamed into more accelerated academic tracks as they enter high school (Barnsley, 1988; Bedard & Dhuey, 2006; Dhuey & Lipscomb, 2010). Students are not just grouped into age level grades. They are also sorted into groups by ability, sometimes within a heterogeneously grouped classroom, and as they enter into high school, enroll in more advanced courses of study. This mixed methods study attempts to track the impact of relative age through the grades within the context of one community and one school district, Scarborough Public Schools, in Scarborough, Maine.

A policy establishing a specific age cut-off and a child's month of birth should not be a significant factor determining a child's projected success in a classroom (Bedard & Dhuey, 2006; Dhuey & Lipscomb, 2010). Understanding the unintended consequences of grouping children solely by age and moving them through the grades together without mitigating the potential impact of their relative developmental differences is critical to ensuring greater educational equity for all learners. In the rest of this chapter, I will provide some background into the gap in practice this study means to address, outline and describe the research problem and purpose of the study, identify the research questions and hypotheses, present the conceptual framework governing the structure and nature of the study, provide necessary definitions, and articulate scope, limitations, and significance of how relative age impacts students and families in Scarborough.

Background

A teacher's perception of a child's ability can promote or impede a child's development and sense of self-efficacy (Campbell, 2014; Martin et al., 2004). Once students begin their K-12 educational journey, a child's skills in literacy, math and other content areas are judged and assessed in a variety of ways by classroom teachers. The youngest students in the class are more

likely to be judged as academically weak and requiring greater intervention and support, while the oldest students in class are more likely to be judged as academically strong and offered more opportunities to accelerate their learning (Martin et al., 2004). The impact of teacher perception of ability can influence academic performance as measured by grades, achievement scores, and how students are grouped by ability. It can be particularly pronounced in schools where in-class ability grouping takes place within each grade (Campbell, 2014; Cobley et al., 2009).

Teacher perception of academic ability can be influenced by a child's relative age and developmental maturity, particularly if instructional decisions are made based mostly on classroom observation without embedded formative assessment data being utilized (Campbell, 2014). Significant differences in performance can persist and even deepen unless effective supports are provided for relatively younger students in the cohort, particularly in the primary grades (Dhuey & Lipscomb, 2010). The relative age effect is most pronounced early in primary schools, but the gap can often persist and have long term implications through high school and beyond (Bedard & Dhuey, 2006; Dhuey & Lipscomb, 2008). Students that receive praise and more academically challenging experiences based on the judgments made about their abilities will further accelerate their learning as they get older, while students who receive negative feedback, require additional support or time, may fall further behind, lose motivation, and struggle to find success in the classroom (Dhuey & Lipscomb, 2010; Larsen et al., 2021; Martin et al., 2004). This cycle can perpetuate itself and lead to further decline in later years. To head this off at the pass, many parents make the choice to deliberately hold their child back one full year to ensure he or she is one of the oldest in the grade. This decision is called redshirting. The impact of ability grouping as students go through the grades can serve to extend and exacerbate the effect of this age difference (Campbell, 2014; Cobley et al., 2009), a phenomenon that

originated with a child's birth month and when it falls relative to the eligibility date. The practice of redshirting (Katz, 2000) may be less tenable for a family of lower socio-economic status (SES) due to the high cost of childcare and the need for multiple income streams to support the family. As a result, low SES students, already at higher risk of poor educational outcomes (Dhuey et al., 2019; Larsen et al., 2021), may be placed at an even greater disadvantage prior to entering a kindergarten classroom (Dougan & Pijanowski, 2011).

Research examining the relative age effect narrowly focuses on specific dimensions of school performance and/or achievement as it relates to the relative differences in age and development across a grade-level cohort. In addition, there is little research literature examining ways in which educators, school districts, and/or policy-makers could counteract embedded advantages for the oldest in a grade level, and embedded disadvantages for the youngest in a grade level. This study extends prior research by examining multiple factors that could potentially contribute to a relative age effect within the context of the same community: Scarborough, Maine. I analyze responses to a parent survey sent to all families of current K-2 students to understand parental decision-making around Kindergarten readiness and whether or not relative age is a factor in determining when their child begins formal schooling. Using historical student data, I examine the impact of relative age on student achievement as measured by performance on the Maine Educational Assessment (MEA) in English Language Arts and Math for the 3rd, 5th, and 8th graders. I then compare the mean ages of students identified as requiring special education with their grade level peers to determine if the youngest in the grade are more likely to be identified. Finally, I examine whether or not age is a factor in high school, where students are streamed into classes with leveled academic rigor; in the case of Scarborough

high school, I examine the ages of students enrolled in at least one Advanced Placement (AP) course, the most academically rigorous level of courses available.

Problem Statement

This study examines the degree to which a child's age relative to his or her peers impacts school performance. How a child performs in school should not be predetermined by their age relative to grade level peers. This study looks at multiple factors that could be influenced by relative age: parental decision-making on when to start their child in kindergarten, the prevalence of red-shirting, the impact of relative age on measures of academic achievement (MEA scaled scores), and the impact, if any, of relative age on identification for special education, and enrollment in the most academically rigorous courses in high school.

In Maine, a child must turn five on or before October 15 in order to be eligible to start Kindergarten. In the early grades, the developmental differences in maturity between the oldest and youngest in the class can be profound (Dhuey et al., 2019; O' Brien, 2018). Kindergarten students who begin school just prior to turning six years old typically are more developmentally mature than their younger classmates and more likely to experience early success in the classroom (Dhuey et al., 2019; O'Brien, 2018). Those that start Kindergarten having just turned five are less developmentally mature. They typically have shorter attention spans and can struggle to develop skills necessary for classroom routines (Harris & McDade, 2018). As a result, they may be more likely to struggle in school and experience less success relative to their older peers (Dhuey et al., 2019; Martin et al., 2004). Younger Kindergarten students are overrepresented among those referred to special education and/or academic support (Martin et al., 2004). The oldest students in the grade are more likely to be sorted into more advanced ability groups as they progress through the grades when compared to their younger peers

(Campbell, 2014). Conversely, those born just prior to the cut-off date, and the youngest in the grade, are more likely to be referred for special education, diagnosed with a learning disability, or sorted into groups requiring individualized academic support (Dhuey & Lipscomb, 2010; Martin et al., 2004).

The increased prevalence of redshirting is another significant factor contributing to the relative age effect and its impact on educational equity. Parents, in an effort to ensure their child is one of the oldest in a grade, will choose to redshirt their child, and deliberately keep them out of school for an extra year. Redshirting is most common among families of higher education and greater socioeconomic means, as many families who live at or below the poverty line cannot afford to keep their child in daycare or out of school for an additional year (Dougan & Pijanowski, 2011).

The phenomenon of redshirting has increased in frequency in the US over the last 20 years (Dougan & Pijanowski, 2011), therefore making it even more critical to understand the impact relative age has on all students. Given that educational systems throughout the world can serve to perpetuate advantage for the oldest in a cohort, and cement challenges for the youngest, it is essential for educators to reflect on how our educational system can address these developmental differences based on age in our classrooms with a greater sense of equity and urgency (Bedard, & Dhuey, 2006). This study adds to the research on how relative age can be perpetuated in educational systems and attempts to understand its impact within the context of a single school district in Scarborough, Maine.

Purpose of the Study

The purpose of this mixed methods study is to examine how the relative age effect impacts students attending Scarborough Schools, the public school system in Scarborough,

Maine. By studying student achievement results in 3rd, 5th, and 8th grades, relative ages of students that qualify for special education services, and relative ages of high school students enrolled in the most advanced courses of study, I examine whether or not there are embedded advantages to being the oldest in the grade, and disadvantages to being the youngest. To further understand the relative age effect in Scarborough, I analyze a parent survey disseminated to all families of enrolled students in the K-2 primary schools to understand the degree to which their child's age relative to peers is a factor when considering Kindergarten readiness. Birth month advantage or disadvantage underlies the increased prevalence of redshirting, a parental decision to hold their child back one year prior to starting kindergarten. The advantages of being the oldest in a grade include a greater likelihood of finding success and praise in the classroom, being selected for more advanced learning groups, performing well on assessments, and receiving praise from teachers (Barnsley, 1988; Bedard, & Dhuey, 2006; Campbell, 2014; Dhuey, & Lipscomb, 2008; O'Brien, 2018; Sprietsma, 2010). In Scarborough, consistent with the literature reviewed in Chapter 2, recognizing advantages of being the oldest, while also being wary of their child being the youngest, those with the means to do so elect to keep their child out of school for an extra year. Educators must increasingly play a role in addressing this widening range of ages and development, particularly in primary schools.

Research Questions

In this study, I examined two research questions:

1. To what extent, if at all, does the relative age effect impact students in Scarborough Schools with regard to (a) student achievement; (b) special education identification; and (c) enrollment in courses with the most academically rigorous curriculum (in Scarborough, Advanced Placement courses)?

2. At what age do Scarborough parents report choosing to enroll their child in Kindergarten and what factors do they report influencing their decision?

Conceptual Framework

This study examines the impact of sorting students into age-specific yearly cohorts with a specific cut-off date for school entry. Grouping students together in the same grade that can be a full year apart in age presents challenges for educators. The differences in biosocial development (Harris & McDade, 2018) at the age they begin Kindergarten may have a profound impact on a child's academic performance and relative success in school. This phenomenon has been identified as the relative age effect (Barnsley, 1988; Bedard, & Dhuey, 2006).

A child who is the youngest in a grade level cohort is more likely to score lower on measures of academic achievement, more likely to be referred for a specific learning disability, more likely to require additional academic support, and less likely to be selected for more accelerated learning opportunities (Martin et al., 2004). Conversely, those born just after the cut-off date–the oldest in the grade cohort–are more likely to score higher on measures of academic achievement, be sorted into advanced academic tracks, and are more often classroom and school peer leaders (Bedard & Dhuey, 2006; Dhuey & Lipscomb, 2008). This dynamic can have long-term effects, as positive and negative feedback loops impact divergent paths for those who are relatively young and those who are relatively old. Schools, by sorting students by ability as they progress through the grades, can inadvertently cement these divergent paths as opposed to mitigating the relative differences in maturity and absolute age.

Nature of the Study

In the Scarborough Public Schools (Scarborough, Maine), all children who reach the age of five by October 15 of the current school year are eligible to enroll in

Kindergarten. Scarborough is one of the largest immediate suburbs of Maine's most populous city, Portland. It had an estimated population of 22,250 residents as of 2020, an increase of over 17% from the census taken in 2010. Scarborough is currently experiencing population growth and economic development. While many School Administrative Units in Maine have experienced a decline in enrollment over the last decade, Scarborough's has remained steady, with approximately 3000 enrolled students K-12. This enrollment is projected to grow over the next ten years, as more families move to town and the population continues to grow. Students attend small neighborhood schools in Kindergarten through second grades: Pleasant Hill School, Blue Point School, and Eight Corners School. Each of the K-2 schools enroll about 200 students. Once a child reaches third grade, all students attend the Wentworth School for grades 3-5, then the Middle School for grades 6-8, and Scarborough High School for grades 9-12. The three larger schools in the district are centrally located in town, and adjacent to one another on a campus next to the Town Hall and Route 1, the economic hub of the town. Scarborough Schools have historically paid staff, teachers, and leaders well in comparison to surrounding communities. The school department recruits and retains effective educators, attracting families to the town in part because the schools have a reputation for being of high quality. Those who live in town are especially connected to the neighborhood K-2 schools, a sentiment evident as the town considers building a new school to replace the aging schools that are no longer able to house the enlarging enrollment of students at the K-2 level.

Scarborough provides an interesting context for examining the relative age effect in schools. Enrollment continues to hold steady and grow, many educators who work in Scarborough are veterans who are not new to teaching, and stay in the community after being

hired. Parents are invested and involved in the schools and most see their child moving on to a post-secondary education following their high school graduation.

Definitions

Relative Age Effect: the impact of a child's age relative to his or her peers within a grade level cohort. There are embedded benefits and advantages to being the oldest in a grade, and embedded challenges and disadvantages to being the youngest. This effect can impact achievement and success in school.

Grade level cohort: an established grade level grouping of students that advance together from one grade level to the next. The age span in a grade level cohort is primarily one year, with the youngest student born the day before the eligibility date (October 15 in Maine), and the oldest born the day after. Exceptions to this one-year age span would be for students who have been redshirted or retained, or for students who have skipped a grade.

School Entrance Age: the minimum age for a child to be eligible for Kindergarten enrollment. For all Maine public schools, a child must be five years old on or before October 15.

Eligibility Date: the date established for when a child is old enough to be enrolled in school. In Maine public schools this date is October 15. A child must be five years old on or before October 15 in order to be eligible to enroll in public Kindergarten.

Redshirt and redshirting: this term refers to a parent's decision to deliberately hold their child back one year or more from starting Kindergarten. It is also called academic redshirting, as the term originated in athletics, where a collegiate athlete would be kept from competing in games for a full season in an effort to provide them an extra year of skill development.

Ability groups: students are sorted into groups by ability. This is done either within the classroom, based on judgment from a teacher, or within the school, where students are streamed

into an honors level or Advanced Placement (AP) course based on assessments and/or teacher recommendations.

Scope & Delimitations:

In this mixed methods study I focused on a common context through investigating the academic impact of relative age within the same community, Scarborough, Maine. Previous studies used a much wider lens to examine one factor relative age may impact, such as standardized test scores, or the impact of redshirting on whether or not a group of students is likely to be referred for special education. By analyzing student data and parent survey responses within the context of the same community, I took a more holistic approach to understanding how relative age advantages or disadvantages could impact students and families across the K-12 spectrum. I examine student data and enrollment across elementary, middle, and high schools, as well as results from a parent survey on kindergarten readiness and decision-making. The scope of relative age does not focus on extracurricular performance and activities, such as athletics and performance in other areas beyond the classroom, nor does it compare decisions or performance across multiple communities. This is also a potential limitation of the study in terms of whether or not the analysis would transfer to other contexts or communities, given that the student data is limited to those attending Scarborough Schools and with parents of Scarborough families. The impact of relative age could also be dependent on how schools respond to students with diverse academic needs. Each community can have their own strategies and programs to address individual learning needs of students and may have unique systems in place with respect to assessment and measures of academic achievement. While many school districts adopt similar models and intervention strategies for those who are struggling to learn, each district can have their own unique strategies to handle diversity in learning profiles. This

can include variability in how students are grouped by ability and academic achievement, options for students to accelerate and take more rigorous courses in high school, intervention strategies for students struggling to learn, referral rates and funding for special education, and multi-tiered systems of support (MTSS) for students in primary and secondary grades. Given the diversity of how a school system may respond to the needs of all learners, it makes sense to keep the scope of this study, which includes student performance and enrollment data K-12, within the borders of the Scarborough Schools community. This allows for multiple research questions and hypotheses on the impact relative age may have on a child's overall development and success in school.

Validity/trustworthiness

In order to ensure validity and trustworthiness, I conducted a pilot survey to establish the internal validity of survey questions and make necessary adjustments prior to sending out to all potential participants. A possible external threat to validity was the anonymous nature of the survey. Given no names, email addresses, or IP addresses were collected, it is possible that some responses may not have been from the target population of Scarborough parents of students in the K-2 schools. To help mitigate this threat, the survey was sent only to those families who have enrolled students at the district's three elementary schools.

Limitations

The primary limitation of this study is the sample size of the population I am examining. Scarborough Public Schools is one of the larger public school districts in Maine, with approximately 3000 students K-12. Discerning whether or not relative age has an impact on current and future school performance is limited when student data is collected only from one school administrative unit. I mitigated this limitation by expanding my analysis of student

achievement data to include MEA data from three separate grade levels, 3rd, 5th, and 8th, and look at trends over multiple assessment years. This allowed for independent comparisons across different grade level cohorts as well as a longitudinal examination of one grade level cohort as they progressed from 3rd to 5th grade.

A similar limitation existed with respect to the parent survey disseminated. The goal was to get enough respondents to be able to mitigate the smaller sample size given the focus on parents residing in Scarborough who have recently started their children in Kindergarten. By expanding the target audience to all parents who have students in the K-2 schools, I enlarged the number of respondents and gained some insight into the degree to which parents make the decision to start their children on time, as outlined by the October 15 cut-off date, or to hold them for an extra year. While the survey was designed to be anonymous, I developed a question related to parent and family demographics to see if there were equity factors around those that choose to redshirt their children versus those who enroll their kids at age five.

Summary

In this mixed methods study, I examined student academic achievement data, relative age for those who qualify for special education services, relative age for those enrolled in the most academically rigorous high school courses, and a parent survey on Kindergarten readiness, disseminated to all parents of students enrolled in K-2 primary schools. Student data as well as responses to the multiple-choice questions on the survey were quantitatively analyzed to answer the first two research questions. The last question on the survey, where respondents described their decision-making for enrolling their child in Kindergarten is examined qualitatively to further understand the degree to which a child's age in relation to his or her peers is a factor in determining Kindergarten readiness.

The chapters to follow offer a comprehensive review of the literature, outline the research method to answer the questions outlined in this chapter, review the results, both quantitative and qualitative, and in chapter five, discuss the implications of the findings to educators as well as related topics for further study and research.

CHAPTER 2: LITERATURE REVIEW

This mixed methods study examines the degree to which the relative age effect may impact students in Scarborough Public Schools with respect to academic achievement, special education identification, and enrollment in the most academically rigorous courses in high school. The study provides a qualitative analysis of parent survey responses where participants describe factors in their decision-making around enrolling their child in Kindergarten. As outlined in the introduction of the first chapter, the relative age effect refers to the impact differences in age among students in the same grade may have on academic achievement, performance in school, and outcomes that extend beyond the K-12 classroom. Considerable research has been done, starting in the early 1980s, to understand embedded advantages for the oldest students in a grade and disadvantages for the youngest. Students who turn five in the months just prior to the eligibility cut-off date for starting Kindergarten (October 15 in Maine) are nearly one year younger than those who are born in the months immediately after October 15. In addition, there are parents who deliberately choose to start their child in Kindergarten at age six, a decision called *redshirting*, which can make the age difference between some classmates almost two full years. As outlined in this chapter, considerable research exists to understand the possible impact the wide diversity in age and developmental maturity can have on a child's school experience and success in the classroom as they progress through the grades. Peer reviewed journal articles, as early as the late 1980s, outline the impact of the relative age effect, first with an example from the world of Canadian ice hockey, as described by Malcolm Gladwell's book *Outliers*. Peer reviewed journal articles further assess whether the relative age effect extends beyond the early grades of primary school, into secondary grades, and even beyond to college and universities and the work world. There are many studies attempting to

understand the challenges of being the youngest in the grade, and the possible impact of being more likely to be referred for special education or receive additional academic support or intervention. Finally, I will summarize the research related to academic redshirting, a parent deciding to deliberately hold their child back one year to start kindergarten at age six, and recent research related to the impact of ability grouping on educational equity. Both of these concepts are ways to counteract the impact of the relative age effect.

Literature Search Strategy

My search strategy centered around finding peer reviewed journal articles related to relative age impact and the prevalence of redshirting. I used the ERIC database maintained by the US Department of Education to find peer reviewed journal articles, many of which shared findings between 2000 and 2014. I expanded my search to include dissertations, and found more recent research conducted, as well as two peer reviewed studies on relative age and redshirting from Australia in 2020 and 2021. The primary search terms utilized to identify journal articles on the relative age effect were: *relative age effect, ability grouping, school readiness, academic achievement, grade level cohort, academic red-shirting, age differences, and age grade placement.*

Theoretical Foundation

Malcolm Gladwell, in his 2011 book *Outliers,* outlines the theoretical framework for the relative age effect in the chapter entitled the Matthew Effect (Gladwell, 2011). Gladwell recounts the story of Roger Barnsley, a Canadian psychologist, who was attending a semi-professional hockey game with his wife and kids in Alberta. His wife, looking at the roster of players, which included their date of birth, noticed a majority of the players had birthdays in January, February, or March. Gladwell recounts how the pattern jumped off the page; following

the game, Barnsley started to research as many elite hockey players and teams as he could, including Canadian born NHL players, and found an identical pattern across all elite hockey leagues in Canada. This pattern became "the iron law" of Canadian hockey: 40% of professional hockey players are born between the months of January and March, 30% between April and June, 20% between July and September, and 10% between October and December (Barnsley & Thompson, 1988; Gladwell, 2011). The elite players were five times more likely to be born between the months of January and April than any other month. Why? Barnsley and his fellow researchers came up with the following explanation. In Canada, the cut-off for age level groupings in youth hockey is January 1, and starting at age ten, hockey players are grouped by ability, with the most skilled players chosen for travel or "rep" teams. A player born on January 2 is one year older than a player born on December 30, and playing on the same ice, and on the same team, while being more fully developed, bigger, faster, and likely more skilled than the younger player. Once the player born in January reaches the age of ten, he is much more likely to be selected for the travel team. Travel teams play a longer schedule, have more practices, and compete against better teams. Thus, the player selected plays a longer schedule, with more practices, better coaching, and against better competition than the player competing on the "house" team. This differentiated experience furthers the performance divide between the January and December birthdate players as they get older (Gladwell, 2011). In 1988, Roger Barnsley wrote a paper for the Canadian Society for the Study of Education titled *Birthdate and Performance: The Relative Age Effect*, which outlined the potential impact of relative age in the classroom. He presented data to suggest, much like the iron law of Canadian hockey, success in the classroom can be impacted by a child's birth month, providing embedded advantages to the oldest in a grade, and additional challenges to the youngest (Barnsley, 1988).

Conceptual Framework

This study examines the impact and consequences of organizing schools into age-specific grade levels with a single cut-off date for school entry eligibility. Having students grouped together in the same grade where those born just prior to the eligibility date can be almost a full year younger than those born just after the cut-off date can have a measurable impact on a child's experience in the classroom. Advantages to the oldest in a grade, and disadvantages to the youngest define the conceptual framework behind the relative age effect. A child who is the youngest in a grade is more likely to score lower on measures of academic achievement, be referred for a specific learning disability, and require additional academic support. These students are also less likely to be selected for more accelerated learning opportunities (Martin et al., 2004). Conversely, a child who is the oldest in a grade is more likely to score higher on measures of academic achievement, be sorted into advanced academic tracks, and less likely to require individualized or remedial academic support (Bedard & Dhuey, 2006; Dhuey & Lipscomb, 2008).

The oldest students are more likely to experience success in a classroom and school environment. Advantages for the older students, and disadvantages for the younger students, can persist through the primary grades, creating divergent paths between those who are relatively young and those who are relatively old (Bedard & Dhuey, 2006; Campbell, 2014; Cobley et al., 2009; Dougan & Pijanowski, 2011). Those at the older end of the cohort are more likely to experience success and therefore grow in self-confidence and self-efficacy. This positive feedback loop for older students can reinforce itself through even stronger performance and praise/additional challenge from teachers, coaches, parents, and others that hold influence in a child's life. In this way, the advantage originating from their birth month can grow as a child

gets older. Schools, particularly those that routinely sort students by ability at regular intervals as they progress through the grades, can cement these divergent paths, and even exacerbate the differences, negatively impacting outcomes for students who are the youngest in the grade, and positively impacting those who are the oldest (Bedard & Dhuey, 2006; Cobley et al., 2009; Martin et al., 2004). These divergent pathways can extend through high school, beyond graduation, and into the workforce as students become adults (Hurwitz, 2015). Relative age can impact academic outcomes and performance in school, a child's feelings of self-efficacy and confidence, social emotional health, peer leadership opportunities, and even entrance into four-year college and university placement (Barnsley, 1988; Bedard & Dhuey, 2006; Campbell, 2014; Dhuey, & Lipscomb, 2008; O'Brien, 2018; Sprietsma, 2010). Further, greater numbers of leadership opportunities are afforded to students who are relatively older than their peers, performance on SAT and ACT exams are impacted as students contemplate post high school education and college admissions, and the types of jobs and careers young adults are contemplating and entering are also influenced by relative age (Dhuey & Lipscomb, 2008).

Implications for Special Education:

Although some research suggests advantages for the oldest in a grade dissipate over time, there is significant evidence in the literature to conclude disadvantages for the youngest are likely most pronounced in the primary grades (Bedard & Dhuey, 2006; Larsen et al., 2021). The degree to which the youngest students are referred to special education, or require additional intervention and support to be successful in school outpaces that of older students. The youngest in a grade is more likely to face the challenges of being on the early end of the developmental spectrum, to have their lack of developmental maturity misinterpreted as inability to thrive in a primary school classroom, and to be referred for additional services and/or evaluation for a

learning disability. (Martin et al., 2004). The observed percentage of students born in the months of September through November (older) was 10.2% *below* the expected number of students diagnosed with specific learning disability (SLD) while the observed percentage of students born in the months of June through August (younger) was 12.5% *above* the expected number of students diagnosed with an SLD, highlighting the inequity of special education referrals associated with students' birth month (Martin et al., 2004).

The *maturity hypothesis* contends that neurological maturity relative to one's peers impacts learning performance and the potential for being diagnosed with a specific learning disability is greater for those on the younger end of the cohort, particularly in the early grades. The youngest in the class would have more difficulty sustaining attention, working independently, and developing the executive functioning skills to implement successful learning routines in the classroom (Martin et al., 2004). Particularly in the primary grades, younger students within a grade level cohort are more likely to be referred for academic intervention (Dhuey & Lipscomb, 2010; Martin et al., 2004), assessment for a specific learning disability, and/or additional academic support (Martin et al., 2004).

Persistence of the relative age effect through the grades

In educational systems where grouping by ability is done at different points during a child's K-12 schooling journey, a relative age effect is present (Campbell, 2014; Cobley et al., 2009). In the United Kingdom, where students are streamed into different tracks by ability and academic performance at different points in their educational journey, significant advantages exist for the oldest students in a grade cohort (Cobley et al., 2009). Disadvantages for the youngest in a grade level are also documented and can persist through primary school and into secondary school (Campbell, 2014; Cobley et al., 2009). In systems where there is less

regrouping and sorting by ability, the relatively older students that may outperform their younger classmates significantly in 3rd grade, do so to a lesser degree in 5th and 7th, and any age-related advantage is virtually eliminated by the 9th grade (Dougan & Pijanowski, 2011; Larsen et al., 2021). Some studies assess the impact of relative age as even shorter, with any age or developmental maturity advantage disappearing by 3rd grade (OBrien, 2018; Steffan, 2018). This suggests that the impact of relative age on academic achievement is likely the most pronounced at the early primary grades, K, 1, 2, and 3 (Larsen et al., 2021; Steffan, 2018). The pervasiveness of relative age through primary school and into secondary school may be estimated by comparing the academic performance of older students versus younger students (Bedard & Dhuey, 2006; Larsen et al., 2021). Metrics include performance on achievement tests in specific content areas (Bedard & Dhuey, 2006) as well as being tracked into more advanced academic groups as they enter secondary school and high school (Campbell, 2014; Cobley et al, 2009; Larsen et al., 2021). When students are regularly grouped by ability and sorted into different academic groups at regular intervals, the relative age effect is more persistent through primary school and into secondary school (Campbell, 2014; Cobley et al., 2009).

A child's effectiveness in a classroom, as measured by their grades and academic performance, can often be attributed to their age in comparison to their grade level peers (Campbell, 2014; Cobley et al., 2009). The oldest students are more apt to perform well in school, and are more likely to gain entry into more advanced academic tracks as they enter secondary school (Cobley et al., 2009). In a UK study, children born in the month immediately following the cutoff date are more than twice as likely to be placed in the highest performing groups, while those born in the month immediately preceding the cutoff date are more than twice as likely to be placed in the lowest performing groups (Campbell, 2014). The youngest students

in a cohort are also the most likely to be retained and repeat a grade, an outcome that often leads to further academic struggles for our youngest students (Cobley,et al., 2009). In contrast, the oldest students in the cohort often excel in school and activities, given their relative developmental maturity, size, and age differential. Older students in a cohort are often overrepresented in gifted and talented programs, and score higher on standardized achievement tests, and perform better academically relative to their younger peers (Cobley et al., 2009). Researchers in the UK analyzed school performance among 692 students at a secondary school in North England to assess a possible relative age effect, looking at the following data points: (a) attainment in 4 secondary school subjects, (b) attainment consistency across subjects, (c) pupils enrolled in gifted and talented programs, (d) pupils referred for learning support or identified as having special educational needs, and (e) whether RAEs were related to pupil attendance. Older pupils were more likely to attain consistently high scores across all subject areas and more likely to be enrolled in gifted and talented programs. In contrast, relatively younger pupils were overrepresented in learning support referrals and more likely to be among the lowest 20% of attainment and among the highest with attendance problems (Cobley et al., 2009). In educational systems where students are regularly sorted and grouped by ability, relative age can play a significant factor in determining educational outcomes and performance in school.

Bedard and Dhuey (2006), looked at achievement results among students across multiple OECD (identify) countries and established statistically significant patterns in the results that suggested the relative age effect can persist into adolescence and young adulthood. Using the Trends in International Mathematics and Science Study (TIMMS), student achievement data from across 19 different countries, they found anywhere from a 4-12 percentile advantage for the oldest in a cohort, vs the youngest, at the 4th grade level, and a 2-9 percentile advantage at the

8th grade levels. The study also looked at enrollment in the US to four-year universities and found the youngest students in a given cohort were underrepresented by as much as 11.6% vs the relatively older students in the cohort (Bedard & Dhuey, 2006). These results were most pronounced in systems where students were grouped by ability and streamed into differentiated tracks or courses of study. In classroom environments where students are not sorted into different groups and continue to have access to the same curriculum as classmates that may be more accelerated, or less so, other research studies have suggested any early age advantages are no longer present by the time students are in secondary school (Larsen et al., 2021; Mavilidi et al., 2021). The advantage of relative age dissipates as students move through the grades, with early advantages for grade level peers nonexistent by the time students reach high school (Mavilidi et al., 2021). Two dissertations written in 2018 track the relative age effect with respect to early literacy skills in primary schools. A relative advantage for older kindergarten students with respect to literacy, and a disadvantage for relatively younger peers, means that younger students were more readily referred for intervention and/or special education services. This difference, while statistically significant in Kindergarten, dissipated and were virtually erased by Grade 3 (OBrien, 2018; Stefan, 2018). Given some of these findings, and the research supporting the existence of a relative age effect, particularly in the early grades, it is not surprising to observe an increase in redshirting, the parental decision to hold their child back an extra year from starting Kindergarten. This practice has increased across public schools in the US, and in other countries in recent decades (Dougan & Pijanowski, 2011).

Redshirting:

The beneficial impact of being the oldest in the class has led to a second phenomenon directly attributed to the relative age effect, a decision of a parent to hold off on starting their

child in Kindergarten until they have turned six, or redshirting (Katz, 2000). While redshirting is not exclusive to the US, this term is most used in the United States and its prevalence has grown over the course of the last three decades (Dougan & Pijanowski, 2011). This is most common in middle- and upper-income households, where parents can make the decision to delay school entry without facing further economic hardship (Larsen et al., 2021). The prevalence of redshirting can exacerbate the achievement gap between students and families of varied socioeconomic status (Dougan & Pijanowski, 2011; Larsen et al., 2021). More current research on the impact of redshirting, or delaying a child's entry into kindergarten by one year, has been conducted in Australia (Larsen et al., 2021). National Assessment Program Literacy And Numeracy (NAPLAN) achievement data showed statistically significant achievement outcomes for those who delayed entry at the 3rd, 5th, and 7th grade levels in both literacy and numeracy. By the 9th grade, any advantage was no longer statistically significant. The advantage and impact for 5th and 7th graders were less than the performance outcomes for the 3rd graders, but still persisted into middle school years (Larsen et al., 2021). The degree to which a child's birth month can predetermine academic achievement and success in the classroom is salient for educators as they address issues of educational equity and meeting the needs of all learners. Families in upper middle classes are more likely to redshirt their child to ensure they are the oldest in the cohort. Low income families with working parents, who may struggle to afford childcare and pre-school, are more likely to enroll their child in Kindergarten as soon as they are eligible. This dynamic can serve to further exacerbate the achievement gap between those with economic means and those without.

Ability grouping

The degree to which an educational system tests and groups by ability, has an impact on outcomes for students based on relative age (Bedard & Dhuey, 2006). Even within classrooms of students of all abilities, teachers will assess skills and group by ability (Webel et al., 2021). This can impact equitable instructional experiences for kids, as outlined in a 2021 journal article on ability grouping in Mathematics (Webel et al., 2021). Researchers explored alternative instructional strategies to ability grouping in Mathematics, a common practice among teachers. In the abstract, the authors suggest ability grouping "can exacerbate existing inequities, and there is evidence to that alternatives to grouping can improve learning experiences for all students." (Webel et al., 2021). Authors identify the unintended consequences of sorting students by ability into distinct groups, particularly with respect to the impact this practice has on those sorted into lower groups, who often receive less effective instructional experiences, experience less growth, and likely would have benefited from learning among those of higher mathematical ability in mixed groups (Webel et al., 2021). This study outlines the challenges embedded in teaching mathematics to students with varied ability and shares the many new strategies teachers of mathematics are exploring to engage students more equitably, and seek to group students randomly, or assign them in a manner where ability is mixed and students of varied ability benefit from engaging with one another (Webel et al., 2021).

Summary and Conclusions

A child's age relative to their peers is a factor educators must consider when considering the impact of educational equity and meeting the needs of all students. The literature review presented includes a theoretical framework defining the relative age effect, embedded advantage of being the oldest and disadvantage of being the youngest. The literature reviewed outlined the

framework starting with Roger Barnsley and the iron law of Canadian Hockey (Barnsley & Thompson, 1988), and applied it to grade level cohorts in schools. Research on this topic revealed patterns related to ability grouping, the likelihood of the youngest students in a grade being identified as needing special education services, the prominence of older students in more advanced courses of study, and the persistence of the relative age effect through the grades. Finally, the review includes literature related to the increased prevalence of redshirting and the impact it has on educational equity for low income students with working parents. No qualitative or mixed methods studies on this topic were found, nor was there one where researchers attempted to understand the decision-making process of a parent determining when to enroll their child in Kindergarten.

In this study, I use mixed methods to examine the relative age effects within one school district/community. The intent is to examine the degree to which relative age is a factor with respect to educational outcomes for children in Scarborough. By examining relative age in the same community, across the K-12 spectrum, I hope to contribute findings on how a child's age relative to his or her peers impacts their experience in school. Scholarly practitioners can better understand how the relative age effect can impact a child's success in school, opportunities for advanced coursework in high school, even post-graduate plans to attend college and universities. Educators can also better understand parental decision-making around school readiness, the impact of increased redshirting by families, and the unintended consequences of streaming students into courses of study with different levels of academic rigor.

CHAPTER 3: RESEARCH METHOD

This study examines how the relative age effect impacts students attending Scarborough Schools, the public school system in Scarborough, Maine. In Scarborough schools, students born in August, September, and the first half of October represent the youngest students in a given grade level, while students born in the second half of October, November, and December represent the oldest students. Advantages for students born just after October 15 (the oldest), and disadvantages for students just prior to October 15 (the youngest) include academic achievement, performance on standardized assessments, referral rates for special education and identification of learning disabilities, student self-efficacy and confidence, peer leadership opportunities, placement into high achieving academic tracks, and post-secondary collegiate admissions (Barnsley, 1988; Bedard, & Dhuey, 2006; Campbell, 2014; Dhuey, & Lipscomb, 2008; OBrien, 2018; Sprietsma, 2010). It is critical for educators to understand the impact of the birth month advantage or disadvantage, whether real or perceived, in order to best meet the needs of all students. Given the age disparities within a grade level, some parents will choose to keep their child out of school for an additional year, and enroll them in kindergarten at age six to ensure he or she are among the oldest in the class, a decision called redshirting. This study examined the degree to which relative age impacts Scarborough students, and hopes to reveal further opportunities for study regarding ways educators or policy makers can mitigate and address the potential inequities of being born early or late within a grade level.

Setting:

In the Scarborough Public Schools (Scarborough, Maine), all children who reach the age of five by October 15 of the current school year are eligible to enroll in Kindergarten. Scarborough Maine is one of the largest immediate suburbs of Portland with an

estimated population of 22,250 residents as of 2020, an increase of over 17% from the census taken in 2011. Scarborough, along with Gorham, Westbrook, and some other immediate suburbs of Portland, is currently experiencing significant population growth and economic development, unlike many districts in other parts of Maine, where school enrollment has been in decline. Scarborough continues to grow in population, and in the last 10-15 years, enrollment in the public schools has grown to approximately 3000 students in grades K-12. Students attend small neighborhood schools in Kindergarten through second grades: Pleasant Hill School, Blue Point School, and Eight Corners School. Each of the K-2 schools enroll about 200 students. Once a child reaches third grade, all public school students attend the Wentworth School for Grades 3-5, then the Middle School for Grades 6-8, and Scarborough High School for Grades 9-12. The three larger schools in the district are all centrally located in town, and adjacent to one another on a campus next to the town hall and Route 1, the economic hub of the town. Scarborough Schools have historically paid staff, teachers, and leaders well in comparison to surrounding communities. The school department recruits and retains effective educators, attracting families to the town in part because the schools have a reputation for being of high quality. Those who live in town are especially connected to the neighborhood K-2 schools, a sentiment evident as the town considers building a new school to replace the aging schools that are no longer able to house the enlarging enrollment of students at the K-2 level.

Scarborough provides an interesting context for examining the relative age effect in schools. Enrollment continues to hold steady and grow; many educators who work in Scarborough are veterans who are not new to teaching and have remained in the community after being hired. Parents are invested and involved in the schools and most see their child moving on to a post-secondary education following their high school graduation. The special education

department and student support services for students are strong and well-respected; many parents have reported their decision to move to Scarborough was based on the reputation of the schools and the special education department in meeting the needs of students with unique learning challenges. While real estate values and the overall valuation of the town continue to grow at a rapid rate, there is considerable socioeconomic diversity in Scarborough, and a mix of families who have lived in Scarborough for generations and those who are new to the town and to Maine.

Research Design and Rationale

This mixed methods study examines the degree to which the relative age effect impacts student achievement outcomes for students K-12 in Scarborough Public Schools. The relative age effect refers to the impact differences in age among students in the same grade cohort can have on performance in school. Students who turn five in the months just prior to the eligibility cut-off date for starting Kindergarten (October 15 in Scarborough, ME) are nearly one year younger than those who are born in the months immediately after October 15. In addition, there are parents who choose to delay their child's enrollment in Kindergarten for one year, a decision called *redshirting*, which can serve to make a child who otherwise would have been one of the youngest in a grade cohort, now one of the oldest. The primary quantitative part of this study compares student achievement results, specifically Maine Educational Assessment (MEA) scores in Math and English Language Arts for Scarborough students in Grades 3, 5, and 8. Achievement, as measured by MEA scaled scores, for the youngest students in a grade are compared to scores for the oldest students in a grade. A longitudinal analysis of performance was also conducted, tracking the same cohort of students from 3rd grade in 2017, to 5th grade in 2019. Students in a grade level cohort were sorted by birth date, from oldest to youngest, and then sorted into Group 1, those born in summer and early fall, the youngest, and Group 2, those

born in late fall, early winter, the oldest. Next, the age of all current students in grades 3, 5, and 8 who qualify for special education services (on Individualized Educational Plans (IEPs), were compared to the age of their grade level classmates to determine if they were more likely to be the youngest. Finally, a similar age comparison was conducted for current students at the high school who were enrolled in at least one Advanced Placement Course. At Scarborough High School, an Advanced Placement (AP) course represents the highest level of academic rigor in a given content area. In this case, the hypothesis would be those in at least one AP course would be, on average, older than their grade level classmates. To test this hypothesis, I examined the relative age for students in grades 9, 10,11, and 12. Following the examination of MEA data, age comparisons for those identified with special needs, and age comparisons for high school students enrolled in AP courses, I developed and disseminated a parent survey to all Scarborough parents with students in the K-2 schools. This survey, comprised of six multiple choice questions, and one open response question, produced responses meant to understand a parent's decision-making around Kindergarten readiness and whether relative age was considered as a factor. The examination of results includes a quantitative analysis of multiple-choice responses, and a qualitative analysis of written responses to the open-ended question number seven.

This study aims to understand the degree to which the relative age effect is impacting educational equity in Scarborough schools. The research questions this study is designed to examine are the following:

1. To what extent, if at all, does the relative age effect impact students in Scarborough Schools with regard to (a) student achievement; (b) special education identification; and (c) enrollment in courses with the most academically rigorous curriculum (in Scarborough, Advanced Placement courses)?

2. At what age do Scarborough parents report choosing to enroll their child in Kindergarten and what factors do they report influencing their decision?

To address the first research question, descriptive and inferential statistics are used to compare two groups of students: those who are the youngest in a grade level cohort, with those who are the oldest in a grade level cohort. Historical Maine Educational Assessment (MEA) scaled score results are used to track student achievement in Math and English Language Arts for students in three different grade levels: 3rd, 5th, and 8th. Group 1 contains achievement results for those born in August, September, and the first half of October (youngest in the cohort), and Group 2 contains achievement results for those born in the second half of October, November, and December (oldest in the cohort). The most recent set of MEA achievement data to be analyzed is 2019, as there is no data for students in the spring of 2020, the year the COVID pandemic closed schools. For research question number one, with respect to student achievement & MEA data, the hypothesis to be tested is Group 2, the oldest in the grade will have statistically significantly higher scaled scores on both the English Language Arts and Math sections of the MEA. This directional hypothesis would be proven if after conducting an independent t-test between Groups 1 and 2, p is less than alpha (set at 0.05).

To address part b of the first research question, related to special education identification, current students qualifying for special education services in grades 3, 5, and 8 were sorted by their birthdate, from youngest to oldest. These lists of students were exported from PowerSchool, our student management system, into Excel, where names were removed, and then sorted by age. The mean age of students who qualify for special education was then compared to the mean age of all students in the grade. To address part c of the first research question, high school students currently enrolled in at least one Advanced Placement (AP) course, were

separated and sorted by age from oldest to youngest. Then the mean age for all students enrolled in AP classes was compared to the mean age for all students in each grade level, 9-12. This was done to explore whether there were statistically significant differences in age between those enrolled in at least one Advanced Placement course and their grade level peers.

With respect to the second research question, a quantitative analysis of parent survey responses to questions 1-6 (multiple choice), is accompanied by a qualitative analysis of answers to question seven, where participants describe Kindergarten readiness decision-making. The data collection and analysis of parent survey responses will attempt to understand the degree to which parents think about developmental readiness for school, relative maturity, and whether or not the decision to redshirt, or delay entry by a year, has been considered. There is also a question related to the economic impact of waiting a year to enroll a child in Kindergarten. The qualitative analysis of the parent survey sent out to all K-2 parents is meant to complement the quantitative analysis of historical student achievement data and current student enrollment data outlined to address the first research question, an attempt to determine whether or not a relative age effect exists for students in Scarborough. The analysis of both components, qualitative and quantitative, will determine the role relative age plays in parental decision-making about when to start school, to what degree age differences within a grade impact MEA achievement scores, special education identification, and enrollment in the most academically rigorous courses of study in high school. These factors are studied within the context of Scarborough Schools and the students who attend them. The research questions and the methodology to examine real student data will serve to confirm whether or not there is a measurable impact of relative age, supporting embedded advantages for the oldest in a grade and additional challenges for the youngest. This quantitative examination of student data is then connected to understanding

qualitative data collected in a parent survey around school readiness decision-making. Does relative age factor into decisions around whether to start kindergarten at age five or age six? The study explores the degree to which relative age is a factor in Scarborough Schools, and whether or not educators have considered effective practices to ensure educational equity and provide intervention for a wide diversity of developmental differences among students in all grade levels.

Role of the Researcher

As the only primary researcher, I recruited all parent survey participants through the use of our email system linked through our student management database, PowerSchool. Invitations to participate were sent via email to families of all enrolled students in grades K-2. I was responsible for the collection, protection, and analysis of all student achievement data and survey response data. As the current superintendent of Scarborough Schools, I have been cognizant of the impact professional and personal relationships could have on responses to surveys or decisions regarding the qualitative methods for data collection. With respect to the quantitative pieces of the methodology, all student data: MEA scaled scores, currently enrolled students who qualify for special education, and current high school students enrolled in AP courses, have all been collected through export from PowerSchool into Excel, and did not require any active participation from any member of the Scarborough community. With regard to the qualitative portion of this mixed methods study, I disseminated the survey to all families of enrolled K-2 students and chose not to select a specific sample or just one of the three K-2 schools. Responses to the survey were designed to be anonymous, and the communication regarding the reasoning for the survey was open and transparent. Any conflict of interest or issues around power and influence was minimized.

Methodology

The primary goal of the study is to determine whether or not the relative age effect, embedded advantages to the oldest in a grade, and challenges to the youngest, impacts students in Scarborough Schools. The research design of this study is mixed methods. It is primarily a quantitative analysis of student achievement data: MEA scaled scores in Math and English Language Arts for students enrolled in Grades 3, 5, and 8; current enrollment for students who qualify for special education services, and current enrollment for high school students taking at least one Advanced Placement (AP) course, the most academically rigorous level of courses at Scarborough High School. All student data was retrieved from the student management system, PowerSchool, and exported directly into Excel. Student names were removed and spreadsheets identified individual students only by their date of birth. Students were then sorted in groups from youngest to oldest, and a child's absolute age was calculated utilizing a formula in Excel. Descriptive statistics were calculated to compare groups of students based on their relative age within a grade level. This includes central tendency (mean, median, and mode) and standard deviation. Inferential statistics were calculated to establish statistically significant differences between groups of students based on relative age. Independent t-tests assess statistically significant variance between groups of the oldest and youngest students. In addition, achievement results for the same cohort of students, from 3rd, to 5th, to 8th grade, is compared to assess any variance in performance. Finally, the Pearson correlation coefficient value was calculated to determine strength of correlation between a child's age and scaled score on the Math and English Language Arts sections of the MEA.

To address the second research question on parental decisions around when to start their child in formal schooling, parents of students at the K-2 schools have been surveyed

regarding their child's enrollment in Kindergarten. The email recruitment message was sent to all parents of enrolled students in grades K-2, approximately 600 households. At the end of the survey response window, 207 responses to the survey were received, a 34% response rate. The survey required approximately 10-15 minutes to complete, and was distributed using Qualtrics survey software. Responses were anonymous and no emails or personally identifiable information were collected. Parents were asked to identify their child as born in the following date ranges: July 1 to October 14, October 15 to January 31, and February 1 to June 30th. Following this identification, parents were asked to respond to statements related to the relative age of their child in an effort to understand the mindset around making the decision to start them in school as a five-year-old, based on the cut-off date, or to wait another year, until they turn six, a decision referred to as *redshirting*.

Participant Selection

An email message containing a link to the survey and informed consent was sent to parents and guardians of all enrolled students at the three K-2 schools in Scarborough, ME: Pleasant Hill School, Blue Point School, and Eight Corners School. This represents approximately 600 households. All participants who responded to this survey were at least 18 years old. Consent to participate in the research study was sought by providing informed consent information embedded on the first page of the online survey. The survey was anonymous and participation in the survey indicated consent. No IP addresses were collected and no individually identifying information was linked to any responses to survey questions. Any personally identifiable information shared as part of a written response to an open response question was redacted. With regard to student historical achievement data, current special education identification, and enrollment in Advanced Placement courses, information was exported directly

from PowerSchool into Excel and all student names removed, sorted only by date of birth. Any personally identifiable student data was removed and sorts were completed only by scaled score, grade level, and date of birth.

Sampling frame/methods

Students in each grade level were first sorted by age, from youngest to oldest based on their date of birth. Group 1 represents the youngest in a grade level, and group 2 represents the oldest students in a grade level. MEA scaled scores in Math and English Language Arts were correlated with a child's age within a grade level to determine whether or not there is a connection between MEA performance and absolute age. Do the oldest out-perform the youngest in 3rd, 5th, or 8th grade? Are there statistically significant differences in scaled scores between groups 1 and 2 within a given grade level? Scaled Score MEA data was examined for the following MEA test administrations: 3rd grade math and language arts MEA results in 2017, 5th grade math and language arts MEA results in 2019, and 8th grade math and language arts MEA results in 2019.

To determine if there were statistically significant differences in age between students who qualify for special education services and grade level peers, I compared the mean age of currently identified special education students with their grade level peers in the same grades, 3rd, 5th, and 8th, to determine if the youngest in the grade were more likely to qualify for services.

For high school students enrolled in Advanced Placement courses, Scarborough High School's most academically rigorous curriculum, I sampled all current students (school year 2022-2023) who were enrolled in at least one Advanced Placement (AP) course. This allowed me to compare the mean age of students in each grade level who were enrolled in at least one AP

course, to the mean age of their respective grade level as a whole. This would allow me to determine whether or not there is a statistically significant difference in age between high school students enrolled in AP courses with the mean age of the grade level as a whole.

Data collection procedures

Historical MEA student achievement data in English Language Arts and Math was collected for all students in the 3rd, 5th, and 8th grades over two different years: 2017 and 2019. Cumulative performance results were analyzed for students falling into groups 1 and 2. Current data for students who qualify for special education and high school students enrolled in Advanced Placement courses were collected through exporting student data from PowerSchool into Excel for analysis. An anonymous parent survey utilizing questions related to the parental decision to have a child begin kindergarten at age five, or delay until they are older, was developed and disseminated to all parents with children in Scarborough's K-2 elementary schools. This survey tool has an open-ended question related to a parent's decision-making around Kindergarten readiness.

Data analysis procedures

To address the first research question, I conducted a quantitative analysis of MEA performance in Math and English Language Arts for 3rd, 5th, and 8th grade students on two separate administrations of the MEA in 2017 and 2019. Descriptive statistics were calculated to analyze achievement across the grade level and among both groups of students: Group 1, the youngest in a grade, and Group 2, the oldest in a grade. Central tendency (mean, median, and mode) and standard deviation were calculated for the youngest students in a cohort as well as the oldest students in a cohort. Inferential statistics were calculated to establish trends between the groups of students categorized by relative age. Independent *t*-tests assess statistically significant

variance between the two groups. In addition, achievement results for the same cohort of students, from 3rd to 5th, were compared to assess any variance in performance. Finally, a Pearson correlation coefficient was calculated to determine a child's age correlates to his or her scaled score on the Math and English Language Arts sections of the MEA. Results include a scatterplot to establish a visual trend line and provide a linear regression analysis.

Validity/trustworthiness

A pilot of the survey to establish the internal validity of survey questions and make necessary adjustments prior to sending out to all potential participants was conducted (over 60 responses). Most of the quantitative data to be analyzed is historical achievement data, special education identification, and advanced course and placement student enrollment that is both internally and externally valid. With regard to the parent survey, a possible external threat to validity is the anonymous nature of the survey, and the fact that the study will not be collecting email addresses. Given these features, there is a possibility some responses may not be from Scarborough parents of students in the K-2 schools. To minimize this threat, the survey will only be sent to those families who have enrolled students at Pleasant Hill, Blue Point, or Eight Corners Schools.

Limitations

The primary limitation of this study was the sample size of the student population I examined. While Scarborough Public Schools is one of the larger public school districts in Maine, with approximately 3000 students K-12, discerning whether or not relative age had an impact on current and future school performance is tricky when access to student data is limited to one school administrative unit. I chose to mitigate this limitation by expanding my analysis of student achievement data to include MEA data from three separate grade levels, 3rd, 5th, and

8th, and look at trends across two different assessment years. This allowed for independent comparisons across different grade level cohorts as well as a longitudinal examination of one grade level cohort as they progressed from 3rd to 5th grade.

A similar limitation existed with respect to the parent survey developed and disseminated. The goal was to get enough respondents to be able to mitigate the smaller sample size given the focus on parents residing in Scarborough who have recently started their children in Kindergarten. By expanding the target audience to all parents who have students in the K-2 schools, my hope was to enlarge the number of respondents and gain some insight into the degree to which parents make the decision to start their children on time, as outlined by the October 15 cut-off date, or to hold them for an extra year. While the survey was anonymous, I developed questions related to parent and family demographics to see if there were equity factors around those that choose to redshirt their children versus those who enroll their kids at five.

A secondary limitation with regard to identifying a potential impact of relative age on student achievement and performance in school was the Maine Educational Assessment (MEA) itself. All students attending public schools in Maine are required to take the English Language Arts and Math sections of the MEA in grades 3-8 and one year in high school. These are state-mandated assessments designed to assess an individual student's performance on content and skills outlined in the Maine Learning Results, the Department of Education's statewide curriculum framework. Given local control over curriculum and instruction, expectations for school performance can vary significantly across School Administrative Units. Therefore, it is possible the MEA may not be the best measure of how a child is performing relative to their peers in a given grade, and may be too blunt an instrument to discern whether or not a relative age effect exists.

Ethical Obligations and IRB Approval

To maintain student confidentiality, all historical achievement data, special education referral data, and participation in accelerated academic sections and/or programs does not include any personally identifiable information. Student outcome data will be analyzed and reported cumulatively based only on birth month range. The large sample size of students enrolled will ensure that cumulative totals of students are large enough so as not to be personally identifiable based solely on birth month. The survey instrument to be developed was administered anonymously and did not include personally identifiable information beyond basic demographic information. While the survey is meant to be anonymous, it is designed to be limited to parents of Scarborough students which may have some unintended consequences depending on the sample size, i.e. the number of parents responding to the survey. In anticipation of this, the necessary disclosures regarding the purpose of the study were shared as part of dissemination of the survey tool. With respect to securing the data of the survey tool, those who respond will not be required to submit an email address or any personally identifiable information. All data that is shared as part of the analysis and discussion of results will be aggregated based on multiple choice responses to demographic questions. With respect to the open response question at the end of the survey, any names or personally identifiable information that could be part of a response were redacted.

Qualitative Component Analysis and Data Collection

Survey responses to question seven are open-ended and describe a participants decision-making process to establish their child's readiness for Kindergarten. Responses were analyzed utilizing In Vivo coding, where common language among responses are grouped and highlighted by repeated words or phrases that are alike. First cycle In Vivo coding for the 180 responses

identified 35 different common phrases and words used by participants to describe their Kindergarten readiness decision-making. The second cycle of coding analysis utilized conceptual coding to identify thematic patterns among the first cycle In Vivo codes identified. The concept codes were identified with different color highlights to group common phrases together. Common In Vivo codes were highlighted in red to represent the second cycle concept code defined as social and emotional readiness for school. In Vivo codes related to the concept code identifying a child's age were highlighted in yellow. Phrases referring to the concept code defining academic readiness were highlighted in light blue. Phrases related to holding a child back were highlighted in green. Phrases referring to relative age far out into the future, to high school and college entrance, were put into italics. Phrases around economic concerns related to cost of daycare were identified in bold font. By sorting the first cycle In Vivo codes into conceptual codes, as outlined here, I was able to come up with three distinct findings with respect to parental decision-making around Kindergarten readiness among parents in Scarborough.

Summary

The research design of this study addresses the first research question through a quantitative analysis of Maine Educational Assessment (MEA) data from 2017 and 2019 to determine whether or not older students in a grade perform better than younger students in a grade as measured by their scaled scores. The directional hypothesis to be examined would expect scaled scores in both English Language Arts and Math to be higher than those of the younger students in a given grade. In addition to comparing performance on the MEA, the first question also considers an age comparison for current students who qualify for special education with their respective grade level classmates. The directional hypothesis to be tested would be for

students who qualify for special education services to be, on average, younger than the average student in their grade. Finally, the age of current high school students enrolled in at least one AP course is compared to the average age of their grade level peers. With respect to the disseminated parent survey, the first questions, 1-6, are analyzed quantitatively, while the last open response, number seven, is analyzed qualitatively through first cycle In Vivo codes, and 2nd cycle concept codes to establish findings around parental decision-making for school readiness. Taking a mixed methods approach has allowed me to thoroughly examine the degree to which the relative age effect impacts students and families within the context of one K-12 schools district, Scarborough, Maine.

CHAPTER 4: RESULTS

This mixed methods study examines the impact of relative age on students attending Scarborough Schools, the public school system in Scarborough, Maine. The results outlined in this chapter begin with a quantitative analysis of Maine Educational Assessment (MEA) scaled scores in Math and English Language Arts for 3rd, 5th, and 8th grade students. Individual student data was exported from PowerSchool, Scarborough Public School's student management system, into Excel, including student date of birth and their scaled score for each content area. Students were then sorted oldest to youngest, by birthdate. For each MEA test administration, Group 1 represented the oldest students in a grade level, and Group 2 represented the youngest students in the grade level. Descriptive statistics were calculated for each group, and then an independent *t*-test conducted to determine whether or not there was a statistically significant difference between the scaled scores of the oldest and youngest in the grade level. Following this, a correlation analysis was conducted to determine if there was a relationship between a child's age (relative to grade level peers) and how he or she performed on the MEA.

To better understand identification of students with exceptionalities, the age of current 3rd, 5th, and 8th graders enrolled in special education were compared to the average of students in their respective grade levels to determine whether or not they were, on average, younger than their grade level classmates. The final quantitative part of this study examines the relative age of students enrolled in Advanced Placement (AP) courses, Scarborough High School's most academically rigorous courses, and compares their age to the average of grade level peers.

The prevalence of redshirting, holding a child back one year, until age six to begin Kindergarten, has increased in recent years (Dougan & Pijanowski, 2011). To better understand parental decision making around school readiness in Scarborough Schools, I collected qualitative data around redshirting via the parent surveys. Through an open-ended survey question, I examined to what extent parents in Scarborough think about their child's age relative to their peers and the decision to delay Kindergarten entry until their child is six years old.

Research Questions

1. To what extent, if at all, does the relative age effect impact students in Scarborough Schools with regard to (a) student achievement; (b) special education identification; and (c) enrollment in courses with the most academically rigorous curriculum (in Scarborough, Advanced Placement courses)?
2. At what age do Scarborough parents report choosing to enroll their child in Kindergarten and what factors do they report influencing their decision?

In the first part of this chapter, I present results of a quantitative analysis to determine impact of relative age on Maine Educational Assessment (MEA) scaled scores for students in 3rd, 5th, and 8th grades in Math and English Language Arts. Results will test a directional hypothesis: the oldest students in a grade should have a higher scaled score on both content area assessments than the youngest students in a grade. This should hold true for 3rd, 5th, and 8th grade students. Spring administrations for students in these grades in 2017 and 2019 are examined. MEA scaled scores to be analyzed were deliberately selected prior to the spring of 2020, when all state assessments were suspended due to the COVID pandemic. Following the MEA results, average age for current students who qualify for special education in 3rd, 5th, and

8th grades are compared to the average age of their grade level peers. The same comparison is conducted for high school students enrolled in at least one Advanced Placement (AP) course.

Following the quantitative analysis of student historical data, results of a parent survey sent to all families of current Scarborough students enrolled at the three K-2 primary schools: Pleasant Hill, Eight Corners, and Blue Point, are presented. Respondents were asked six multiple choice questions regarding their child's readiness to start kindergarten and their child's relative age in comparison to their classmates. Following the multiple-choice questions, the survey asked an open response question regarding their child's readiness for starting Kindergarten.

Data collection

All student data used for the quantitative analysis part of this mixed methods study was collected from the Scarborough Schools student management system, PowerSchool. Reports from PowerSchool were generated and necessary data was exported directly into Excel for analysis. For the Maine Educational Assessment (MEA) analysis, all students in 3rd, 5th, and 8th grades, who took the MEA in English Language Arts and Math, were sorted oldest to youngest, by their date of birth, with each student's scaled score in English Language Arts and Math. Separate reports were then generated in PowerSchool and exported into Excel with all current students in 3rd grade, 5th grade, and 8th grade, with each child's date of birth and special education designation. A final report was generated and exported into Excel, for all high school students enrolled in at least one AP course. These reports, like the MEA data, were then sorted in Excel by a student's date of birth. There is a formula in excel that will calculate exact age based on date of birth. This added field was utilized to calculate descriptive statistics for each group of students analyzed. In all instances, once student data was sorted in Excel, all names

were removed from the fields, and comparative analysis was completed using only a child's date of birth to establish relative age.

To address the research question related to the parental decision on when to start their child in Kindergarten, I disseminated a survey to parents of all current students (school year 2022-2023) at Scarborough's three K-2 primary schools. These parents were chosen to receive the survey because the decision to start their child in Kindergarten was likely still fresh in their minds. An email recruitment message was sent to all parents of enrolled students in grades K-2, which represented approximately 600 households. Out of the 600 survey invitations sent, 207 responses were received, representing a 34% response rate. The survey, which required approximately 10-15 minutes to complete, was distributed using Qualtrics survey software. Responses were anonymous and no emails or personally identifiable information were collected. The survey was sent out on Monday, March 27, 2023, and the window for collecting responses closed on Friday, April 21, 2023. Parents were asked to identify their child as born in the following date ranges: July 1 to October 14, October 15 to January 31, or February 1 to June 30. Following this identification, parents responded to four multiple choice questions related to their child's relative age to potential peers in school, and whether or not they considered redshirting their child, waiting until they are six years old to start Kindergarten. They were then asked an open-ended question related to their decision-making on when to start their child in Kindergarten.

Student Achievement on MEA: English Language Arts and Math

The first set of results analyzes 3rd grade scaled scores on the Spring 2017 administration of the MEA in Language Arts and Math. Spring 2017 results for third grade were selected deliberately, to accompany the next set of MEA scaled scores to be analyzed, 5th grade scores in 2019. This

serves to follow the same cohort of students from 3rd to 5th grade, to determine whether or not relative age impacts the same students as they mature from 3rd to 5th grade. Scaled score results for the 172 third grade students who took the test in the spring of 2017 were sorted from oldest to the youngest according to their date of birth. These students were then sorted into younger, Group 1, and older, Group 2. I then calculated descriptive statistics for both groups with respect to performance on English Language Arts and Math. Descriptive statistics for both groups are identified in Table 1.

Table 1: 2017 3rd Grade MEA – English Language Arts & Math

	Mean	Median	Mode	SD	Min	Max	Range
ELA Group 1 (n = 47)	364	365	377	13.28	323	390	67
ELA Group 2 (n = 47)	367	366	349	13.32	331	390	59
Math Group 1 (n = 47)	361	363	370	15.48	300	385	85
Math Group 2 (n = 47)	363	362	354	11.57	342	390	48

The mean scaled score for Group 2, the oldest in the grade level cohort, is only slightly higher than the mean for Group 1, the youngest in the grade level cohort. The median for both groups is almost the same. Next, to identify the appropriate *t*-test for this analysis, I conducted an *f*-test to determine equal or unequal variance, an independent *t*-test to establish whether or not the difference in performance between the relatively young students (group 1), and the relatively old students (group 2), is statistically significant (alpha = 0.05). This will serve to test my directional hypothesis that older students in a grade will outperform younger students on both MEA tests. The results of the *f*-test are shown in Table 2.

Table 2: *f*-test for 2017 MEA 3rd Grade

	Group 1		Group 2					
	M	SD	M	SD	f	df	p	Variance
2017 3rd Grade ELA	364	13.28	367	13.32	0.6	46	0.492	Equal
2017 3rd Grade Math	361	15.48	363	11.57	1.8	46	0.0255	unequal

As shown in Table 2, the *f*-test determined equal variance for the ELA test, and unequal variance for the Math test. For the independent *t*-test, the alpha value is set at 0.05. The results of the independent *t*-test for both Math and ELA are summarized in Table 3.

Table 3: *t*-test for 2017 MEA 3rd Grade

	Group 1		Group 2			
	M	SD	M	SD	df	p one-tail
2017 3rd Grade ELA	364	13.28	367	13.32	92	0.14
2017 3rd Grade Math	361	15.48	363	11.57	85	0.25

p is greater than alpha, both in English Language Arts and Math. Therefore, the null hypothesis is retained and there is no statistical significance between the scaled scores of Group 1 and Group 2. Older students in the grade did not outperform the younger students.

To further test the relative age hypothesis, I used the student's date of birth to calculate age in years and months and then conducted a linear regression analysis to see if there was a correlation between age and MEA performance on the English Language Arts (ELA) and Math sections. The linear regression scatterplot is summarized in Figures 1 and 2.

Figure 1: Scatterplot of Scaled Score vs. Age in Years – 2017 3rd Grade ELA

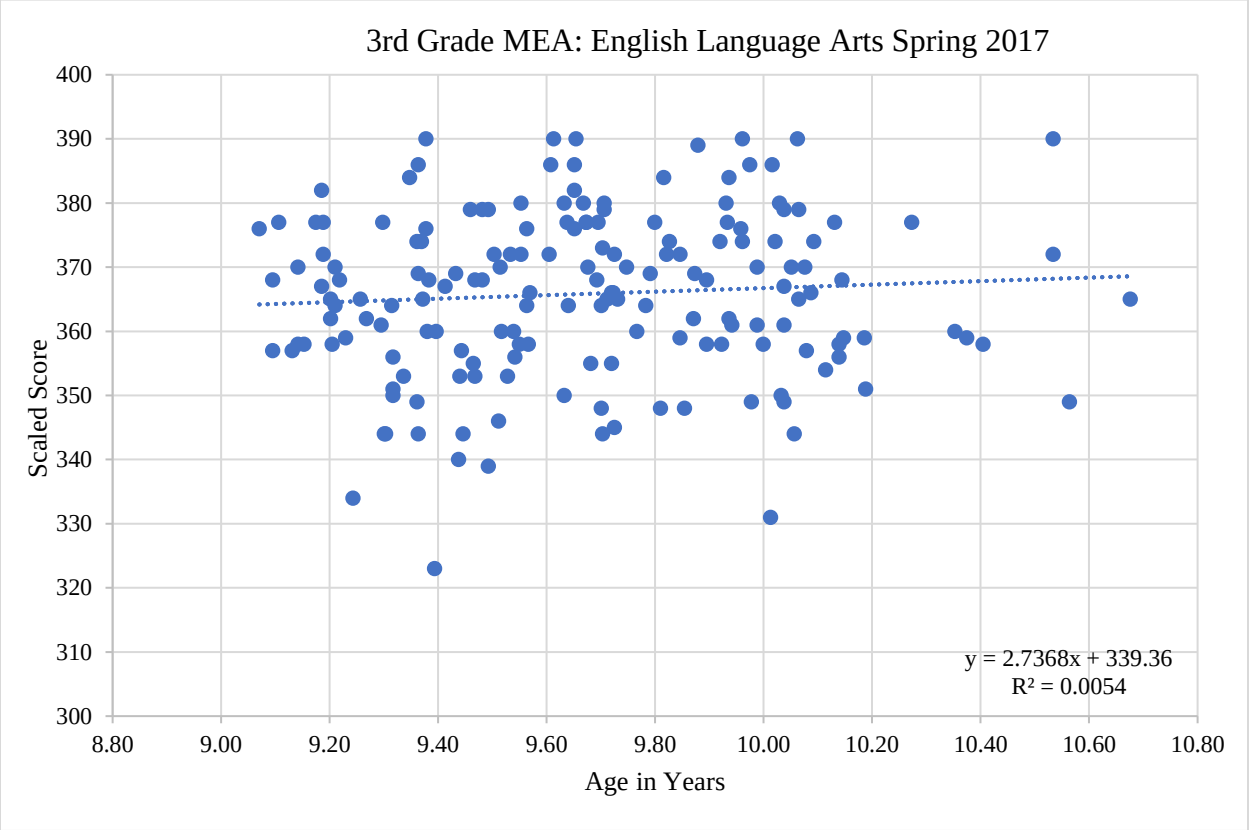
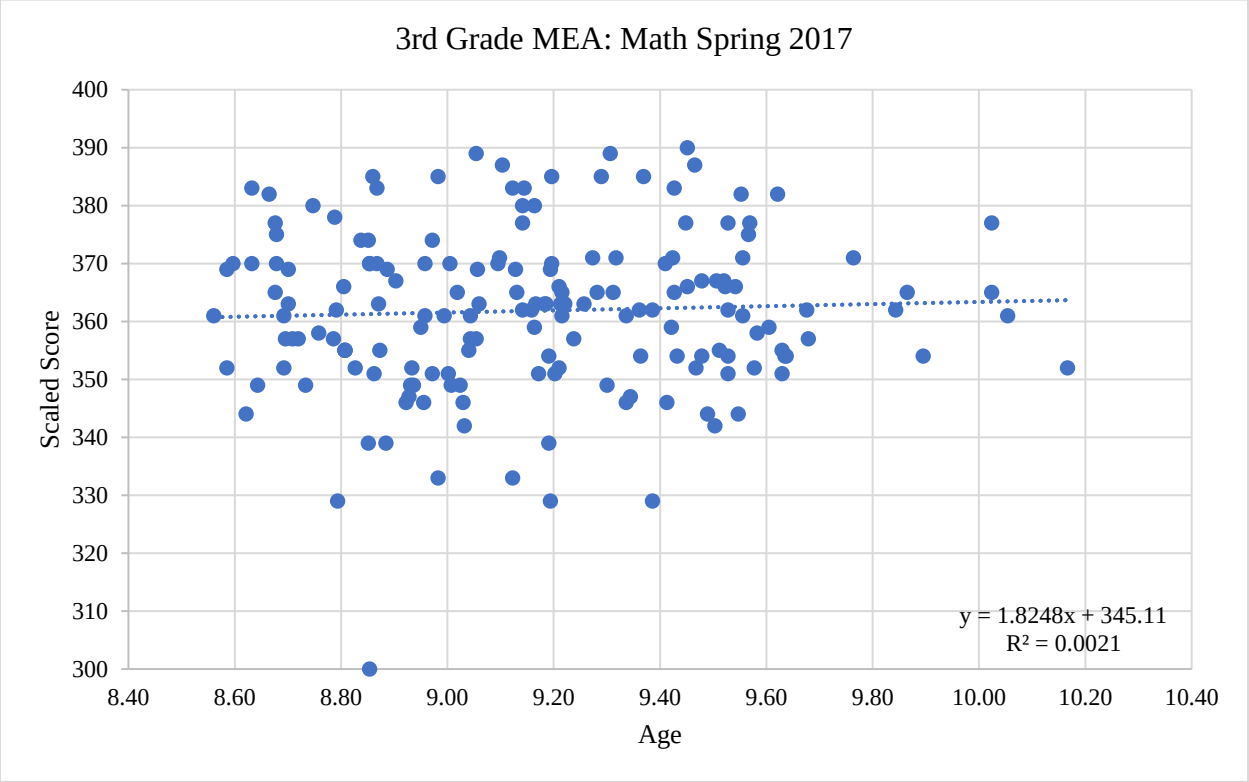


Figure 2: Scatterplot of Scaled Score vs. Age in Years – 2017 3rd Grade Math



The trend line is horizontal, and the performance of each student is widely dispersed with little to no pattern. Pearson's correlation coefficient $r = 0.046$ and is close to zero, therefore there is no correlation between age and scaled score. Scales scores on English Language Arts and Math were not correlated to age among all 3rd graders. I conducted the same analysis testing the same directional hypothesis on the same cohort of students now 5th graders on the Spring 2019 MEA test administration. Descriptive statistics comparing Group 1, oldest, and Group 2, youngest, are summarized in Table 4.

Table 4: 2019 5th Grade MEA – English Language Arts & Math

	Mean	Median	Mode	SD	Min	Max	Range
ELA Group 1 (n = 55)	568	570	587	13.44	535	590	55
ELA Group 2 (n = 50)	572	572	590	12.34	537	590	53
Math Group 1 (n = 55)	558	559	563	14.28	516	588	72
Math Group 2 (n = 50)	559	561	545	12.22	525	583	58

Group 2 had higher mean and median scores in both ELA and Math, but the difference was minimal. To identify the appropriate *t*-test for this analysis, I conducted an *f*-test to determine equal or unequal variance. The *f*-test results are summarized in Table 5.

Table 5: *f*-test for 2019 MEA 5th Grade

	Group 1		Group 2					
	M	SD	M	SD	f	df	P	Variance
2019 5th Grade ELA	568	13.44	572	12.34	1.59	54/49	0.27	Equal
2019 5th Grade Math	558	14.28	559	12.22	1.59	54/49	0.13	Equal

As shown in Table 5, the *f* – test determined equal variance for both the ELA and Math tests. For the independent *t*-test, the alpha value is set at 0.05. The results of the independent *t* – test for Math and ELA are summarized in Table 6.

Table 6: *t*-test for 2019 MEA 5th Grade

	Group 1		Group 2			
	M	SD	M	SD	df	p one-tail
2019 5th Grade ELA	568	13.44	572	12.34	103	0.089
2019 5th Grade Math	558	14.28	559	12.22	103	0.343

p is greater than alpha, both in English Language Arts and Math. Therefore, the null hypothesis is retained and there is no statistical significance between the scaled scores of Group 1 and Group 2. Older students in the grade did not outperform the younger students.

As with the 3rd grade cohort in 2017, a 5th grade 2019 MEA linear regression scatterplot analysis supports the null hypothesis being retained. There is no correlation between age and scaled score on the 5th grade MEA in either ELA or Math. This is illustrated in Figures 3 and 4.

Figure 3: Scatterplot of Scaled Score vs. Age in Years – 2019 5th Grade ELA

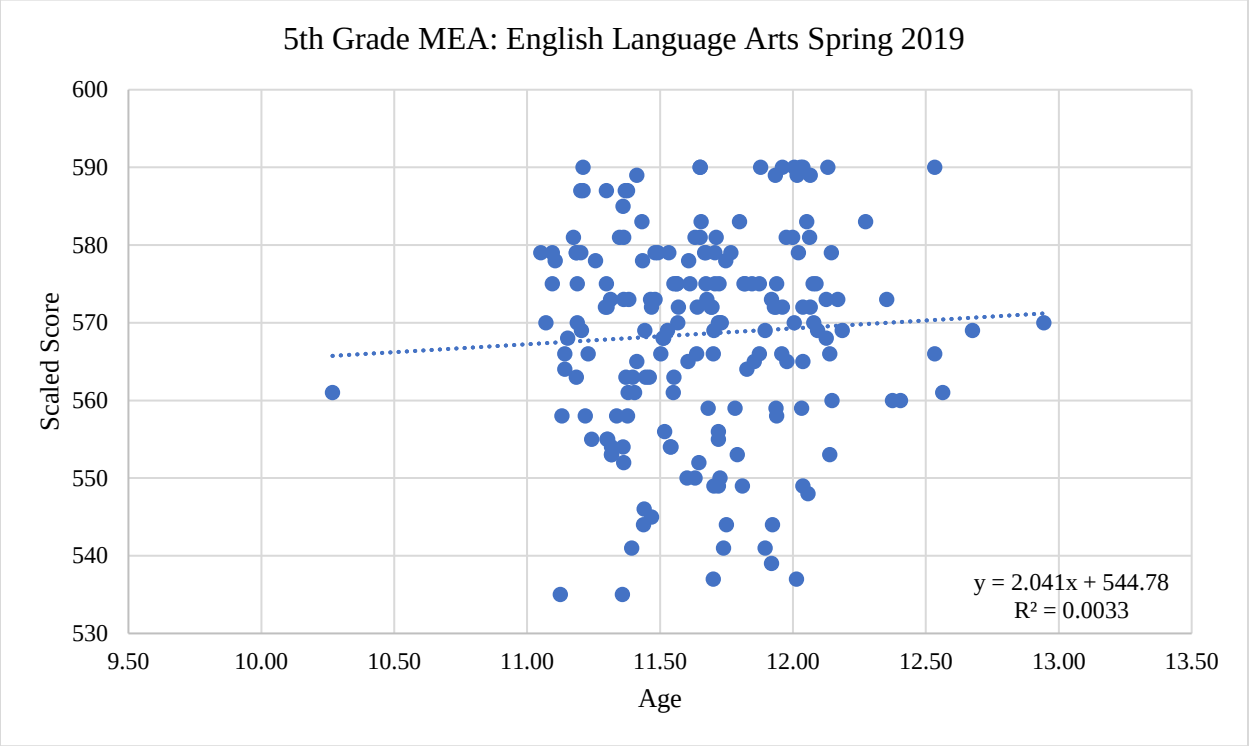
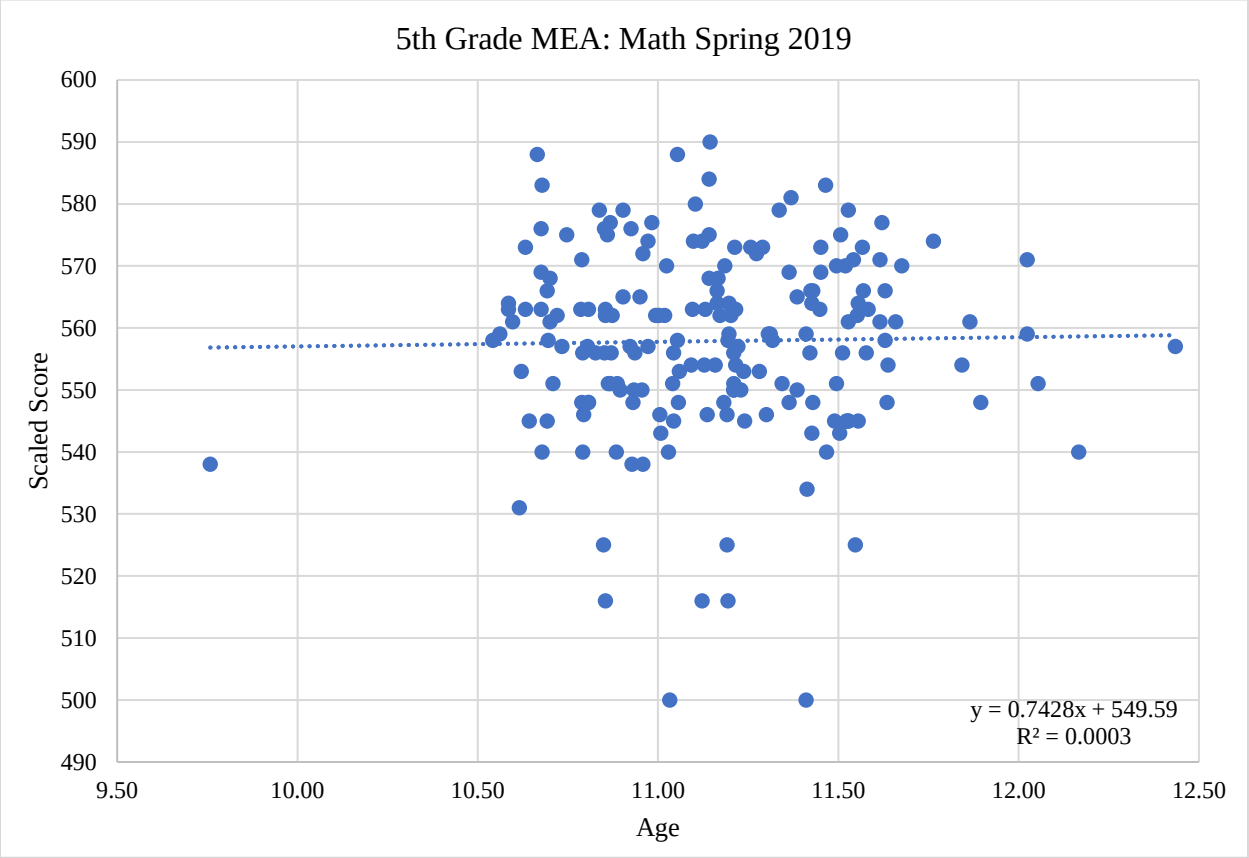


Figure 4: Scatterplot of Scaled Score vs. Age in Years – 2019 5th Grade Math



As the two scatterplots demonstrate, trend lines are virtually horizontal; the dots, representing a student's age vs scaled score, are not clustered in a linear fashion, and the Pearson's *r* value is close to zero: $r = 0.017$. This means there is no correlation between age and scaled score in either ELA or Math.

The final set of results is for 8th grade on the Spring 2019 MEA. Descriptive statistics for 8th grade 2019 results in ELA and Math are summarized in Table 7.

Table 7: 2019 8th Grade MEA – English Language Arts & Math

	Mean	Median	Mode	SD	Min	Max	Range
ELA Group 1 (n = 55)	870	872	870	13.69	822	890	68
ELA Group 2 (n = 50)	869	872	866	15.08	835	890	55
Math Group 1 (n = 55)	862	865	850	13.16	830	885	55
Math Group 2 (n = 50)	860	861	852	19.73	800	890	90

Similar to the descriptive statistics for 3rd and 5th grade, the 8th grade ELA and Math mean and median scaled scores are very close. In fact, the mean for Group 1, the younger students, is slightly higher than the mean for Group 2, the older students.

To identify the appropriate *t*-test for this analysis, I conducted an *f*-test to determine equal or unequal variance. The *f*-test results are summarized in Table 8.

Table 8: *f*-test for 2019 8th Grade MEA

	Group 1		Group 2					
	M	SD	M	SD	f	df	p	Variance
2019 8th Grade ELA	870	13.69	869	15.08	0.62	51/41	0.25	Equal
2019 8th Grade Math	862	13.16	860	19.73	0.62	51/41	0.0032	unequal

As shown in Table 8, the f-test determined equal variance for the ELA test, and unequal variance for the Math test. For the independent *t*-test, the alpha value is set at 0.05. The results of the independent *t*-test for both Math and ELA are summarized in Table 9.

Table 9: *t*-test for 2019 MEA 5th Grade

	Group 1		Group 2			
	M	SD	M	SD	df	p one-tail
2019 8th Grade ELA	870	13.69	869	15.08	92	0.26
2019 8th Grade Math	862	13.16	860	19.73	69	0.29

When an independent *t*-test is run to compare the two groups, *p* is greater than alpha and the null hypothesis is retained. Older students do not outperform younger students in 8th grade on the 2019 MEA tests.

Like with 3rd grade and 5th grade results, the linear regression scatterplots show no correlation between age and scaled score for 8th graders on the 2019 MEA tests. This is illustrated in Figures 5 and 6.

Figure 5: Scatterplot of Scaled Score vs. Age in Years – 2019 8th Grade ELA

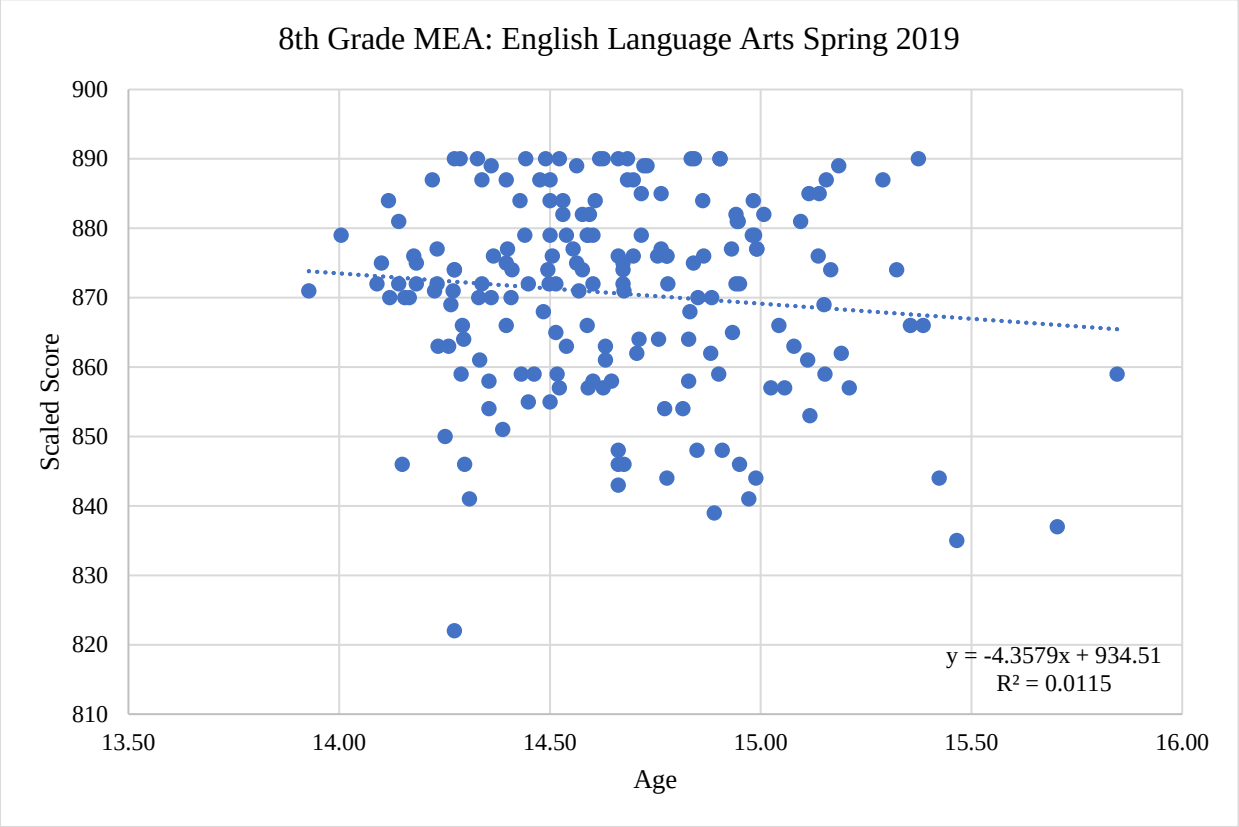
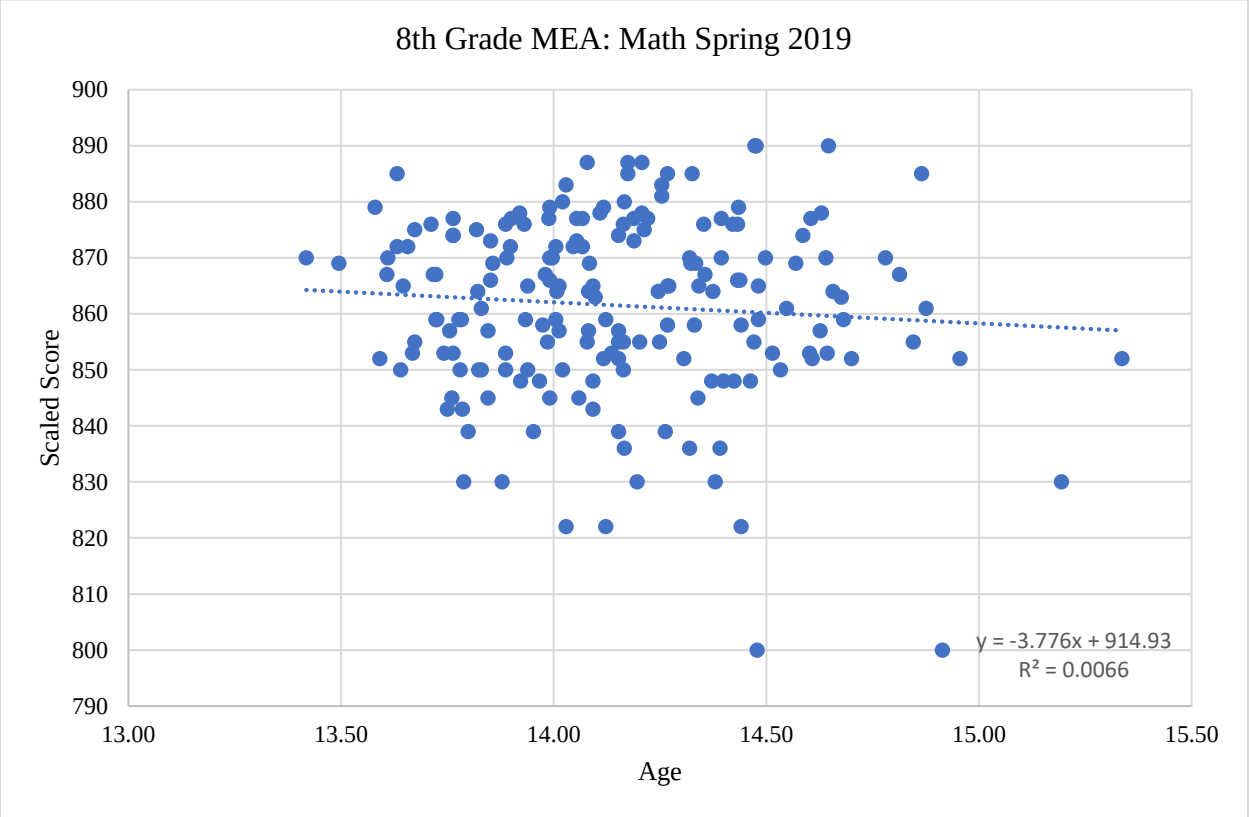


Figure 6: Scatterplot of Scaled Score vs. Age in Years – 2019 8th Grade Math



The linear regression analysis and the Pearson's *r* value confirm no correlation between the relative age of 8th graders and their corresponding scaled scores on the ELA and Math MEA tests.

For 3rd, 5th, and 8th grade students, relative age was not a factor in academic achievement as measured by scaled scores on the MEA tests in English Language Arts and Math. The directional hypothesis for the first research question on relative age and academic achievement was not supported. There is no statistically significant difference between the older and younger groups, 1 and 2, the null hypothesis is retained, and there is no correlation between scaled score and age.

Special Education Identification

To answer the first research question regarding the impact of relative age on special education identification, I first established a directional hypothesis: students who qualify for special education would be significantly younger than their grade level peers (alpha = 0.05). To test this hypothesis, I calculated the absolute age of all students in a grade and compared the data to those in the grade identified as requiring special education services. I conducted this comparison for currently enrolled students in grades 3, 5, and 8. The descriptive statistics for this comparison is presented in Table 10.

Table 10: Descriptive Statistics – Age of Special Education Students vs. All Students

	Mean	Median	Mode	SD	Min	Max	Range
Grade 3 Special Education	8.6	8.6	9	0.35	8	9.3	1.2
Grade 3 All Students	8.6	8.6	8.6	0.35	8	9.9	2
Grade 5 Special Education	10.7	10.6	11	0.37	10.1	11.8	1.7
Grade 5 All Students	10.6	10.6	10.9	0.34	9.2	11.8	2.6
Grade 8 Special Education	13.7	13.7	14	0.33	13.1	14.3	1.3
Grade 8 All Students	13.6	13.6	13.6	0.33	12.7	14.3	1.6

As Table 10 illustrates, the mean age for students who qualify for special education is not younger than the mean age of all students in a given grade level. This holds true in all three grades: 3, 5, and 8. To identify the appropriate *t*-test for this analysis, I conducted an *f*-test to determine equal or unequal variance. The *f*-test results are summarized in Table 11.

Table 11: *f*-test for Special Education Student Age vs. All Student Age

	Special Ed		All					
	M	SD	M	SD	F	df	p	Variance
Grade 3	8.6	0.35	8.6	0.35	1.44	42/213	0.45	equal
Grade 5	10.7	0.35	10.6	0.34	1.37	65/224	0.2	equal
Grade 8	13.7	0.33	13.6	0.33	0.66	46/205	0.5	equal

In all three grade levels, the *f*-test determined an equal variance. Next, I conducted an independent *t*-test to determine whether or not there are statistically significant differences in the data and to prove or disprove my directional hypothesis. The summary of the *t*-test is outlined in Table 12.

Table 12: *t*-test for Special Education Student Age vs. All Student Age

	Special Ed		All			
	M	SD	M	SD	df	p one-tail
Grade 3	8.6	0.35	8.6	0.35	255	0.43
Grade 5	10.7	0.35	10.6	0.34	289	0.09
Grade 8	13.7	0.33	13.6	0.33	251	0.004

With alpha set at 0.05, and a directional hypothesis outlined as special education students should be, on average, younger than their grade level peers, the *t*-test results support the null hypothesis. In grades 3 and 5, $p >$ alpha, and in grade 8, $p <$ alpha, however, it is in the wrong direction. For currently enrolled 8th grade students, the mean age for special education students is higher than the mean age for all 8th grade students.

High School Students Enrolled in Courses with the most Rigorous Curriculum

To examine the relative age of current high school students enrolled in the courses with the highest levels of academic rigor (at Scarborough High School these are Advanced Placement courses), I compared the age of students enrolled in at least one Advanced Placement (AP) course to the mean age of all students in a grade level cohort. At Scarborough High School there are students enrolled in AP courses in each of the four grade levels. The comparison of mean

ages between those enrolled in AP classes and the grade level as a whole are outlined in Table 13.

Table 13: Relative Age of High School Students – Advanced Placement vs. All Students

	Mean	Median	Mode	SD	Min	Max	Range
Grade 9 AP Students	15.5	15.5	15.4	0.34	15.1	16.2	1.1
Grade 9 All Students	14.5	14.5	14.4	0.35	13.7	15.7	2
Grade 10 AP Students	16.6	16.6	17	0.37	15	17.3	2.3
Grade 10 All Students	15.6	15.6	16	0.39	15	17.9	2.9
Grade 11 AP Students	17.5	17.5	17.5	0.34	17	18.4	1.4
Grade 11 All Students	16.6	16.6	16.9	0.39	15	18	3
Grade 12 AP Students	18.5	18.5	18.4	0.32	17.8	19.3	1.46
Grade 12 All Students	17.6	17.5	17.5	0.48	17	19.9	2.9

The difference in age between students enrolled in one or more Advanced Placement courses and their grade level peers is large. To identify the appropriate *t*-test for this analysis, I conducted an *f*-test to determine equal or unequal variance. The results of the *f*-test in each grade is presented in Table 14.

Table 14: f-test for Advanced Placement vs. All Students

	AP Students		All Students					
	M	SD	M	SD	F	df	p	Variance
Grade 9	15.5	0.34	14.5	0.37	0.48	15/234	0.51	equal
Grade 10	16.6	0.37	15.6	0.39	0.74	85/238	0.2	equal
Grade 11	17.5	0.34	16.6	0.39	0.76	110/213	0.07	equal
Grade 12	18.5	0.32	17.6	0.48	0.78	131/228	3.03E-07	unequal

Following the results of the *f*-test, I conducted an independent *t* – test for each grade level comparison: equal variances for grades 9, 10, and 11, and unequal variances for grade 12. The *t* – test results are illustrated in Table 15.

Table 15: *t*-test for Advanced Placement vs. All Students

	AP Students		All Students			
	M	SD	M	SD	df	p one-tail
Grade 9	15.5	0.34	14.5	0.37	249	**3.20E-22**
Grade 10	16.6	0.37	15.6	0.39	323	**9.70E-58**
Grade 11	17.5	0.34	16.6	0.39	323	**6.10E-63**
Grade 12	18.5	0.32	17.6	0.48	352	**2.70E-65**

***p < .05**

When comparing students in each grade level cohort, 9th through 12th, there is almost a full year's difference in mean and median age between students enrolled in at least one AP class and all students in each grade. As *t*-tests in each comparison group demonstrates, this is a statistically significant difference, and the group of students enrolled in AP classes are much more likely to be older than the average student in their grade level cohort, in this case, on average, almost a full year older.

Parent Survey

A parent survey was sent to all families of students enrolled at our K-2 Elementary schools, Pleasant Hill, Eight Corners, and Blue Point. This represented families of 645 students in total, and I received 207 responses to the survey. The first six questions were multiple choice,

and the last two questions were open responses, and meant to get at parental decision-making around starting their child in kindergarten and whether or not they thought about their child's relative age as a factor in their decision-making. The results for each question are shared below:

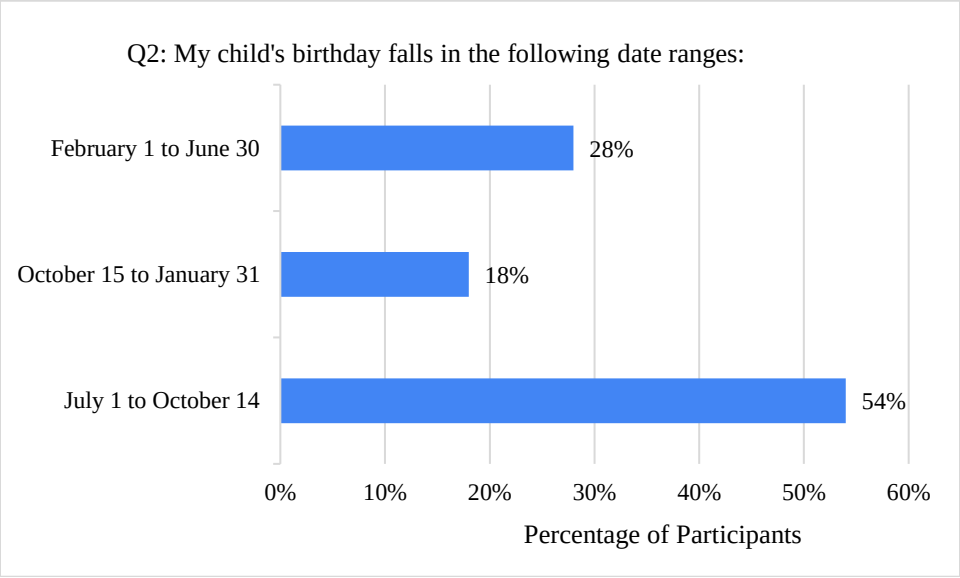
Question 1: I am aware of eligibility requirements for my child to start Kindergarten. My child must be five years old as of October 15th of the current school year.

Out of the 207 total participants, 197 respondents responded they were aware of the eligibility requirement and October 15 date. Only 7 responded that they were unaware of the eligibility requirements and cut-off date.

Question 2: My child's birthday falls in the following date ranges:

The results for question two are presented in a bar chart below, outlining the percentage of participants that shared the birthdate ranges of their child. The birthdate ranges in the figure are sorted from oldest to youngest. Results are presented in Figure 7.

Figure 7: Results for Question Two – Birthdate Ranges Shared by Participants

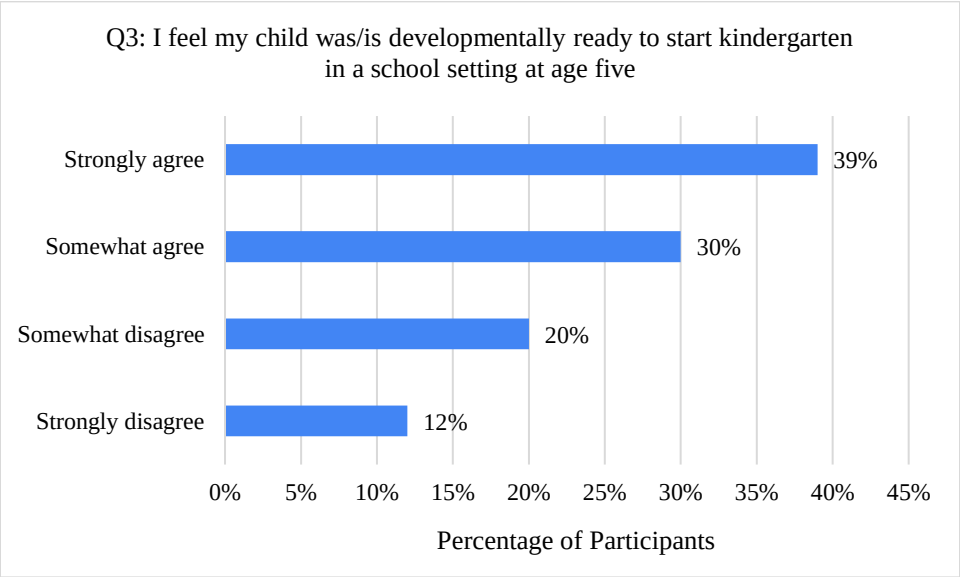


Slightly over half of parents responding to the survey identified their child as falling in the July to October range, which would place their child in the younger third of the grade level cohort.

Question 3: I feel my child was/is developmentally ready to start kindergarten in a school setting at age five.

For question 3, responses from participants are presented the bar chart, Figure 8.

Figure 8: Results for Question Three – Confidence in School Readiness by Age Five

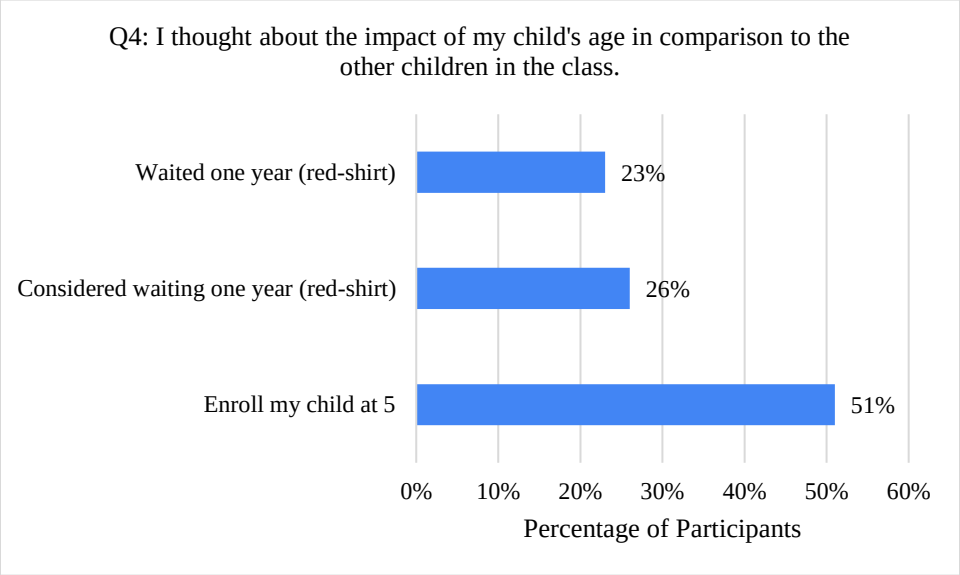


A little over one third of all respondents did not agree with their child being ready to start kindergarten at age five.

Question 4: I thought about the impact of my child's age in comparison to the other children in the class.

For question 4, responses from participants are presented in the bar chart Figure 9 below.

Figure 9: Results for Question Four – Impact of my Child's Age in Comparison to Peers

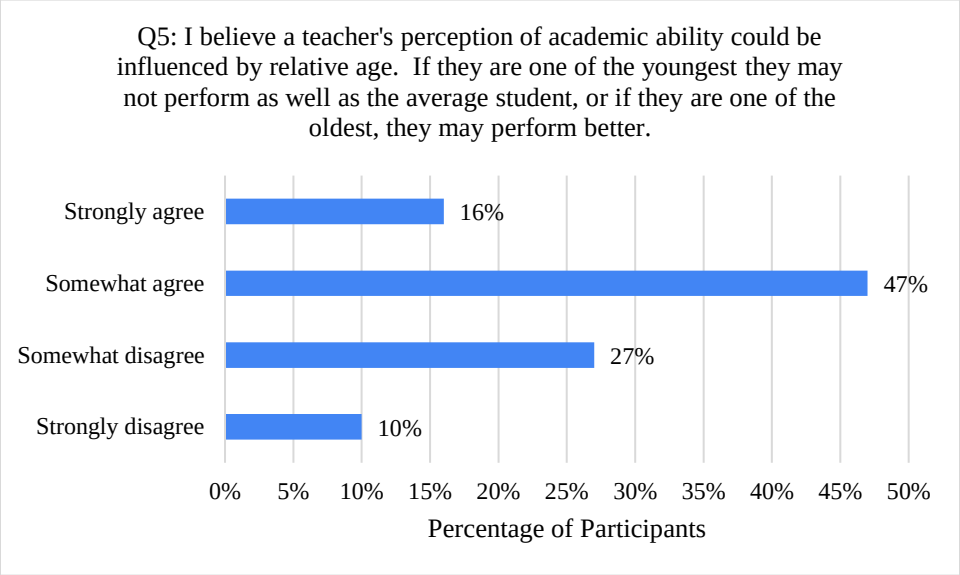


Almost half of those that responded to the survey either redshirted their child or considered doing so.

Question 5: I believe a teacher's perception of academic ability could be influenced by the relative age of my child. If they are one of the youngest in the class they may not perform as well as the average student, or if they are one of the oldest, they may perform better than the average student.

For question 5, responses from participants are presented in the bar chart Figure 10.

Figure 10: Results for Question Five – Teacher Perception of Academic Ability & Maturity

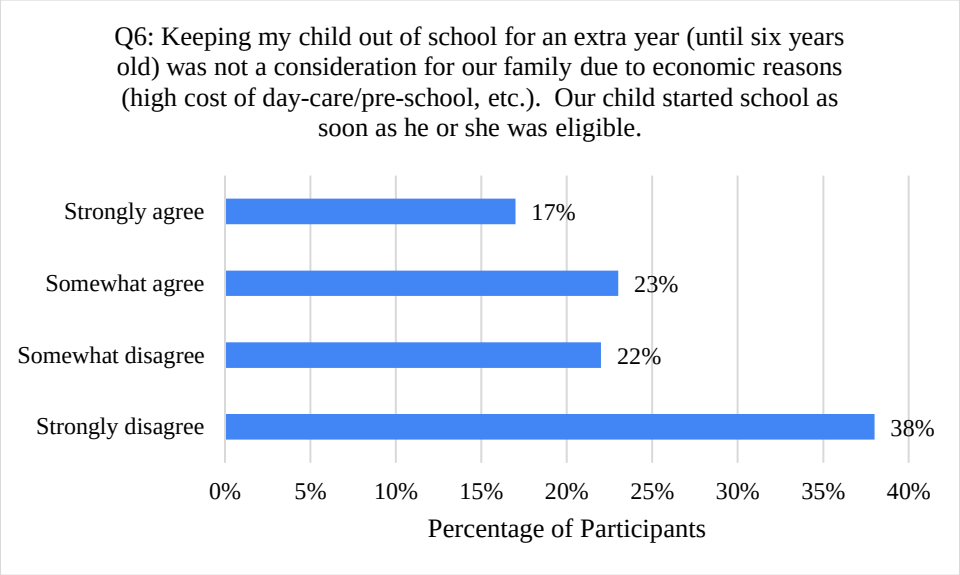


Close to two-thirds of respondents agreed that teacher perception of academic ability could be influenced by the relative age of their child.

Question 6: Keeping my child out of school for an extra year (until six years old) was not a consideration for our family due to economic reasons (high cost of day-care/pre-school, two working parents, etc.). Our child started school as soon as he or she was eligible at age five.

For question 6, responses from participants are presented in the bar chart Figure 11.

Figure 11: Economic Considerations of Redshirting



One third of those that responded felt that redshirting their child and waiting until they were six would not be a consideration because of economic reasons. This suggests that for many families, holding their child out for one year is simply not a realistic option, even in a relatively wealthy suburban community such as Scarborough.

Qualitative Data

Question 7: In a few sentences, please describe how and when you decided to enroll your child in Kindergarten. Discuss your thought process with respect to your child's readiness to start school.

This question requires the participant to answer in paragraph form to describe how and when they, as parents, determined when their child was ready for Kindergarten. To analyze the 180 responses to this question, I utilized a combination of In-Vivo and concept coding (Saldana, 2016), first to identify common language in the responses of the participants (In-Vivo first cycle codes), and second, to group the In-Vivo codes into common clusters and themes: concept coding. I identified 35 first cycle In-Vivo codes which were then grouped together into a 2nd

cycle list of common concept codes. The clustered common language revealed three distinct findings, discussed below. Here are examples of participant responses, In Vivo codes, and concept codes.

Concept Code: keeping your child back one year.

In Vivo code examples: keep him back; delay her entry; repeat kindergarten; held him; start K one year later; hold her back; waited to send her.

Concept Code: social and emotional readiness/development.

In Vivo code examples: socially and developmentally ready; capable and mature enough; social/emotional skills; ready emotionally; develop more socially; my child's confidence; socially needed some time; age and social development.

Concept Code: parents considering impact of relative age for their child in high school and into college.

In Vivo code examples: think about middle school and high school; didn't want to send her to college when she was only seventeen; students who start K later do better throughout their academic career; how impressionable they will be because they'll be younger than most other college students; I also appreciate that when he goes to college he'll be almost nineteen, and so in theory the tiniest bit more emotionally prepared; maturity – especially graduating at eighteen vs. seventeen.

Concept Code: parents enrolled their child as soon as they were eligible and could not consider keeping them out of school an extra year due to economic reasons.

In Vivo code examples: high cost of daycare; pay for full time daycare; limited access to child care; use existing daycare due to economic restrictions; impossible choice for many families economically; enrolled in K due to financial/childcare needs; economic considerations

were a strong factor; high cost of preschool; paying for full time daycare is very expensive; was economic decision; due to financial constraints started year earlier.

For the second round of qualitative analysis, common phrases identified in the first cycle of in-vivo coding were compared to establish patterns and a conceptual theme or themes emerging from the common phrases used by respondents.

Finding 1

A child's age relative to their peers is an important component of parental decision-making around readiness for Kindergarten and many think about the advantages of being relatively older far into the future, for when their child is in high school and beyond. Many parents responded in such a way that reflected considerable thought to their child's relative age compared to peers now, and far into the future, particularly into high school and possibly into college. The future, and possible advantages for being on the older side, as opposed to the younger side among their peer cohort, were embedded in many responses:

> *We made the decision to hold our son back a year because he just didn't seem ready emotionally. We thought another year (though it would cost us more money in daycare and pre-k) would be beneficial to him not only now but during pre-teen and teen years. I don't think you can put a price tag on your child's confidence. I have met so many people who have regretted not keeping their child back at this age and no one who has regretted keeping them back.*

Finding 2

Responses from parents prioritized social and emotional adjustment and wellness over academic readiness. Parents prioritized social and emotional adjustment of their children over academic readiness. Many responses described concerns and/or decisions being governed by how their

child will get along and function in a group and classroom setting as opposed to whether or not they were academically ready.

> *Emotional and physical maturity was our main reason for holding our son back. We do not regret this decision at all. Our son has prospered socially, emotionally, intellectually, and physically. None of this may be a result of holding him back, but it was the reason we made the decision. Whatever the reason for his success - we are happy for it.*
>
> *Our child was born on Oct 2nd, two weeks early. Had he been born on his due date, then he would have been automatically placed in his current class. In other states the cut off is Aug 15th, so between his proximity to Maine's Oct 15th threshold and looking at other states' thresholds, it was clear our son would benefit from going to Kindergarten one year later. Additionally, we noticed his early ventures into youth sports was slightly challenging. At 4yrs old we enrolled him in youth soccer based on his expected Kindergarten start date. He was discouraged by playing with kids slightly older and bigger than he was. He didn't want to play at all. The following year we kept him in the same age grouping and he had a much better time. It was clear that delaying his Kindergarten starting year was important.*

Finding 3

Parents expressed the economic challenges of waiting a year to enroll their child, beyond the age at which they are initially eligible. They cited the high cost of child-care, preschool programs, and daycare in general. The economics of redshirting made it not an option, even for those with children who fall on the younger side of their grade level cohort who might be expected to benefit most from waiting an additional year before starting school. Some parents expressed a

desire to keep their child back one year, but felt they were unable to do so for economic reasons.

> *My child was not ready to start school, but was aging out of CDS eligibility. Our health insurance did not cover speech therapy which was highly necessary; we could not keep him out and pay for full time daycare another year in addition to paying hundreds a month for speech. We started him in school so that he could get the services he needed at the time.*
>
> *The ability to start kindergarten at 6 gives that child an advantage in both academics and athletics. However, this is an impossible choice for many families economically. I would have loved to give our child this advantage, especially because as it becomes more common the children unable to participate are at an even greater disadvantage. My child would have benefitted in the future if he was able to start K one year later."*

Given the three themes–a child's future opportunities in high school and college, the importance of social and emotional adjustment, and the economic challenges of redshirting–that emerged from the responses, it was clear the majority of families think about their child's age and how it compares to peers. These concerns were elevated for parents of children with summer or fall birthdays. Parents expressed concerns about how their child will perform not just in the early grades, but through adolescence, into high school and even after graduation as they consider college and enter early adulthood. The perception of an embedded advantage for those who are relatively older, and an embedded disadvantage for those relatively younger, is revealed in the parent survey responses. Families and parents think about the relative age effect and it impacts their decision-making around their child's education.

Summary

The quantitative analysis of student achievement results, age comparisons between special education students and grade level peers, and age comparisons of high school students enrolled in at least one Advanced Placement course, revealed some clearly defined results. With respect to the Maine Educational Assessment scaled scores, the directional hypothesis that older students would outperform younger students in the same grade was not supported and the null hypothesis retained. There were no statistically significant differences in scaled scores between Group 1, the youngest, and Group 2, the oldest. This held true for both the 2017 and 2019 spring administrations for all grade levels and in both content areas. With respect to students who qualify for special education services, the hypothesis that younger students were more likely to qualify for special education was disproved. An independent *t*-test comparing the age of currently enrolled special education students with their grade level peers, found no statistically significant difference, and in the case of 8^{th} grade, found that students identified were on average, older than their average peer. What leaps off the page in this Chapter are Tables 13 and 15, where ages of students enrolled in Advanced Placement courses at the high school are compared to their grade level peers. In all grades, students enrolled in one or more AP courses, the most academically rigorous classes offered at the high school, are a full year older on average than their grade level peers. With respect to the parent survey, the analysis of the multiple-choice responses reveals most respondents think deeply about their child's age in relation to peers, and not just when they enter a classroom in Kindergarten, but far out into the future, to when they are in high school and beyond.

CHAPTER 5: DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

Our K-12 public school educational system divides students into grade levels based on a minimum eligibility age to start Kindergarten. For schools in Maine, a child is eligible to start Kindergarten at the age of five, on or before October 15. As outlined in the literature review, and supported by the findings of this mixed methods study, many parents choose to delay their child's entry into Kindergarten until they are six years old, a decision referred to as redshirting. The age range for students in each grade exceeds one year, and can be as large as two years. Thus, differences in maturity and development within a grade level can be wide.

In this mixed methods study, I examined the degree to which a child's relative age, in comparison to his or her peers, can impact educational outcomes and success in school. Using historical student data from Scarborough Public Schools, this examination attempts to determine if a relative age effect, embedded advantages to being the oldest in a grade and disadvantages to being the youngest, exists. I also investigated whether parents consider their child's age relative to peers when they enroll their child in Kindergarten. The analysis of student data for Grades 3, 5, and 8 found no evidence of a relative age effect in measures of student achievement K-8. The oldest students in a grade did not outperform the youngest on the MEA, and the students who qualified for special education were not any younger than their grade level classmates. Yet findings from the parent survey confirm parents consider their child's age relative to peers as being impactful to their success in school, and high school students enrolled in at least one Advanced Placement course are a full year older than their grade level peers. The relative age effect does impact students and families in Scarborough and must be considered a factor in addressing equity and opportunity for all students.

Over the last 10 years, as a district leader and superintendent in two southern Maine districts, I have seen multiple iterations of the Maine Educational Assessment (MEA), now the Maine Through Year Assessment (MTYA). The MEA has morphed multiple times, from the NECAP (New England Common Assessment Program), to the Smarter Balanced Test, to multiple iterations of assessments designed by Measured Progress, and now the MTYA. These are Grade level assessments designed by NWEA (Northwest Evaluation Association). The MEA and MYTA are designed to measure student performance on Maine's Learning Results, the state's curriculum framework outlining the content and skills students across the state should know and be able to do at each grade level. Additionally, Maine continues to function as a local control state, with curriculum and instruction decisions made independently by each School Administrative Unit. Given the multiple redesigns of state testing and embedded local control over curriculum and instruction, I question the efficacy of the MEA, now the MTYA, as a useful tool of how a child is performing in ELA or Math at a given grade level. The findings in this study further call into question the state's ability to credibly measure student achievement and a child's academic performance in school.

Maine's Model of School Support, the accountability system that measures the progress of how each School Administrative Unit is performing, and determines whether or not additional supports are needed, is based on seven indicators. Four out of the seven are impacted by how students perform on the MTYA/MEA. These indicators are Math & ELA academic achievement: student performance relative to state expectations, and Math & ELA academic progress: how students perform from one year to the next. As a superintendent, responsible for the overall success of Scarborough Public Schools, I must be able to rely on state assessments to be valid and credible measures of how students are doing in Math and ELA, and trust they are

connected to what is being taught in the classroom. In addition to being the central indicators for how the district is performing, MTYA/MEA student achievement and academic progress results are also important components of an educator's summative proficiency rating. All districts in Maine must develop and incorporate a model for teacher Professional Evaluation and Professional Growth (PEPG). If these assessments are to serve the critical function as indicators of performance for statewide accountability and as a component of how all educators are evaluated, they must credibly assess the content and skills taught in our schools. The findings of this study underscore the need to revisit and strengthen how the state measures student achievement and assesses student learning.

In the quantitative part of this study, I analyzed historical student achievement data, MEA scaled scores in ELA and Math for 3rd, 5th, and 8th grade students, to examine differences in performance between the oldest and youngest students in a grade level. The analysis of the scaled scores in both content areas determined there was no statistically significant difference in performance between the youngest and oldest students at any of the grade levels. The oldest in the grade, Group 2, did not outperform the youngest in the grade, Group 1. No correlation existed between a child's age and his or her scaled scores on either the Math or ELA sections of the MEA.

A similar trend was evident for students with exceptionalities. No statistically significant difference in age existed between current students who qualify for special education services, and their grade level peers. When considering parts "a" and "b" of research question number one, the analysis of student achievement and special education qualification supports the notion that relative age does not impact performance in Scarborough Schools in grades 3, 5, or 8. When examining age comparisons among high school students enrolled in at least one Advanced

Placement (AP) course, the most academically rigorous courses of study at Scarborough High School, a much different result was found. Current high school students enrolled in at least one AP course are on average, *a full year older* than their grade level classmates. This is true in every grade 9-12.

Quantitative analysis of responses from the parent survey sent to all families of children in K-2 primary schools in Scarborough revealed that virtually all parents, 96% of participants, were aware of the age eligibility requirements in Maine (age five by October 15). Over half, 54% of participants, fell in the youngest third of the cohort, and almost half, 49%, either thought about redshirting or redshirted their child. The quantitative analysis of student data did not reveal statistically significant differences in performance between the oldest and youngest students in grades 3, 5, and 8. However, in high school, the relative age among peers was significant when comparing the age of high school students enrolled in AP courses in relation to others in their grade. Further, parent responses to the survey revealed a high percentage of respondents who redshirted their child or considered doing so.

Qualitative analysis of an open-ended survey question asking participants to describe their decision-making around Kindergarten readiness revealed three major themes. First, a child's age relative to their peers is an important component of parental decision-making around readiness for Kindergarten. Many parents consider the advantages of their child being the oldest, not just in the primary grades, but far into the future, to when they are in high school and entering college. Second, parents prioritize social and emotional adjustment and wellness over academic readiness. Third, parents expressed the economic challenges of waiting a year to enroll their child, beyond the age for which they are eligible, citing high cost of child-care, pre-school,

and daycare. For some participants, they expressed that keeping their child out of school an extra year was simply not feasible.

Interpretation of the Findings

The conceptual framework presented in this study represents how the oldest in a grade level may be more regularly grouped into higher level classes, receive additional advantages, and emerge with more favorable opportunities, while the youngest get stuck in a less favorable feedback loop, requiring more frequent academic intervention, even specialized instruction, in order to progress successfully through the grades. The findings from the quantitative analysis of student MEA data and special education identification do not support this conceptual framework. The oldest students did not outperform the youngest and there was no correlation between age and scaled score performance on the MEA. With respect to qualifying for special education services, no evidence of overrepresentation of younger students was found. However, when considering high school students enrolled in more rigorous and advanced courses of study (AP classes), the age differences among the students support the conceptual framework, and a significant impact of relative age is present. The mean age of a student enrolled in at least one Advanced Placement course, the most academically rigorous offered at SHS, is a *full year older* than the mean age of his or her grade level peer. When the students streamed into classes with differentiated levels of rigor, the oldest students in the grade were much more likely to be enrolled in the most advanced classes. This is a significant advantage for students seeking admission to selective colleges and universities.

At first glance, the quantitative findings of this study suggest that as long as students remain mixed in grade level classes where students receive the same grade level curriculum, and are not streamed into courses with distinctly different curricula and levels of rigor, there is little

evidence of a relative age effect and older students do not outperform younger students. The age difference of students enrolled in the most rigorous courses tell a much different story than the achievement results on the 3rd, 5th, and 8th grade MEA. This calls into question the efficacy of using the MEA to accurately assess skill and content knowledge needed for the most rigorous courses of study in high school. Differences in developmental maturity exist within the classroom, and in some cases the range in age can be as high as two years, given the increased number of students who are redshirted. The analysis of MEA results in grades 3, 5, and 8 reveal no relative age effect, and yet high school students in the most advanced classes are one full year older than their classmates. This aligns with the third qualitative finding from the parent survey, where many participants discussed their child's high school future and college entry as a significant factor in determining when to start Kindergarten. Students who are motivated to attend competitive universities and colleges are advised to take the most academically rigorous courses available in high school.

Limitations of the Study

Historical student data and parent survey results are limited to only one community and one school district: Scarborough, Maine. The quantitative analysis completed with respect to MEA results, special education designation, and high school AP class enrollment, is limited to data across one school district only. It was critical to understand how evidence researchers used to measure a relative age effect in schools (standardized test scores, special education qualification, enrollment in advanced coursework) could relate to one another in the same community and school district. In Maine, where decisions related to curriculum and instructional methodology are localized, how students are assessed and supported across classrooms can vary across School Administrative Units. Therefore, different findings could exist in another district,

even one in a community with similar demographics and resources. With respect to finding a common measure to benchmark achievement, the only choice is the MEA, now the MTYA; students in all School Administrative Units in Maine must take it in grades 3-8 and one year in high school. As noted in the methods section of this study, using an imposed state-wide assessment, given the localized nature of curriculum and instructional practice, may be too blunt an instrument to detect how a child is performing in school relative to their peers.

Recommendations

The examination of relative age in Scarborough could be strengthened by assessing methods teachers employ to differentiate instruction and meet individual student needs in a heterogeneous classroom. Results from assessments utilized in primary schools and middle schools are used to differentiate academic support for kids as part of a Multi-Tiered System of Support (MTSS) in place for all students. Further examination into metrics used to establish tiered interventions for support for students at all grade levels could reveal effective differentiated instructional strategies that counteract any relative age or developmental difference and ensure effective educational equity for kids in heterogeneously grouped classrooms.

I recommend further quantitative analysis of academic performance for students in Scarborough that have been redshirted and/or retained at some point along their educational journey. This would include a comparison of students who are beyond the one-year range in age at each grade level. Comparing the educational outcomes between redshirted/retained students to students within the age span for each grade would provide greater clarity around whether or not there are embedded advantages, or at least performance differences for students who are over one year older than their youngest grade level peers. It would also shed more light on the efficacy of redshirting. It is clear many parents perceive an advantage, but for educators, it is

important to know whether or not this advantage is perception only, and not necessarily supported by student data. In addition to separating out the students redshirted, I would also recommend disaggregating the data by gender. In the review of the literature, particularly the Larsen study from Australia, boys are more likely to be redshirted than girls, and there is evidence to suggest boys are more susceptible to a relative age effect than girls.

With respect to the boundaries of this study, there was no measurable evidence to suggest that the oldest 8th graders would be any better prepared academically for Advanced Placement courses held at Scarborough High School than their younger classmates. The finding that those enrolled in AP courses are on average a full year older than grade level peers bears further study, and calls into question the efficacy of the MEA as an accurate measure of student achievement. It is important to understand how the streaming of high school students into courses of study with varying levels of rigor led to an overrepresentation of older students in Advanced Placement courses. I would recommend examining relative age in the most academically rigorous courses in other high schools across Maine to determine if this is a common phenomenon. This might further the hypothesis that relative age is an embedded advantage when students are streamed into courses with distinct differences in academic rigor. I would also recommend disseminating a parent survey to families of middle school students regarding their child's transition into high school. This could provide context and additional data around decision-making as students enter high school and explore post-graduate study in college or university.

Further study is needed to explore the efficacy of the Maine Educational Assessment as an instrument to measure proficiency on content and skills outlined in Maine's Learning Results, a document specifying what students should know and be able to do in ELA/Literacy and Math.

I recommend conducting a correlation analysis of a student's spring MEA scaled score with their summative grade in the corresponding content area at the end of the year. A child's performance on the ELA and Math MEA should correlate with how their performance is being assessed and judged by their classroom teacher.

Implications

The findings of this research study into the relative age effect suggest that the conceptual framework presented outlining embedded advantages for the oldest in a grade, and challenges for the youngest in a grade, are not supported by student achievement performance on the MEA, or qualification for special education services at the 3rd, 5th, or 8th grade levels. Keeping students heterogeneously grouped, and providing individualized tiered levels of support, seem to counteract any embedded advantage to being among the oldest in a grade, or disadvantage to being the youngest. A child's success in school in the K-8 grades was not predetermined by birth month or relative age. Despite this K-8 finding that retained the null hypothesis and did not support both hypotheses associated with parts a and b of the first research question, students enrolled in AP courses, starting in 9th grade, were on average one full year older than their grade level peers. This finding is buttressed by parent survey responses confirming a perception of a distinct advantage to being the oldest in a grade level. Many are motivated to consider redshirting their child to reap the benefits of this advantage. As responses from the parent survey further confirmed, consistent with the literature on the prevalence of redshirting among families with high Socioeconomic Status (SES), a perceived equity issue also exists, as those who do not have the means to keep their child back an additional year cannot provide their child with this advantage. The quantitative findings for 3rd, 5th, and 8th graders do not identify an academic

advantage for the oldest in the grade, yet, the oldest students in each grade at Scarborough High School are much more likely to be enrolled in the most rigorous courses of study.

This study supports the efficacy of strengthening a Multi-Tiered System of Support (MTSS) for all students, who would ideally receive responsive individualized support, and not be separated from more advanced, or less advanced peers. In this model, all students develop their skills and knowledge together, and are provided the individualized support necessary to learn effectively. This aligns with K-8 classrooms in Scarborough, where virtually all students are in classes of mixed ability with a common curriculum. The statistically significant age difference between Scarborough high school students enrolled in at least one AP course and their grade level peers bears further study.

For educational leaders, the finding of the oldest students in a grade being overrepresented in the most advanced courses of study in high school, when K-8 measures of achievement do not suggest any performance advantage for the oldest in a grade, needs to be addressed. Students entering high school should be equivalently ready to take on advanced coursework in high school, whether they are among the youngest or the oldest in their grade. A comparative study across high schools in Maine could determine whether this phenomenon exists in other Maine high schools. Evidence from the parent survey on Kindergarten readiness and the prevalence of redshirting in Scarborough suggests that students and families are conditioned to believe there is an embedded advantage to being among the oldest in a classroom, and this advantage extends into high school, and beyond graduation.

Juniors in high school who are planning on completing applications to selective colleges and universities are advised to take the most rigorous courses of study offered by their high school. This is considered a baseline pre-requisite for admission. For students attending

Scarborough High School, AP courses represent the most rigorous courses of study. Many colleges award credit for students successfully completing AP courses and scoring a 4 or 5 on the AP exam. For those students earning college credit in high school, they have an economic advantage before they set foot on campus. As the results of this study underscore, the oldest high school students in a grade are much more likely to be in AP courses, and are therefore more likely to have greater choice when applying to selective colleges and universities, and more likely to earn college credit before they walk across the stage at their own high school graduation. Scarborough parents of K-2 students consider relative age as an important factor well beyond Kindergarten and project an advantage of their child being among the oldest in a grade far out into the future. Many chose to redshirt, even more considered it, and many that did not, might have done so if they had the resources. The relative age effect is evident in Scarborough, and serves as a privilege multiplier to those students and families with the means to redshirt their child and provide them with the advantage of being among the oldest in the grade.

Conclusion

This mixed methods study examines how the relative age effect, embedded advantages for the oldest in a grade, and challenges for the youngest, impacts students in families across an entire School Administrative Unit. The conceptual framework describes divergent paths for the oldest and youngest students that permeate their development from Kindergarten to graduation, with greater success and opportunities afforded to the oldest, and interventions, challenges, and less opportunity afforded to the youngest. The impact of relative age, while not evident in the data at the primary and middle grades, is present when considering enrollment in the most rigorous courses of study at the high school. At the K-8 grades, where students are kept in classes with no differentiated curriculum or levels as they advance, no statistically significant

differences in performance between the oldest and youngest were found in the data. In Scarborough, it is not until 9th grade when the divergent paths based on age appear. For high school students enrolled in the most academically rigorous courses of study, Advanced Placement (AP), the differences in age are significant. The oldest in a grade are much more likely to be enrolled in at least one Advanced Placement course. This finding is troubling, given there is no evidence of a relative age effect found in the MEA data in Grades 3, 5 or 8. Retaining the null hypothesis at every grade, with no performance advantage to the oldest in a grade, calls into question the efficacy of the statewide assessment system as a credible measure of student achievement and performance in school. The MTYA/MEA assessments in ELA and Math must credibly reflect Maine's Learning results and connect to what our students are learning in schools and classrooms. For students applying to selective four-year colleges and universities, taking the most advanced level courses offered in high school is a critical factor for admission. The parent survey findings demonstrate a perception among most respondents that providing a maturity advantage by redshirting their child will lead to better educational outcomes, not just in the primary grades, but in high school and into college or university.

This study suggests educators in the Scarborough Schools have been successful in mitigating the relative age effect at the K-8 grades through keeping students together in classrooms of mixed ability and providing structured and differentiated individualized academic intervention as needed. This has served the students well in addressing any academic impact associated with relative age and maturity differences in the classroom. Current research suggests maintaining mixed groups and resisting ability grouping and differentiated curricula based on the sorting of kids by ability is a prerequisite for strengthening educational equity for all students (Webel, 2021). As this case study in Scarborough demonstrates, educators should reflect on the

impact streaming students into leveled courses can have on equity in educational outcomes. Educational leaders and policy-makers should take note of the implications of relative age with respect to the perception of age-related advantages within a grade, particularly as students enter high school and are offered differentiated curriculum that impact opportunities following graduation. For those applying to selective colleges and universities, taking the most rigorous courses of study in high school is considered a prerequisite for successful admission. Relative age should not be a significant factor determining whether or not a student is considered for admission to selective colleges and universities, nor should it be a privilege multiplier, providing those with the economic means to redshirt their child, an additional embedded advantage that ensures he or she will be among the oldest in the grade.

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BIOGRAPHY OF THE AUTHOR

Geoff Bruno was born in Norwalk, Connecticut and graduated high school from Choate Rosemary Hall, an independent preparatory school in Wallingford, CT. He went on to attend Wesleyan University in Middletown, CT where he earned a Bachelor's of Arts Degree in International Relations. Following his undergraduate degree, he embarked on a career in education, first as a center director at an after-school tutoring center in Newton, MA, and then as a middle school science teacher at Community Day Charter Public School in Lawrence, MA. Geoff began working on his Master's Degree at Boston University, and earned his M.Ed. in Educational Leadership and Policy in 2004. He took on his first school leadership role as Head of School at Community Day Charter Public School in Lawrence. Geoff served as Assistant Principal in Hopkinton, MA, and then Principal of Belmonte Middle School in Saugus, MA. After three years leading Belmonte, he took on his first district leadership role as Executive Director of Curriculum and Instruction for the Saugus Public Schools. During this time, Geoff completed the National Institute for School Leadership (NISL) program, and earned MA DESE certification as a Superintendent. In 2014, Geoff and his family moved to Maine, where he served as Superintendent of Schools in Falmouth for seven years and in Scarborough for three years. Geoff serves as the Maine School Management Association's Ethics Chair, and is an active member of the Cumberland County Superintendent's Association (CCSA) and the Greater Sebago Educational Alliance (GSEA). Geoff currently lives in Andover, MA with his wife Melissa and four daughters, and is making a professional transition back to Massachusetts, starting his new position as Superintendent of Groton Dunstable Regional School District in July 2024. Geoff is a candidate for the Doctorate of Education degree in Educational Leadership from the University of Maine in May, 2024.