Elementary Mathematics Acceleration: One District's Policies and Practices

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Abstract

This study focused on the mathematics acceleration policies and practices of a large, suburban, public school district in the Midwest. There is a lack of research specifically related to the acceleration of elementary students, particularly subject-based (i.e., mathematics) acceleration. This represents a significant gap in the empirical literature and presents an opportunity for this study to contribute to what is known and understood about this important educational policy issue. The purpose of this study was to examine the policies which govern one district's mathematics acceleration program and investigate the practices (including the selection of elementary students for mathematics acceleration) which support the sustained implementation of a mathematics acceleration program in this particular district in order to better understand a contemporary educational phenomenon (e.g., accelerating elementary students in mathematics).

This particular district was purposefully selected as a unique and ideal location in which to study mathematics acceleration in an elementary context because of its formal, institutionalized system of mathematics acceleration for qualifying elementary and middle school students, with *mathematics acceleration* being operationally defined as subject-based acceleration whereby students who meet the eligibility criteria may be permitted to skip one or more grade-levels of mathematics curriculum and instruction. This was a case study and utilized qualitative methods. Data were collected from multiple sources, including; a) semi-structured interviews, b) documents, c) student enrollment and demographic information, and d) district enrollment and demographic information. Semi-structured interviews were conducted with 12 participants, including current and former mathematics coordinators and current middle school

counselors, purposely selected for their first-hand knowledge and experience with the district's mathematics acceleration process.

This study found that implementation gaps and problematic practices have persisted over time which have challenged the power of district mathematics coordinators to uphold or make changes to the district mathematics acceleration policy. There is evidence to suggest that mathematics acceleration in this district is a parent-driven process and that some students may be selected for mathematics acceleration on the basis of parent pressure rather than academic merit. The implementation of mathematics acceleration in this district is fundamentally different at the elementary and middle school level, which suggests that meeting the goals of acceleration may depend on the instruction in the classroom more than accelerated mathematics placement at the elementary level. There are statistically significant differences in the representation of gender and ethnicity among mathematics accelerated students compared to the overall student population, and these differences in both gender and ethnic representation were accurately identified and described by participants in this study.

This study contributes to the overall understanding of mathematics acceleration, particularly of elementary students. This study concludes with recommendations for district leaders and policy makers who seek to establish effective educational policies which ensure equitable outcomes for all students regardless of gender, race, ethnicity, or socio-economic status. A limitation of this study is that it is focused on the mathematics acceleration policy and practices of one purposefully selected school district, and thus the findings are not generalizable. It would be difficult to replicate this study because the methods were designed to fit the specific context and unit of analysis of this study.

Acknowledgements

I was standing in a crowded sanctuary, head bowed, eyes closed, listening (probably impatiently) to a benediction from my pastor at the end of a typical Sunday worship service when I felt it… that undeniable realization that a new dream has found you. It tickled at the edge of my mind, sent a soft shiver down my spine, caused my heart to skip a beat in anticipation, and then gently settled in my soul; captivating me with hope. By the time I raised my head and opened my eyes, I knew I wanted *exactly this moment* that's happening right now… achieving a doctoral degree. Somehow, an instinctive wisdom deep inside knew I would need this transformation in a way I could never have predicted. The journey – with all of its perilous pitfalls, disorienting stretches, and mountaintop moments – has been precisely what I needed to help me become more of the person I was always meant to be.

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Chapter One

Introduction

Defying decades of research, the question of how schools can best, and most equitably, organize students for learning still challenges school administrators. The topic of grouping students by perceived academic ability, has been studied and debated by scholars as early as 1916 (Ansalone, 2000; James A Kulik & Kulik, 1992). The research around ability grouping is situated within an on-going debate between the advocates and critics of student tracking, which has been characterized as the *tracking wars* (Loveless, 1999, p. 10; Oakes, 2005, p. 215; Page, 2000, p. 108). Tracking, also referred to as ability grouping, is the practice of assigning students to homogenous groups by academic ability level for instructional purposes (Ansalone, 2009; Hallinan, 1994a; C.-L. C. Kulik & Kulik, 1982; Lucas & Berends, 2002; Oakes, 2005; B. C. Rubin, 2006; Slavin, 1990). This study is focused on mathematics acceleration as a form of ability grouping. Acceleration is the systematic practice of providing high-ability students opportunities to move through the curriculum at a faster pace than their same-aged peers (Colangelo, Assouline, & Gross, 2004; James A Kulik & Kulik, 1992; Slavin, 1990).

Acceleration practices fall under two broad categories: grade-based and content-based (Colangelo et al., 2004). Grade-based acceleration options are often referred to as grade-skipping (James A. Kulik & Kulik, 1984; Southern & Jones, 2004). According to Southern and Jones (2004), this can include starting kindergarten early, as well as skipping entire grade levels of curriculum. Content-based acceleration options provide students with access to more advanced curriculum in one or more specific subjects, like mathematics (Colangelo et al., 2010; James A. Kulik & Kulik, 1984). This can occur in a variety of ways; two common examples include a student physically attending a mathematics class in a higher grade, or a student progressing through a compacted curriculum (Southern & Jones, 2004). In the latter example, the student may remain in their assigned-grade classroom, but progress through the assigned curriculum and materials at a faster rate than their same-aged peers so they can more quickly move on to the next grade level's curriculum. According to Colangelo et al. (2010), research-based acceleration policies inform practices intended to ensure all students (regardless of their race, ethnicity, gender, class, or disability) have access to appropriately rigorous curriculum and learning goals, as well as access to levels of mathematics which suit their interests and talents.

Offering accelerated mathematics tracks to high-ability students is a common practice in middle- and high-schools across the nation. The intent of early mathematics acceleration is to provide high-ability students with greater opportunities and potential to pursue more advanced mathematical courses, thus positioning students for acceptance into competitive universities and likely success in rigorous post-secondary mathematics courses (Colangelo et al., 2010; Diezmann & Watters, 2000; Fong & Finkelstein, 2014; Ma, 2005; Rogers, 2002). However, students who are regarded as highly successful in mathematics are often students who demonstrated mathematical fluency to be very fast at computational thinking and procedural mathematics tasks. According to Boaler (2016, p. 138), "High achievers are often high achievers in the U.S. system because they are procedurally fast." This belief is based in a narrow, traditional view of mathematics as a set of discrete skills and procedures to be carried out quickly and efficiently. Thus, rather than deep understanding of mathematical concepts, speed becomes the driver of the perceived need for acceleration. However, speed and mastery of computational procedures do not necessarily equip students for the levels of abstraction and complexity of mathematical standards that are one to two years ahead of their current grade level's expectations (Boaler, 2016). In determining eligibility for acceleration, a student's ability to demonstrate a deep understanding of skipped content (due to acceleration) is necessary in order to prevent gaps in learning or rushing through critical concepts (Assouline & Lupkowski-Shoplik, 2010).

Academic acceleration - mathematics acceleration, in particular - has primarily been studied in middle- and high-school contexts. There is a need to better understand acceleration policies and practices and the various factors that may determine a child's eligibility and presumed need for mathematics acceleration as early as the elementary grades. While mathematics tracking practices may appear to be exclusive to middle- and high-schools, the reality is that acceleration decisions made in the elementary grades may prematurely set students on an enrollment trajectory for high-track mathematics courses (or exclude students from those courses) at the secondary level too early in the student's development.

The purpose of this qualitative case study was to describe the mathematics acceleration policies and practices and examine the process of selecting elementary students for mathematics acceleration in a large, suburban, public school district in the Midwest, referred to in this study by the pseudonym *Great Plains School District (GPSD).*

Research Questions

This study was guided by the following research questions:

1) What are the current mathematics acceleration policies and practices within the Great Plains School District?
2) How are elementary students selected for mathematics acceleration in the GPSD?
3) What is the demographic distribution of students participating in mathematics acceleration compared to the overall district's demographics?

This study paints a picture of elementary mathematics acceleration in the Great Plains School District - including the current policies and practices, eligibility criteria, purpose, and demographic distribution of mathematics accelerated students. Chapter Two of this study provides an overview of current literature related to academic acceleration, student tracking, and mathematics acceleration. Chapter Three describes the research methods utilized to collect, analyze, and report data for the purposes of this study. The goal of this dissertation is to provide a rich description of the current elementary mathematics acceleration policies and practices in the Great Plains School District.

Definition of Key Terms

In an effort to create a sense of clarity and uniformity, the following operational definitions guided the use of these specific key terms throughout this dissertation.

Acceleration: Acceleration is the systematic practice of providing high-ability students opportunities to move through the curriculum at a faster pace than their same-aged peers (Colangelo et al., 2004; James A Kulik & Kulik, 1992; Slavin, 1990).

Graduation Rate: The graduation rate percentage represents the number of high school students who graduate on time (within 4 years with a regular high school diploma), as measured by the adjusted cohort graduation rate (ACGR).

Great Plains School District (GPSD): Pseudonym for the school district being studied.

High-Ability: Throughout this proposal, the term *high-ability* will be used to refer to students with the potential for high academic achievement. "High ability students have unique academic, cognitive, and social needs. (Colangelo et al., 2010)." "This term reflects a continuum of academic ability and avoids an identification of giftedness (Dare & Nowicki, 2018)." Acceleration is not in lieu of, nor a prerequisite of, gifted education services or programs, but part of a comprehensive program to address the needs of high-ability students.

Tracking: Tracking, also referred to as *ability grouping*, is the practice of assigning students to homogenous groups by academic ability level for instructional purposes (Ansalone, 2009; Hallinan, 1994a; C.-L. C. Kulik & Kulik, 1982; Lucas & Berends, 2002; Oakes, 2005; B. C. Rubin, 2006; Slavin, 1990).

Chapter Two

Review of the Current Literature

This literature review is organized around three sections to provide a framework for understanding the education organizational practice of ability grouping, which is used by schools to classify and group students for learning. In this literature review, ability grouping is broken down into two of its common manifestations: tracking and acceleration. A structural link is established between student tracking at the secondary level and elementary acceleration practices, particularly with regard to mathematics. The first section defines student tracking, provides a brief history of tracking practices in the United States, and offers an explanation for the persistence of tracking practices over time. In addition, this section strives to convey the essence of both sides of the scholarly debate surrounding the practice of tracking. *Opportunity to learn* is presented as a conceptual framework for explaining how ability grouping provides opportunities for learning to occur and simultaneously imposes constraints on student access to those same learning opportunities. Finally, this section describes how tracking practices have changed since tracking was first initiated and how track placement may affect student achievement over time.

The second section of this literature review focuses on acceleration as a form of ability grouping. Acceleration is defined and described as a method of allowing students with high abilities to advance through the curriculum at a faster pace than their typical grade-level peers. A framework is presented for categorizing the types and purposes of varied acceleration options. The rationale for acceleration is explained and the potential benefits and concerns of acceleration are described and discussed. A present gap in the literature reinforces the need to better understand acceleration policies and practices at the elementary level.

The third and final section of the literature review provides a summary of recent research regarding mathematics acceleration. A present gap in the literature is identified and discussed.

Tracking

For more than a century, schools have been using tracking methods to sort students by their perceived academic ability into various ability groups or curricular tracks (Ansalone, 2009; Giersch, 2018; Hallinan, 1994a; C.-L. C. Kulik & Kulik, 1982; B. C. Rubin, 2006). The practice of ability grouping can be traced back to 1867 when W.T. Harris began "rapidly promoting groups of bright students through the elementary grades (C.-L. C. Kulik & Kulik, 1982)." Around the turn of the century, the United States experienced a rapid influx of immigrants, generally from southern and eastern Europe, seeking a better life for themselves and their families (Oakes, 2005). Many settled in newly industrialized American cities, found work in factories, and their children began flooding the public-school system. Tracking was introduced as a practical solution to the need for a differentiated curriculum to accommodate the diversity of the student population in large urban schools, as well as provide a means of socialization and preparing students for their place in society (Ansalone, 2000, 2009; C.-L. C. Kulik & Kulik, 1982; Mallery & Mallery, 1999; Oakes, 2005).

The practice of sorting and assigning to various ability groups or curricular tracks on the basis of their perceived academic ability has persisted for over a hundred years. Tyack and Cuban (1995) describe this classification of students as part of the *grammar of schooling*, which are the general beliefs about how schools should be organized for instruction and what schooling should look like. These notions are so deeply embedded in the public mind that they have "become taken for granted as just the way schools are" (Tyack & Cuban, 1995, p. 85). However, regarding the scholarly debate around tracking, James A Kulik and Kulik (1992) state, "Few educational practices have been scrutinized by researchers and reviewers for a longer period of time." Despite receiving ongoing, persistent criticism from researchers, the practice of tracking enjoys widespread popular support (Giersch, 2018; Loveless, 1999).

Tracking debate. A review of the tracking literature reveals contradictory findings that have become the center of an ongoing debate (Ansalone, 2000, 2009; Hallinan, 1994b; Loveless, 1999). Proponents of tracking contend that it facilitates instruction, promotes learning, and provides a practical method for teachers to address the individual needs of all students (Ansalone, 2009; Hallinan, 1994a; Lucas & Berends, 2002; Slavin, 1990). Supporters emphasize its efficiency (Ansalone, 2000; Hallinan, 1994b) as a means of allowing teachers to adapt instruction to the needs of a diverse student body (Hallinan, 1994a; Slavin, 1990). This efficiency was the key characteristic of the appeal of tracking systems to the earliest adopters of the practice. The central rationale for tracking is that differences in curriculum and instruction (i.e., tracks) are necessary to address the differences in students' abilities, and that by grouping students of similar achievement together, instruction will be more appropriately tailored to students' needs, thus benefiting the achievement levels of both high- and low-track students (Kelly & Price, 2011; Oakes, 2005; Slavin, 1990). Teachers prefer tracking, not only for the perceived academic benefits for students, but because tracking reduces the range of student abilities in any one class, thus making the demands of teaching more manageable (Ansalone, 2009; Oakes, 1987). In addition, teachers in the United States have been found to prefer teaching high-track, socially advantaged students (Page, 2000). Class assignments reflect an informal status hierarchy among teachers where good teachers were rewarded with the opportunity to teach higher-ability students (Kilgore, 1991).

Critics argue that tracking results in unequal access to knowledge, inequality of educational opportunity, and the differential academic treatment of students on the basis of race, gender, and social class (Ansalone, 2009; Hallinan, 1994b; Hamilton et al., 2018; Loveless, 1999; Oakes, 2005; Oakes & Guiton, 1995; B. C. Rubin, 2006; Slavin, 1990). In her review of tracking procedures in 25 of our nation's schools, Oakes (2005) found that educational content consistently varied by track. Curriculum differentiation leads to disparate experiences for students in high- and low-track classrooms (Kelly & Carbonaro, 2012; Slavin, 1990). "Because the school is believed to be a middle-class institution that reproduces the prevailing order of social dominance, children of the disadvantaged are disproportionately exposed to flawed educational experiences" (Gamoran & Dreeben, 1986).

These experiences may include low teacher expectations for student achievement and assignment to lower ability groups where memorization and rote skills are the focus of instruction (Ansalone, 2009; Gamoran & Dreeben, 1986; Oakes, 2005). Once tracked, these students are more likely to remain in the lower track and experience an even greater academic deficit over time (Ansalone, 2009; Kelly & Price, 2011). In contrast, as a result of higher teacher expectations, students assigned to higher ability groups tend to experience higher quality instruction involving opportunities to develop critical thinking, problem solving, and decision making skills (Ansalone, 2009; Oakes, 2005). Thus, tracking practices have been found to sort students along lines of race, gender, and social class which set students on different academic trajectories and have long-lasting effects on student achievement (Giersch, 2018; Hamilton et al., 2018; Slavin, 1990). Students' assignment to groups early in school signals their ability and increases the likelihood of similar placements later on (Oakes & Guiton, 1995). "Curricular tracking is a social structure that differentially provides opportunities and imposes constraints upon what students have the potential to learn" (Carbonaro, 2005).

Opportunity to learn. Ability grouping sets in motion a process of differentiated learning opportunities with variations in the content, pacing, method, and quality of instruction, as well as teacher expectations for student learning. In turn, this stratification of curriculum and classification of students creates differences in the level of access to learning opportunities made available to students based on their assignment to a particular ability group. Wang (1998) defines *opportunity to learn* as a multi-dimensional concept at the classroom level: (1) *content coverage* measures the extent to which students cover the core curriculum for a particular grade level or subject matter; (2) *content exposure* considers the time allotted for learning and the depth of the instruction provided; (3) *content emphasis* observes which topics within the curriculum are selected for emphasis, as well as which students are selected to receive instruction emphasizing lower-order skills (i.e., memorization) or higher-order skills (i.e., problem-solving); and (4) *quality of instructional delivery* reveals how classroom teaching practices affect students' academic achievement. Additionally, Wang (1998) reports student-level variables influencing *opportunity to learn* including general ability, previous achievement, interests, and attendance rate. These dimensions and variables assist in understanding the widening gap in academic achievement over time between upper and lower tracks (Ansalone, 2000; Wang, 1998). Oakes (1987) laments, "Even students who are initially similar in background and aptitude exhibit increased differences resulting from their placements in higher and lower tracks." Thus, a student's track placement will amplify the effects of family background, resulting in the reproduction of social inequality as the advantaged accumulate more privilege and the disadvantaged continue to fall further behind (Giersch, 2018; Hamilton et al., 2018).

Oakes (1987) reflection on tracking practices in secondary schools is a poignant testimonial to the magnitude and complexity of the practical issues inherent in ability grouping.

> School practitioners support tracking because they are convinced that, considering the tradeoffs, it is best for students. Because tracking enables schools to provide differentiated curriculum and instruction, practitioners are persuaded that if students are placed in the "right" track, they will have the best opportunity for school success. Although the empirical evidence suggests a substantial gap between those intentions and the effects of tracking, the dilemma is that *well-intentioned, hard-working people appear locked into a school structure that is contradictory to the expressed goals of schooling.*

Opportunities to learn are central to students' achievement (Kilgore & Pendleton, 1993). "Tracked schools fail to provide equal access to the same curriculum and an equal opportunity to learn for all students" (Ansalone, 2009). As stated by Sørenson and Hallinan (1977), "growth in academic achievement is constrained by opportunities for learning." If students are not provided with information, they cannot be expected to learn (Ansalone, 2000). Access to high-track curriculum is maintained by consistent high-level performance (i.e., demonstrations of ability, effort, and achievement,) where the student must sustain high achievement in order to continue being eligible for advanced curriculum opportunities. However, even if low-tracked students perform successfully, they are often prevented from moving up if they've missed out on learning experiences considered a prerequisite to more advanced curriculum (Oakes, 1987). Thus, the opportunity effect increases differences between students in learning and increases the absolute effect of students' background (Sørenson & Hallinan, 1977).

Tracking practices. Tracking became a common practice in the late 1800s in response to the organizational and societal challenges schools were facing as an influx of diverse, immigrant children began entering the public-school system (Ansalone, 2009; Oakes, 2005). Although tracking is a commonly understood term, it may be somewhat outdated (Carbonaro, 2005; Gentry, 2016) because it refers back to its origins as a traditional, rigid tracking system where students were sorted into academic, general, and vocational tracks across all subject areas for instruction (Ansalone, 2000, 2009; Giersch, 2018; Hallinan, 1994a; Mallery & Mallery, 1999; Oakes, 2005). Research suggests that, while tracking remains a pervasive practice in today's secondary schools (Giersch, 2018; B. C. Rubin, 2006), over time a more flexible approach has emerged where students may be placed in different tracks for different academic subjects (Carbonaro, 2005; Gentry, 2016; Kelly & Carbonaro, 2012; Loveless, 1999; Oakes, 2005; Oakes & Guiton, 1995), based on a number of academic and nonacademic factors including student achievement, intelligence measures, and teacher recommendation (Hallinan, 1994a; Oakes & Guiton, 1995; Slavin, 1990).

Today, secondary schools tend to offer multiple levels of classes where students have increased autonomy to select course sequences based on their post-secondary plans (Oakes, 2005) and to take college-preparatory classes in some subjects, and regular, or even basic classes in other subjects (Kelly & Carbonaro, 2012). This trend appears to shift the responsibility of determining a suitable track from the school to the students themselves. "However, the deep structure of tracking remains uncannily robust (Oakes, 2005, p. xi)." In practice, most middle and high schools still sort students into somewhat predetermined course pathways, offering differing levels of academic rigor based on educator (e.g. administrator, counselor, teacher) judgments of students' abilities (Kelly & Carbonaro, 2012; Kelly & Price, 2011; Oakes & Guiton, 1995; B. C. Rubin, 2006). Once placed in a particular track or ability level of a course, students tended to be placed similarly in subsequent years (Oakes & Guiton, 1995). This lack of track mobility results in lower-track students having less opportunity to take advantage of the benefits of higher track curriculum and learning experiences (Oakes & Guiton, 1995). Specifically, research has found that placement in the top track accelerates achievement and being in the low track significantly reduces achievement (Gamoran & Berends, 1987; Slavin, 1990; Sørensen & Hallinan, 1986). However, Domina et al. (2016) warn of the potential for unintended negative outcomes associated with de-tracking efforts where districts enroll more students in advanced or high track courses for which they may be academically unprepared.

Acceleration

Acceleration is a broad term referring to a variety of opportunities for gifted and high-ability students to move through the school system or curriculum at a faster pace than their typical age-based grade level peers (Colangelo et al., 2010; James A Kulik & Kulik, 1992; Slavin, 1990; Southern & Jones, 2004). The degree to which the content of a course is adjusted to meet the ability of the group of learners has been identified as a key factor of effective grouping (James A Kulik & Kulik, 1992). Lubinski (2004) asserts that a degree of homogeneous grouping by ability is necessary in order for teachers to be responsive to the individual learning needs of each student. "Acceleration is about appropriate educational planning. It is about matching the level and complexity of the curriculum with the readiness and motivation of the child (Colangelo et al., 2004)." High-ability learners need daily challenge in their specific areas of talent to facilitate learning and achievement (Lubinski, 2004; Rogers, 2007). "Consistent practice at progressively more difficult levels in skill, coupled with the talented learner's natural ability to link new knowledge and skill, accounts for what ultimately is perceived as expert performance" (Rogers, 2007). Thus, acceleration opportunities are provided to enable high-ability students to advance more quickly through, or even skip all or parts of, a grade level's curriculum in order to cover more advanced content (Assouline & Lupkowski-Shoplik, 2010; Colangelo et al., 2010; James A. Kulik & Kulik, 1984). Enrichment opportunities may also be provided to add depth and provide high-ability students with richer, more varied learning experiences designed around complex, open-ended, and/or abstract problems and materials (Diezmann & Watters, 2000; Rogers, 2007). James A Kulik and Kulik (1992) observed that programs of enrichment and acceleration, which involve the greatest degree of curricular adjustment compared to other types of ability grouping, have the largest effects on student learning.

Acceleration is not in lieu of, nor a prerequisite of, gifted education services or programs, but rather part of a comprehensive program to address the needs of high-ability students. School districts typically have formal policies related to gifted education which provide specific guidelines for identifying and serving gifted students. However, these policies do not necessarily specify appropriate guidelines or practices for acceleration. "The existence of an acceleration policy helps to ensure that students have their academic needs addressed" (Colangelo et al., 2010). When making acceleration placement decisions, educators analyze the student's past performance or ability and prior achievement to determine both the extent to which a student has already mastered the curriculum, and the ability of the student to acquire new knowledge and skills at an accelerated pace (Southern, Jones, & Stanley, 1993).

Types of acceleration. There are many methods with which schools and teachers can organize students for instruction based on the needs of students, the demands of education policy, and the resources that are available. Acceleration can take a variety of forms and those forms can be classified in two broad categories: (1) content-based acceleration and (2) grade-based acceleration (Colangelo et al., 2004; James A Kulik & Kulik, 1992; Rogers, 2004; Southern et al., 1993).

Content-based acceleration. Content-based acceleration options (e.g., single-subject acceleration, curriculum compacting, dual enrollment, credit by examination or prior experience, Advanced Placement or International Baccalaureate programs, or Talent Search programs) provide students with opportunities to be placed in classes with older peers for part of the school day in order to learn advanced content, skills, or understandings in one or more content areas (Rogers, 2004; Southern & Jones, 2004). This is a flexible approach and could involve the student physically participating in a higher-level class for instruction or the student independently using advanced curriculum or materials (Southern & Jones, 2004) while remaining with same-age peers for most of the school day (Colangelo et al., 2010). “Many subject-based acceleration options show substantial, positive academic effects in specific subject areas” (Rogers, 2007).

Single-subject acceleration. According to Rogers (2004), single-subject acceleration (i.e., the focus of this dissertation) is a form of content-based acceleration where high-ability learners may “bypass the usual progression of skills and content mastery in one subject where great advancement or proficiency has been observed.” An example of this type of acceleration could be an elementary student receiving advanced mathematics instruction in a middle school classroom. Indicators of likely student success in a single-subject acceleration model may include a student who: is achieving two or more grade levels ahead, is independent and persistent, processes and retains information quickly, prefers fast-paced challenging instruction, or has high interest in the accelerated subject area.

Grade-based acceleration. Grade-based acceleration, commonly known as grade-skipping, occurs when a student skips all or part of an entire grade level of curriculum and instruction and is grouped in classes with older students across the full school day in all content areas for the purpose of providing access to appropriately challenging learning opportunities (Colangelo et al., 2010; Rogers, 2004). Grade-based forms of acceleration typically serve to reduce the number of years a student spends in the K-12 school system (Colangelo et al., 2010). Grade-skipping can typically be implemented at any point during the school year. Indicators of likely student success in a grade-based acceleration model may include a student who: achieves two or more grade levels ahead in most academic areas, is frustrated with the slow pace and repetition of regular classroom experiences, is independent and persistent, is socially mature, prefers fast-paced challenging learning, enjoys working with others of like ability, or has a wide-range of academic interests (Rogers, 2004).

The options described here vary in the extent to which the student is treated differently from his or her same-age peers. On a continuum, grade-skipping would represent a significant difference in treatment, as compared to subject-based acceleration or curriculum compacting, which may require only partial placement outside the regular class or typical grade level curriculum. Steenbergen-Hu and Moon (2011) reported positive achievement effects for both content-based and grade-based acceleration methods.

Rationale for acceleration. Acceleration enables students with high academic abilities to progress through the curriculum or learning materials at a pace commensurate with their readiness and motivation, rather than the pacing prescribed by grade-level and age (Dare & Nowicki, 2018). According to Southern et al. (1993), the rationale for acceleration is based on a set of three general assumptions. First, that the primary difference between high-ability students and their typical peers is the rate at which they can acquire knowledge. Second, a strong belief that increasing the pace of instruction or advancing grade placement will meet the needs of these students. Third, and implied by the first two beliefs, that “the content of the curriculum is both appropriate and challenging for gifted students, but that they are denied access to it because of artificial and inappropriate age/grade barriers (Southern et al., 1993).” Acceleration is an acknowledgment of the need for educational flexibility in order to meet the needs of exceptional students (Colangelo et al., 2004).

Acceleration enables high-ability students to work with intellectual peers on learning tasks that match their abilities and interests, thus serving to increase motivation, decrease boredom, and develop critical thinking skills while advancing through the curriculum at a quicker pace (James A. Kulik & Kulik, 1984). Boredom is frequently cited as a significant concern of gifted students and parents of gifted students and stems from a real or perceived lack of challenge in academic tasks, or the perception that academic tasks offer limited educational value to the student (Diezmann & Watters, 2000). “Part of the argument for increasing the challenge in the curriculum for gifted learners centers around the proposition that unchallenging curriculum promotes boredom and does not truly provide gifted students with opportunities to learn (Little, 2012).” Boredom is defined by the APA Dictionary of Psychology as, “a state of weariness or ennui resulting from a lack of engagement with stimuli in the environment” (VandenBos, 2007). According to Csikszentmihalyi (1990), boredom can tend to be experienced when a person is under-challenged, but frustration and anxiety can result when a person is over-challenged. When the curriculum moves at a pace that is slower than a student’s natural or preferred rate of learning, students frequently report experiences of boredom and/or discontent (Lubinski, 2004). Rogers (2007) reports an increase in students’ psychological distress, stress, and boredom when they are held back from making advancements in their specific area of talent. According to Lubinski (2004), appropriate developmental placement through ability grouping and acceleration is important for all students and provides a way for educators to be more responsive to individual differences in learning rates, which, in turn, facilitates achievement and learning. Colangelo et al. (2004) summarize the perceived urgency of the need for acceleration options, arguing, “For countless highly-able children, the pace of their progress through school is determined by the rate of progress of their classmates. In the majority of our classrooms, an invisible ceiling restricts the progress of academically gifted students.”

Mathematics acceleration. Mathematics acceleration refers to providing opportunities for high-ability students to advance through mathematics course pathways at a faster rate, or with more compressed mathematical information, than the standard mathematics courses for a particular grade. The sequential structure of mathematics is, perhaps, one of its most distinct characteristics. McFarland (2006) describes mathematics as the “most rigidly defined subject matter in high schools with the most readily identifiable tracks, course sequences, and mobility structures.” Thus, access to certain courses can function as critical turning points in the mathematical careers of students (Ma, 2005; McFarland, 2006). For example, students who want to take geometry must first take algebra, as a prerequisite. As a result, access to more advanced mathematics courses hinges on the successful completion of algebra. Thus, the structure of students’ educational careers is determined by prior success in prerequisite courses, which are constrained by track placement (Ma, 2005; Sørensen & Hallinan, 1986). Coupled with the knowledge that successful completion of mathematics courses remains critical to college admissions, it stands to reason that the mathematics courses students can access have long-term educational and occupational consequences (McFarland, 2006). Accelerated mathematical courses (often taken initially in middle school but which could be taken as early as elementary school) position students on a pathway to take calculus or statistics in high school (Domina et al., 2016), thus equipping students in high-status academic tracks with an advantage in competing for acceptance to good universities and accomplished careers after college.

Rapid progress is implicit in mathematics acceleration and high-ability students tend to maintain a faster pace of learning, even in their accelerated placement (Lubinski, 2004; McClarty, 2015; Southern & Jones, 2004). However, Assouline and Lupkowski-Shoplik (2010), advocates of acceleration, recognize that students (especially very young students) need time to develop intellectually to avoid rushing ahead before they are ready, resulting in large gaps in their mathematical backgrounds. Boaler (2016, p. 192) writes, “mathematics learning is not a race, and it is mathematical depth that inspires students and keeps them engaged and learning mathematics well, setting them up for high-level learning in the future.” Additionally, Matt Larson (2017), former president of the National Council of Teachers of Mathematics (NCTM) writes the following about the goals of K-12 mathematics curriculum for all students,

> The goals of learning mathematics curriculum are multidimensional and balanced: students must develop a deep conceptual understanding (why), coupled with procedural knowledge (how), but in addition, they also need the ability to reason and apply mathematics (when), and all while developing a positive mathematics identity and high sense of agency. All four goals are critical components of what it means to be mathematically literate in the 21st century.

There is a lack of research specifically related to the acceleration of elementary students, particularly in mathematics. This represents a significant gap in the empirical literature and presents an opportunity for further study. This study seeks to better understand mathematics acceleration by conducting an in-depth case study and analysis of one district’s policies, practices, and the process which guides the educational decisions about accelerating elementary students for mathematics instruction. This will be achieved through the collection and analysis of multiple sources of data, including interviews, documents, and demographic and enrollment data.

Chapter Three

Methodology

Research Design and Rationale

This qualitative case study examined the mathematics acceleration policies and practices of the Great Plains School District. The decision to employ case study methods emerged out of a sincere desire to better understand the understudied phenomenon (Yin, 2014) of accelerating elementary students in mathematics. GPSD presented a unique opportunity to investigate a well-established, robust mathematics acceleration program for elementary students starting as early as third grade. Mathematics acceleration policies at the elementary level can be considered a phenomenon worthy of an in-depth case analysis due to the inherent complexity of implementing a formal, institutionalized process whereby elementary students are selected and sorted into stratified groups presumably for academic and instructional purposes.

Case studies are a unique methodology, as they focus intensely on a specific phenomenon for a sustained period of time and explore the interaction of as many variables as possible; thus, making the case study method especially useful for solving everyday problems of practice or understanding how something has evolved over time (Merriam, 2009). As Yin (2014) explains, "A case study is an empirical inquiry that investigates a contemporary phenomenon (the 'case') in-depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident," (p. 16). Whereas Merriam (2009) succinctly states, "A case study is an intensive, holistic description and analysis of a single, bounded unit" (p. 203). Interestingly, Dr. Yin seems to ascribe verb-like qualities to the term 'case study', offering a process-oriented interpretation. Dr. Merriam's description seems to point to the end product as the defining feature of a case study.

Extrapolating key elements of both descriptions above provides a useful framework for defining the purpose of this case study, as follows: to analyze the *contemporary phenomenon (‘case’)* of elementary mathematics acceleration by *describing* the policies and *investigating* the practices which have supported its sustained implementation within the *single, bounded unit of analysis*, the Great Plains School District. Additionally, the need to collect and analyze a wide variety of data (e.g., interviews, documents, and enrollment and demographic data) in order to fully explore and address the research questions posed by this study (Creswell, 2009; Merriam, 2009) further establishes the suitability of the case study method for its unique ability to “deal with a full variety of evidence” (Yin, 2014, p. 12).

In the sections that follow, I explain the purposeful selection of GPSD as the location and context of this study; describe the qualitative case study research methods and procedures I adhered to while conducting this case study; and discuss the potential for researcher bias.

Location and Context

The Great Plains School District (GPSD) was purposefully selected as a unique and ideal location in which to study mathematics acceleration in an elementary context. This was a convenience sample because I work in the school district being studied and I assist with the implementation of the mathematics acceleration process at both the district and building level. GPSD has instituted a formalized system of mathematics acceleration for qualifying elementary and middle school students, with *mathematics acceleration* being operationally defined as subject-based acceleration whereby students who meet the eligibility criteria may be permitted to skip one or more grade-levels of mathematics curriculum and instruction.

In compliance with GPSD policy, I submitted a formal request to conduct research and received approval from the GPSD Research Review Board (see Appendix B). All email communication (see Appendix C) and interview questions (see Appendix E) were approved by the dissertation proposal committee, the University of Kansas Human Subjects Committee – Lawrence (HSCL), and the GPSD Research Review Board.

Location. Great Plains School District is a large, nationally recognized, affluent suburban school district in the Midwest. Great Plains is surrounded by a variety of similarly described suburban communities, though Great Plains School District is frequently described as the state's and county's aspirational gold standard.

Context. Total K-12 district enrollment was approximately 23,000 students for the 2019-2020 school year, with 21 elementary schools (grades K-5), nine middle-schools (grades 6-8), and five high schools (grades 9-12) arranged in a neighborhood-based, geographical feeder system. As an aspirational district, GPSD is thriving and has experienced enrollment growth for more than forty consecutive years. GPSD boasts a 2018 graduation rate of 96.6 percent compared to the state and national graduation rates of 87.5 percent and 84.6 percent, respectively. Great Plains School District's ACT composite average for 2018 graduates was 25.5 with approximately 90 percent of students taking the test. For comparison, the state average was 21.6. As may be expected, the district is achievement-oriented and offers Advanced Placement (AP) and other college credit courses for high school students, as well as K-12 enrichment and intervention programs.

With the Great Plains School District being bordered by three other highly respected school districts within the same county, parents and guardians have several options when deciding where to live and send their children to school. GPSD's high academic outcomes, along with mathematics course offerings and early acceleration options for eligible students, make the district an attractive choice for parents of college-bound students who want to give their children the best opportunity to compete for scholarships and acceptance to major universities. While this creates opportunities for district growth and funding, it also puts pressure on the district to continue to offer acceleration options, even as research continues to emerge about the potential negative effects of acceleration and tracking. These reasons make Great Plains School District a unique and interesting location in which to apply a case study methodology to study mathematics acceleration.

Data Collection

A key component of case study methodology is the curation of a rich and robust set of data collected over time from multiple sources of evidence which converge in a credible and holistic description of the phenomenon under study (Creswell, 2009; Merriam, 2009; Yin, 2014). For this study, I collected data from four different sources in an effort to triangulate and enhance the credibility of my findings and conclusions, which were drawn from these data: a) semi-structured interviews with purposefully selected participants, b) district documents, c) student enrollment and demographic reports, and d) district enrollment and demographic reports. In the following sections, I describe my sampling methods and data collection procedures.

Sample selection. After receiving formal approval to conduct this study from the dissertation proposal committee, the University of Kansas Human Subject Committee – Lawrence (HSCL), and the GPSD Research Review Board, samples for each data collection method were purposefully selected, with interview participants and documents being selected based on a convenience strategy (i.e., I work in the district and have detailed knowledge and access to the relevant people and documents needed for the study.) Because I work in the district, many of the participants are my colleagues. Thus, potential participants were personally emailed an invitation to participate in an interview. The intent was to convey a sense of collegiality, personal connection, and open communication in an effort to begin building trust with the participants. “Trust increases as people see that you share a common background with them” (H. J. Rubin & Rubin, 2011). The content and format of the email invitation (see Appendix C) was approved by the Great Plains School District Research Review Board (see Appendix B) and the University of Kansas Human Subjects Committee - Lawrence (HSCL) (see appendix A).

Interview participants. Purposeful sampling empowers the researcher to strategically select a sample “from which the most can be learned” (Merriam, 2009). From the greater GPSD population, interview participants (N=12) were purposefully selected from two specific stakeholder groups based on their first-hand knowledge and experience with the GPSD mathematics acceleration process; a) current and former GPSD mathematics coordinators, and b) GPSD middle school counselors. The interview participation goal (N=12) was achieved with participation from six mathematics coordinators and six middle school counselors. In the following sections, I describe the sample selection process for semi-structured interview participants.

Mathematics coordinators. Mathematics coordinators were purposefully selected for participation in this study for three main reasons: 1) they are regarded as experts and leaders in mathematics; 2) they have detailed knowledge of the policies which govern the mathematics acceleration process in GPSD; and 3) they can share informed observations of how mathematics acceleration policies appear to be implemented across the district based on their unique vantage point as district leaders.

I independently identified the current mathematics coordinator, as well as the three most recent predecessors because I work for the district and have direct knowledge of the people who are currently in district leadership roles or who vacated those roles within the last three years.

The current GPSD mathematics coordinator referred me to three additional former mathematics coordinators whom no longer worked for the district. Referrals and shared social networks are accepted methods of locating and gaining access to experienced, knowledgeable participants who can contribute meaningfully to the study (Merriam, 2009; H. J. Rubin & Rubin, 2011). In all, seven current and/or former GPSD mathematics coordinators were identified as potential participants.

I sent personal email invitations (see Appendix C) for a semi-structured interview with a participation goal of conducting six interviews from the mathematics coordinator group. Participation was voluntary and participants were requested to respond within two weeks from the date of the initial email inquiry to schedule an interview. I met the participation goal and conducted interviews with six of the seven potential participants from the group of current and former GPSD mathematics coordinators. One former mathematics coordinator did not respond to emailed interview invitations and I was unable to schedule an interview with that person.

Middle school counselors. Middle school counselors were purposefully selected for participation in this study for three main reasons: 1) they build and maintain class schedules and ensure all students[1] who qualify for mathematics acceleration are enrolled in the correct mathematics courses; 2) they have the opportunity to interact with many of the primary stakeholder groups involved in the mathematics acceleration process (e.g., accelerated elementary students taking mathematics at the middle school, mathematics accelerated middle school students, middle school students who don't pass the mathematics acceleration exam, middle school mathematics teachers, administrators, and parents); and 3) they have their 'boots

[1] *Students*, in this case, includes both middle school students who are mathematics-accelerated *and* elementary students who take accelerated mathematics at the middle school.

on the ground' in a school, so they are uniquely situated to observe and describe how the mathematics acceleration process works at the level of implementation.

There are nine middle schools in the Great Plains School District. Each middle school employs two counselors. I used the GPSD middle school websites to locate the names and school district email addresses of all 18 middle school counselors. I sent an email (see Appendix C) to each pair of counselors that served a particular middle school inviting one or the other to participate in a semi-structured interview. In an effort to collect a representative sample, I set a participation goal of conducting an interview with a representative from at least six of the nine middle schools. This necessitated interviewing just one of the counselors from any given GPSD middle school. Another reason for this approach is that the interview timeframe overlapped with the last two weeks of the counselors' contract and I knew they would likely be busy building class schedules for the following school year. I didn't want to overburden one school by interviewing both counselors during a potentially busy time.

Participation was voluntary and participants were requested to respond within two weeks from the date of the initial email inquiry to schedule an interview. I met the participation goal and conducted interviews with six of the 18 middle school counselors. The six counselors that I interviewed represented six of the nine middle schools in the Great Plains School District. Of the three schools that did not participate, there was no response from either of the counselors at two of the schools, and one counselor from the third non-participating school replied to the initial email invitation and declined an interview.

Enrollment and demographic data. Since Fall 2011, confidential GPSD student information (i.e., name, birth date, course enrollment, demographic, parent contact, emergency contact, medical, etc.) has been securely stored in the online *Synergy*[2] student information system. Upon approval of this study, GPSD provided me with secured access to K-12 student enrollment and demographic data (e.g., grade, birth date, ethnic code, gender, course ID, course title) for the years between 2012-2020. For the purpose of this study, only mathematics courses were included in the sample. GPSD headcount enrollment by grade, race, and gender reports were retrieved from the Kansas State Department of Education (KSDE) Data Central website. The use of these data in this study was approved by the University of Kansas Human Subjects Committee – Lawrence (HSCL), as well as the Great Plains School District Research Review Board.

Documents. Relevant, retrievable documentation related to current GPSD mathematics acceleration policy and practice was collected, coded, and analyzed, (e.g., formal district policy, information currently posted on the district website, documentation, and records).

Semi-structured interviews. This study relied upon the use of human subjects for the collection of interview data, which required that my research plan be submitted and approved by the Institutional Review Board (IRB) at the University of Kansas (see Appendix A) prior to beginning the study. In addition to obtaining IRB approval to conduct research with human subjects, researchers are also required to gain informed consent from the human subjects themselves before engaging in research activities. This ensures that participants "understand the nature of the research, are aware of the risks it poses, and are not forced either covertly or overtly to participate" (H. J. Rubin & Rubin, 2011, p. 91). Using the University of Kansas template, I developed an Adult Informed Consent Form (see Appendix D) which was approved by the IRB. Each participant received a digital copy of the Adult Informed Consent form, in advance,

[2] *Synergy* is a secure, online student information system (SIS) which helps school districts manage data, improve accuracy, simplify and automate processes, and increase productivity.

attached to the email interview invitation. Additionally, I provided participants with a paper copy to review, gave them the opportunity to ask questions, and ensured they signed the waiver before beginning the interview. Before beginning the interview, I informed the participant that their identity would not be revealed, that pseudonyms for all persons and locations would be used, and that no personally identifiable information would be published in the final dissertation document.

The semi-structured interview format was selected for its flexibility, allowing the researcher to be more responsive during the interview (Merriam, 2009). To prepare for the interview, I developed a Semi-Structured Interview Protocol (see Appendix E), which involved listing a limited number of interview questions which were focused on the research questions and developed in advance (H. J. Rubin & Rubin, 2011). During interviews, I utilized the Semi-Structured Interview Protocol (see Appendix E) I had developed earlier as a guide, but improvised the order of the questions and asked follow-up questions during the interview in order to elicit more depth and detail from the participant's responses (Buckler & Walliman, 2016; Merriam, 2009; H. J. Rubin & Rubin, 2011). The interview questions were approved by the Great Plains School District Research Review Board (see Appendix B) and the University of Kansas Human Subjects Committee - Lawrence (HSCL) (see appendix A).

Semi-structured interviews (N=12) were conducted in a person-to-person format; in-person (*n*=10), via phone call (*n*=2), or using the *Zoom*[3] online video conference platform (*n*=1). To make it easier for people to participate in-person, I offered to conduct interviews at the participant's school or office at a time that was most convenient for them. With the verbal permission of the participants, I audio recorded the interviews so that the content could be transcribed for later analysis. Interviews conducted in-person or on the phone were audio-

[3] *Zoom* is a cloud-based platform for hosting video and audio conferences, chats, and webinars.

recorded and transcribed using the *Trint*[4] app on my smartphone. The interview that was conducted on the *Zoom* platform was recorded using the *Zoom* audio recording feature. However, due to technical difficulties[5], the content of the interview conducted on *Zoom* had to be manually transcribed by the researcher.

Documents. To make efficient use of time, while interviews were being scheduled and conducted, I began collecting documentation pertaining to the GPSD mathematics acceleration process from a variety of sources including GPSD digital file storage and the GPSD school website. I was granted access to a number of sources for relevant documentation, including the mathematics department's *Google Drive* electronic file storage system. After receiving formal approval and password access to the GPSD secure *Synergy* student information system, I generated and deidentified K-12 student enrollment reports. These reports included student enrollment information (i.e., year, school, course ID, and course name) and student demographic information (i.e., gender, ethnicity, and birth date). I collected district enrollment and demographic information from the Kansas Department of Education (KSDE) *Data Central* website.

Data Analysis

This was an iterative process that involved moving back and forth between these analytical steps to describe, connect, consolidate, interpret, and understand the phenomenon being studied (Merriam, 2009). In a subsequent section of this chapter, I describe the procedures I followed to analyze, merge, and synthesize these data, including the use of triangulation as a method of increasing the validity of my analysis and credibility of my conclusions. A constant-

[4] *Trint* is a cloud-based platform which records and automatically transcribes audio.
[5] The *Zoom* recording malfunctioned and the audio was recorded in a sped-up format that the *Trint* auto-transcription service was unable to accurately transcribe. The researcher used the *VLC Media Player* application to slow down the playback of the original audio recording and manually transcribed the content of the interview.

comparative method (Merriam, 2009), outlined in the steps below, was used to process and make sense of the data as it was collected. It is important to note that the Great Plains School District mathematics department has experienced frequent reorganization, as well as numerous changes in leadership positions and district mathematics acceleration policies, particularly since 2013. This has resulted in inconsistent documentation and record-keeping at the district-level. By collecting a variety of data (e.g., interviews, district documents, and enrollment and demographic data), when a discrepancy or an inconsistency in the descriptive data occurred, I could triangulate by comparing data across multiple sources.

Interview data analysis. The following steps were used in analyzing data gathered from semi-structured interviews conducted with current and former GPSD mathematics coordinators and current GPSD middle school counselors.

Step One – Interviews were transcribed using the *Trint* transcription service immediately following the interview. Within 48 hours of completing the interview, I listened to the recording to confirm the accuracy of the transcribed content while the interview was fresh in my memory. I added speaker names to the transcript and made corrections where needed.

Step Two – I listened to each interview again while also reading the transcription. I used *Trint* to highlight, color code, and make notes directly on the transcript. Each interview was analyzed and coded independently. This involved making notes in the margins next to bits of data that were interesting, surprising, potentially useful, or important.

Step Three – After the initial coding method of processing the data, I reviewed my codes and notes and grouped them logically into meaningful and relevant categories, patterns, and themes that had emerged from the data.

Step Three – I exported the coded transcripts from *Trint* and loaded them into *Scrivener*[6] software. Using the research questions to provide the overall structure, I used *Scrivener* to create an organized outline of the codes, categories, and themes that fell under each research question. I merged the coded data from each transcript and created categories.

Step Four – The outlining feature in *Scrivener* allowed me to reorganize categories as a means to break down the data and "play" with it (i.e., reorganize it in new, interesting ways). The software streamlined this complex process and gave me the freedom to experiment with new groupings or ways of organizing the categories in order to see the data in new ways and discover interesting connections, patterns, and interactions between the categories.

Step Four – Through an inductive process of comparison, I thoughtfully consolidated the categories by identifying major themes or patterns that cut across the data, as well as relationships that emerged between categories. I continually took steps to preserve the integrity and intended message of the original data.

Enrollment and demographic data. The following steps were used in analyzing GPSD student enrollment and demographic data retrieved from the *Synergy* student information system and GPSD enrollment and demographic data retrieved from KSDE Data Central.

Step One - I accessed the GPSD *Synergy* system with a secure password. I retrieved the student enrollment report for 2019-2020 for each school (elementary, middle, and high). I deidentified the reports by deleting any identifying information (i.e., student name, parent name, phone numbers, district student ID number) from the report. I exported each of those reports as an Excel spreadsheet and saved them in a password protected folder.

[6] *Scrivener* is a word-processing program, outliner, and management system for organizing documents and notes.

Step Two – I deleted extraneous information not relevant to this study from each Excel spreadsheet (i.e., blank rows and columns, classroom numbers, staff names, meeting days, duplicated information). I added a column filled with the school abbreviation to each report. This information was added in order to clearly identify the school associated with each row of data when I merged the schools together in a subsequent step.

Step Three – I imported each Excel spreadsheet into SPSS software and saved the SPSS data file with the same name as the original Excel file and in the same password-protected folder.

Step Four – I merged the SPSS data for all elementary schools into a single SPSS data file containing all enrollment and demographic information for all elementary schools. I repeated this step for all middle school and high school SPSS data.

Step Five – I created one master SPSS data set containing all relevant enrollment and demographic data for the GPSD school district. I deleted all non-mathematics courses from the data set, as the other courses were not directly related to the purpose of this study.

Step Six – I used the Automatic Recode tool from the Transform menu in SPSS to code the data in the School and Ethnic Code columns. This replaced all the string characters in a record with a single number, which became a Value on the Variable tab. This reduced the size of the data set, thus making a very large data set more manageable.

Step Seven - I used sorting and selecting commands to code each record with the level of acceleration (i.e., not accelerated, one year accelerated, two or more years accelerated, or self-advanced) that was observed by comparing the student’s grade to the mathematics course they were enrolled in that year (elementary mathematics courses), quarter (middle school mathematics courses), or semester (high school mathematics courses).

Figure 1 below represents four common pathways through elementary, middle, and high school mathematics courses for GPSD students with the academic intensity increasing with each level of advancement or acceleration as you move from left to right on the table. I outlined these pathways by referencing the GPSD high school mathematics course pathways document (see Appendix S), GPSD course catalog, and prerequisite information for each mathematics course to determine the expected mathematics course progression for a non-accelerated student, a self-advanced student, a single-accelerated student, and a double-accelerated student. Mathematics acceleration is not approved or supported by GPSD for primary students (i.e., kindergarten, first grade, and second grade), thus those grades were not included in the table. The Great Plains School District offers a robust selection of mathematics courses to meet the needs of its diverse study body. The full menu of mathematics courses available for students is not limited to those shown below, but these four categories represent the most common course paths and were useful in coding the enrollment records.

GPSD MATHEMATICS COURSE PATHWAYS							
Grade		Grade		Grade		Grade	
	Traditional/Non-Accelerated		**Self-Advanced**		**Accelerated**		**Double-Accelerated**
3	3rd Grade Math	3	3rd Grade Math	3	4th Grade Math	3	5th Grade Math
4	4th Grade Math	4	4th Grade Math	4	5th Grade Math	4	Advanced Integrated Math 6
5	5th Grade Math	5	5th Grade Math	5	Advanced Integrated Math 6	5	Advanced Integrated Math 7
6	Integrated Mathematics 6	6	Advanced Integrated Math 6	6	Advanced Integrated Math 7	6	Algebra I
7	Integrated Mathematics 7	7	Advanced Integrated Math 7	7	Algebra I	7	Honors Geometry
8	Integrated Mathematics 8	8	Algebra I	8	Honors Geometry	8	Honors Algebra II
9	Algebra I	9	Honors Geometry	9	Honors Algebra II	9	Honors PreCalc or Acc PreCalc BC
10	Geometry	10	Honors Algebra II	10	Honors PreCalc or Acc PreCalc BC	10	AP Calc AB or AP Calc BC
11	Algebra II	11	Advanced Algebra, PreCalc, Honors PreCalc, or Acc PreCalc BC	11	AP Calc AB or AP Calc BC	11	Honors Multivariable Calculus
12	Advanced Algebra or PreCalc	12	AP Calc AB or AP Calc BC	12	Honors Multivariable Calculus	12	

Figure 1. GPSD mathematics course pathways.

The majority of students in GPSD follow a traditional (i.e., non-accelerated) mathematics course pathway taking the standard mathematics course associated with each grade in elementary and middle school, followed by Algebra I as a freshman in high school, and ending high school in either Advanced Algebra (i.e., college-level algebra) or Pre-Calculus. It should be noted that a more remedial course path also exists to support students in need of mathematics intervention or a slower pace of instruction. However, that was not the focus of this study and was not included in the table.

Beginning in middle school, GPSD students may self-select an advanced version of the traditional mathematics course associated with their grade level, this is referred to as a *Self-Advanced* path in the table below. This is not considered formal acceleration, thus there is no exam or qualification process but teacher recommendation is preferred. Advanced courses are a compacted version of the traditional course and deliver the same curriculum at a faster pace so that middle-school students taking advanced mathematics courses can complete Algebra I by the end of eighth-grade, typically enabling them to end high school with Calculus AB or Calculus BC.

Accelerated course paths were the focus of this dissertation. Students on the Accelerated path have been either single- or multiple-accelerated in mathematics through the GPSD's formal mathematics acceleration process at some point in their elementary or middle school years. Students who are single-accelerated may enroll in Algebra I as early as seventh-grade if single-accelerated, as early as sixth-grade if double-accelerated, or even sooner if accelerated more than two years in mathematics. Honors Multivariable Calculus is the most advanced mathematics course offered by the Great Plains School District. The goal of mathematics acceleration, for many parents and students, is for students to be able to complete this course prior to graduation. However, multiple-accelerated students may potentially enroll in Honors Multivariable Calculus by their junior year or sooner, thus creating a gap where students would need to either take a mathematics course which is not as rigorous, simultaneously enroll in a college mathematics course, or graduate early in order to continue to access accelerated mathematics instruction. Many multiple-accelerated students in GPSD enroll in AP Statistics after Honors Multivariable Calculus to fill the gap. However, AP Statistics can be taken anytime after Algebra II, making it no longer an accelerated mathematics course for them at that point in their course path.

Step Nine – I utilized the Kansas K-12 Report Generator, available on the KSDE Data Central website to retrieve district-level enrollment and demographic totals. In the report generator, I selected Excel as the report format, selected the *Headcount Enrollment by Grade, Race, and Gender* report, grouped by District/Organization Totals, selected the Great Plains School District (pseudonym) from the list of Kansas school districts, and selected the school year 2019-2020. This report breaks down the district's enrollment numbers by grade level, gender, and race.

Step Eleven – The district headcount enrollment and demographic data (retrieved from KSDE Data Central) was merged with the student enrollment and demographic data (retrieved from the GPSD *Synergy* SIS) in SPSS. I analyzed these data using descriptive statistics including Case Summary, Crosstabulation, and Chi-Square Test methods to generate descriptive, summary, and comparison reports; and to investigate the interaction of acceleration and demographic variables.

These analyses yielded the findings of the study and provided evidence in support of a more thorough understanding of how the demographic distribution of GPSD students participating in mathematics acceleration compares to the overall district's demographics including comparisons within and across demographic groups and the district overall.

Final synthesis of data. The findings and analyses presented in Chapter Four resulted from the synthesis of data from all the sources described in this chapter, including: interviews with current and former GPSD mathematics coordinators and current GPSD middle school counselors, district documents related to the GPSD mathematics program and/or mathematics acceleration process, GPSD student enrollment and demographic data generated from the *Synergy* student information system, and overall district enrollment and demographic data collected from the Kansas State Department of Education (KSDE). According to Merriam (2009), "To begin the more intensive phase of data analysis in a case study, all the information about the case should be brought together – interview transcripts, notes, records, documents, data (p. 203)." Thus, in this final phase of analysis, I merged data from all sources and analyzed for patterns and themes. This synthesis answered each of the three research questions posed by this study and provided evidence in support of the description of the current mathematics acceleration policies and practices within the Great Plans School District, an examination of the process and criteria used to select elementary students for mathematics acceleration in the GPSD, and a comparison of the demographic distribution of students participating in mathematics acceleration compared to the overall district's demographics.

Researcher Background and Bias

As a part of my job, I have worked closely with the mathematics acceleration process in the Great Plains School District. I am aware that my own lived experience with the phenomenon being investigated in this study could create the potential for researcher bias. However, I believe it can also be perceived as a strength. According to Peshkin (1988), "Subjectivity can be seen as virtuous, for it is the basis of researchers' making a distinctive contribution, one that results from the unique configuration of their personal qualities joined to the data they have collected." As a participant-observer in my district's acceleration practices, my direct knowledge of the district has enabled me to select the most knowledgeable and integral participants to interview. In addition, I had already built trust with many of the interviewees, which resulted in more open dialogue.

Based on my own informal observations of this process and interactions with GPSD students, parents, and educators over the last two years in this role, I have my developed my own beliefs and concerns about the practice of accelerating such young students. I am deeply invested in the well-being, both academic and social-emotional, of GPSD students. My background in working closely with the elementary mathematics acceleration process in my district has catalyzed my belief in the importance of all students having equal access to high-quality mathematics education, regardless of race, ethnicity, gender, or socio-economic status.

I am aware that, as an individual, there is potential for my background experiences and beliefs to be a source of bias in this study. I was committed to following proper standards of qualitative research design to prevent bias. I remained neutral and aware of how my own experiences and expectations may have been affecting my interpretation of what I observed and heard. I actively guarded against bias and sought to preserve the intended message of the original data in my analysis and conclusions. By intentionally seeking to develop an awareness of my own subjectivity and being mindful of its potential to influence my interpretation of the data as they were being collected and analyzed throughout this study enabled me to more effectively monitor and verify my conclusions (Peshkin, 1988).

Chapter Four

Findings and Data Analysis

This study described the policies which govern the mathematics acceleration process in the Great Plains School District; examined the translation of district policies into implemented practices; investigated the process and criteria which form the basis for the selection of elementary students for mathematics acceleration in the GPSD; and compared the demographic distribution of students participating in mathematics acceleration to the overall district's demographics.

In this chapter, I present the findings of this qualitative case study based on data collected from: 1) semi-structured interviews (N=12) with six current and former GPSD mathematics coordinators and six current GPSD middle school counselors; 2) district documents which pertain to or are artifacts of the GPSD mathematics program and/or mathematics acceleration process; 3) student enrollment and demographic reports generated by the GPSD *Synergy* student information system; and 4) district enrollment and demographic reports collected from the Kansas Department of Education (KSDE).

This chapter begins with a descriptive summary of interview data including participant selection and participant background experiences, followed by an analysis of data collected and merged from interviews, district documents, *Synergy* student enrollment and demographic reports, and *KSDE* district enrollment and demographic reports to address each of the three research questions.

Descriptive Interview Data

I conducted semi-structured one-on-one interviews with a purposefully selected sample (N=12) of current and former GSPD mathematics coordinators and current middle school counselors. The interview focused on their experiences and observations of the mathematics acceleration process in GPSD. I purposefully selected these two important stakeholder groups for participation in the study for their first-hand knowledge and experience with mathematics acceleration in GPSD. It is important to note that they were purposefully selected for their differences, as well.

Merriam (2009) urges qualitative researchers to “purposefully look for variation in the understanding of the phenomenon” (p. 219). The integrity and credibility of the study is enhanced by seeking out data which support alternative explanations. Mathematics coordinators primarily work at the district office building thus they are largely removed from the daily instructional interactions of students and teachers. Whereas, middle school counselors work in close proximity to the teaching and learning that occurs in classrooms daily. These contrasting vantage points serve to complement one another, thus revealing a more balanced and robust description of the GPSD mathematics acceleration policies and practices from both the district- and building-level perspective.

It is important to acknowledge that, within a case study, what is being investigated is not necessarily ‘reality’, but “people’s constructions of reality – how they understand the world” (Merriam, 2009, p. 214). In the context of this study, it is expected that there will be multiple constructions of how participants understand and describe the phenomenon of accelerating elementary students in mathematics, based on their experiences. As such, participants in this study described how they understand the GPSD mathematics acceleration process through the lens of their personal and professional background experiences, which have influenced their personal attitudes and beliefs about mathematics and how children learn mathematics, possibly going as far back as their own childhood memories of learning mathematics. It is also important to note that some participants have a personal stake in the GPSD mathematics acceleration process as either they, or their children, have qualified for mathematics acceleration in GPSD as students at some point. Therefore, the background experiences of the participants have the potential to influence their perceptions, as well as the personal meaning they have ascribed to their own experiences and observations of the mathematics acceleration process. If the participants had not had personal experiences with the GPSD mathematics acceleration process, their perceptions may have been different.

Pseudonyms were assigned to each interview participant to maintain their confidentiality. Due to the extremely limited population of current and former GPSD mathematics coordinators (i.e., there are only seven of them), as well as the limited population of current GPSD middle school counselors (i.e., there are only 18), I chose not to report the gender of the participants and to use gender-neutral pseudonyms and pronouns throughout this chapter because I felt that revealing the participants' gender could potentially identify them.

Table 1 presents information about the professional background experiences of the GPSD middle school counselors I interviewed. Names listed are pseudonyms.

Table 1

GPSD Middle School Counselor Professional Background Experience

Participant Name *(pseudonyms)*	Educator Experience *(in any role)*	# Years of Experience as a *GPSD Counselor*	# Years of Counseling Experience *outside of GPSD*	# Years of Experience as a Classroom Teacher	Total # Years in the Education Profession	Prior Experience in a Career other than Education *(Yes or No)*
1) Adrian	MS	17	0	11	28	Yes
2) Cameron	MS	5	0	0	5	Yes
3) Jamie	MS, HS	30	0	5	35	No
4) Shay	MS, HS	3	7	0	10	No
5) Ashton	MS	2	0	0	2	Yes
6) Sawyer	MS, HS	3	0	4	7	No
Average	**n/a**	**10**	**1.2**	**3.3**	**14.5**	**n/a**

Note. ES=Elementary School. MS=Middle School. HS=High School. PS=Post-Secondary.

As presented in Table 1 above, the middle school counselors who are reporting on their experiences with the mathematics acceleration process in GPSD represent a wide variety of experience. As middle school counselors, it is expected they would all report experience at the middle school level. Three of the six counselors also have experience at the high school level. Three of the six counselors have experience at more than one level, and none have elementary or post-secondary experience. The total years of counseling experience ranges from 2-35 years. Three of the six counselors were classroom teachers before transitioning into the counseling role. Two of the three counselors who reported having no classroom teaching experience did report having prior experience in a career other than education. The total years of experience in education ranges from 2-30 years. All but one counselor (Shay) have spent their entire counseling career in GPSD.

Table 2 presents information about the professional background experiences of the current and former GPSD mathematics coordinators who participated in this study. Names listed are pseudonyms.

Table 2

GPSD Mathematics Coordinator Professional Background Experience

Participant Name *(pseudonyms)*	Educator Experience *(in any role)*	# Years of Experience as a GPSD Mathematics Coordinator	# Years of Experience as a Classroom Teacher	Total # Years in the Education Profession	Prior Experience in a Career other than Education *(Yes or No)*
7) Alex	MS, HS, PS	4	12	16	No
8) Blake	ES	2	19	23	No
9) Jordan	MS, HS, PS	2	10	14	No
10) Kennedy	ES, MS	2	7	13	No
11) Morgan	ES, MS, HS	7	33	41	No
12) Dana	ES, MS, HS, PS	16	18	48	No
Average	**n/a**	**5.5**	**16.5**	**25.8**	**n/a**

Note. ES=Elementary School. MS=Middle School. HS=High School. PS=Post-Secondary.

As presented in Table 2 above, the mathematics coordinators who are reporting on their experiences with the mathematics acceleration process in GPSD held the mathematics coordinator role for varying amounts of time and have varying years of experience. Two of the six mathematics coordinators (Dana and Morgan) have experience as an educator in elementary, middle, and high school. Five of the six coordinators have experience at more than one level; one participant (Blake) only has elementary experience. The years of experience in the mathematics coordinator role ranges from 2-16 years. All of the mathematics coordinators reported having classroom teaching experience. The total years of experience in education ranges from 13-48 years.

When comparing the background experiences of the middle school counselors and the mathematics coordinators, the range of experience varies considerably both within and between the groups. As a group, the middle school counselors have less breadth of experience (e.g., middle and high school only), and three of the six counselors have experience at the middle school level only. In contrast, the mathematics coordinator group has experience ranging from elementary through post-secondary level with all but one mathematics coordinator (Blake) having experience with multiple levels. Given the fact that elementary students frequently attend middle school mathematics classes, it is worth noting that none of the middle school counselors have elementary education experience. In fact, the middle school counselors are less experienced overall with an average of 14.5 total years in education, compared to the mathematics coordinators with an average of 25.8 years. This experience gap is particularly evident when comparing the classroom teaching experience of middle school counselors with an average of 3.3 years to the mathematics coordinators with an average of 16.5 years in the classroom. In fact, three counselors have no prior classroom teaching experience (Cameron, Shay, and Ashton). While there is an apparent *educational experience gap* between the middle school counselors and the mathematics coordinators, it is worth noting that three of the six middle school counselors

(Adrian, Cameron, and Ashton) are bringing the experience of working in a different career with them to their counseling role, whereas the mathematics coordinators have only ever worked in the field of education.

An important consideration related to the findings and conclusions of this study is the fact that it may have been several years since some of the former mathematics coordinators have left the position. The more time that had elapsed between the person's lived experience as a GPSD mathematics coordinator and the time of the interview could create greater potential for error in their interview statements ranging from minor mistakes (e.g., less clarity, fuzzy or missing details, etc.) to omissions, incorrect transmission of facts, or exaggeration. Table 3 below summarizes the years of employment of each mathematics coordinator including the total number of years they served in a mathematics coordinator role and the number of years since they had left the position at the time of being interviewed for this study.

Table 3

GPSD Mathematics Coordinator Years of Employment

Years	Name *(pseudonyms)*	Total Years as Mathematics Coordinator in GPSD	Years Since Left the Position
1992-2008	Dana	16	11
2008-2015	Morgan	7	4
2014-2016	Kennedy	2	3
2016-2018	Blake	2	1
2016-2018	Jordan	2	1
2016-2020	Alex	4	n/a

Based on Table 3, it has been five years or less since four of the former mathematics coordinators have been actively engaged in the role of mathematics coordinator. This includes Blake, Jordan, Kennedy, and Morgan. However, it has been 12 years since Dana was actively engaged in the role of mathematics coordinator. When interpreting the table above, there are instances where an overlap in the tenure of certain mathematics coordinators is observed. For example, Morgan's years as mathematics coordinator are listed from 2008-2015, which overlaps with Kennedy's tenure beginning in 2014. This is due to the fact that the structure and duties of the mathematics coordinator position have changed numerous times[7] since 1992 and mathematics coordinators often served in teams of two or three at a time, with one typically focused on elementary and one or more focused on secondary (i.e., middle and high school).

The mathematics coordinator interviews provided a window into the evolving structure and organization of GPSD mathematics leadership at both the district and building level over the last 28 years. The history and evolution of the mathematics coordinator role in GPSD, while fascinating, was not the purpose of this case study. It is understandable, however, that the content of the interviews contained a significant amount of historical information since the former mathematics coordinators were relating stories and information from their experience as mathematics coordinators, which had taken place in the past. As the researcher, I found it useful to capture these historical details as I encountered them during data analysis. I ordered them sequentially and a detailed and interesting timeline began to take shape detailing the history of GPSD mathematics over nearly three decades. An abbreviated summary of these events, focused on changes to the role of mathematics coordinator and the mathematics acceleration process, can be found in Appendix T, for reference.

[7] See Appendix T for a timeline of the evolution of the mathematics coordinator role in GPSD, as well as the significant changes to the GPSD mathematics acceleration process over nearly three decades.

Research Question #1: GPSD Mathematics Acceleration Policies and Practices

In this section, I describe the current mathematics acceleration policies within the Great Plains School District based on data collected from district documents, the GPSD website, and statements from GPSD mathematics coordinators. In addition, I examine the way district policies are translated into practice, as well as identify and explore three interconnected implementation gaps between policy and practice, based on observations and experiences of GPSD middle school counselors and district mathematics coordinators.

This section specifically addresses research question #1: *What are the current mathematics acceleration policies and practices within the Great Plains School District?*

GPSD mathematics acceleration policy. GPSD posted the following official statement on the district webpage regarding the mathematics acceleration protocol:

> Great Plains School District is committed to meeting students where their needs and interests are. Mathematics acceleration is a program that offers exceptional students, who also have a real love and interest in mathematics, the opportunity to enhance their mathematics skills by advancing them through our mathematics curriculum. Each spring, students are given the opportunity to determine whether or not they qualify for mathematics acceleration by demonstrating mastery of the curriculum (the advanced course in middle school) in the level they desire to skip.

The official policy governing the 2018-2019 GPSD mathematics acceleration process is documented in three places: 1) Mathematics Acceleration Protocol document (see Appendix F); 2) GPSD website; and the 3) GPSD Mathematics Acceleration Frequently Asked Questions (FAQ) document (see Appendix G). The protocol (see Appendix F) dictates a window of time, from February to May, which contains the entire mathematics acceleration process, including; recommending students (see Appendix H and Appendix I)), notifying parents/guardians and securing permission for examination from parents/guardians (Appendix L and Appendix M), a two-stage examination process consisting of a screening exam and a battery of exams, notifying parents/guardians of the results (See Appendices N-R), and logistical academic planning for the following school year for students who will be accelerating in mathematics. Figure 2 below presents a flowchart of the GPSD mathematics acceleration process.

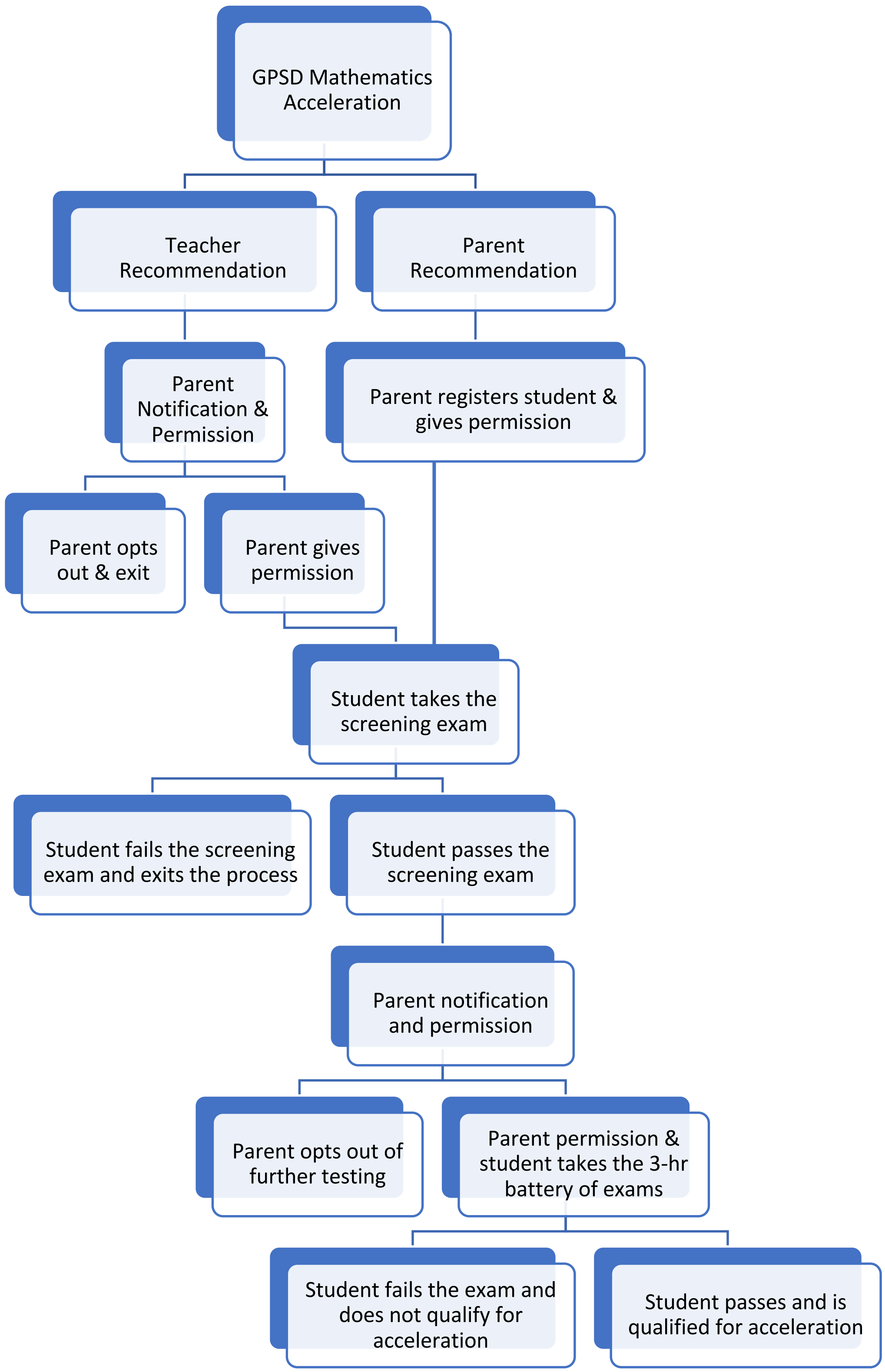

Figure 2. GPSD mathematics acceleration process flowchart.

In the sections that follow, I describe each component of the current GPSD mathematics acceleration policy and the formal process as published in district documents and supported by district documents, interview data, and district mathematics acceleration records. In the next section, I examine the implementation of these policies as practices within GPSD, as well as identify and explore implementation gaps between the intended policy and the implemented practices of the GPSD mathematics acceleration process.

Initial district planning. The mathematics coordinator worked with district administrators to establish and approve the protocol and timeline which would be followed by the GPSD that year. In January, the mathematics coordinator met with elementary and middle school principals, then met separately with elementary and middle school Instructional Design Coaches (IDCs) to brief them on the mathematics acceleration protocol and timeline. Principals and IDCs set a date for the screening exam to be administered in each building by the IDC serving that building. Principals and IDCs were responsible for communicating to teachers by the end of January to inform them of the mathematics acceleration protocol, timeline, and suggested criteria for student recommendation.

Student recommendation policy. Students entered the mathematics acceleration process based on teacher or parent recommendation. Students who were in second through seventh grade could be recommended. The student recommendation window opened in early February.

Teacher recommendation. If a teacher wanted to recommend a student for acceleration, the teacher had to complete a Google form by February 22, 2019 (see Appendix H). Teachers were encouraged to inform the parents of any student they were planning to recommend for mathematics acceleration and explain the reason for the recommendation during parent-teacher conferences in mid-February. Teachers were provided with QR codes which could be provided to the parent of students they were recommending, as well as any parent who inquired about the mathematics acceleration process. The QR codes linked to the GPSD website where information about the mathematics acceleration process, timeline, and FAQs could be accessed. After the teacher recommendation window closed, the mathematics coordinator collected the recommendations and initiated communication with the parents of students who had been recommended by teachers to take the mathematics acceleration screening exam (see Appendix L). In this email, parents were notified that their child had been identified as a possible candidate for mathematics acceleration by a teacher. They were provided a link to the GPSD mathematics acceleration FAQ document (see Appendix G) and asked to read it. The two stages (screening exam and battery of exams) of the eligibility determination process were briefly explained in the email. A link to a Google permission form was provided for parents to grant permission for their student to enter the screening process. At this point, parents could choose to either enter their child into the screening process by filling out the permission form or opt out of the screening process. By opting out, the child would not be screened and would be enrolled in the standard mathematics class for their grade level the following year.

Parent recommendation. If parents wished to recommend their student for the mathematics acceleration screening exam, the parent had to contact the mathematics coordinator via email. The mathematics coordinator would respond with an email (see Appendix M) containing a link and unique activation code for a Google form (see Appendix I) for the parent to both register their child for the screening exam and give permission for the child to be screened. It is important to note that a child did not need, nor was there any benefit, to being recommended by *both* a parent *and* a teacher. The recommendation process was simply a functional system to establish a list of students who needed to take the screening exam and to acquire the necessary parent/guardian permission.

Screening exam policy. All students who have been recommended (either by a teacher or a parent) are required to take the mathematics acceleration screening exam. Parents had to grant permission for students to enter the mathematics acceleration screening process by submitting a digital permission slip via a Google form by March 8, 2019.

Administering the screening exam. The screening exams were administered by the IDC in each elementary and middle school in GPSD between March 19-29, 2019. On testing day, IDCs were provided an envelope containing: a list of all students who would be testing and the grade-level test they needed to take, exams for each student pre-marked with student names, a protocol document with detailed instructions for administering the test (see Appendix J), extra blank paper, and extra pencils. The screening exam is a multiple-choice test which covers the mathematic standards for the grade level the student is attempting to test out of. For example, a third-grade student who is attempting to accelerate directly to fifth-grade mathematics curriculum the following year (i.e., skipping fourth-grade mathematics curriculum and instruction) would take the fourth-grade mathematics acceleration screening exam. Students had exactly one hour to complete the test. If students arrived late or needed to leave the test for any reason (e.g., to use the restroom), they forfeited that time. At the end of the allotted hour, the IDC who was proctoring the test collected all the tests and sent students back to class.

Grading the screening exam. The mathematics coordinator and the elementary IDCs graded the elementary screening exams on March 29, 2019. The mathematics coordinator recorded student scores as pass/fail with the percentage of correct answers in a spreadsheet. Students with a passing score were eligible to advance to the next stage in the examination process. Students without a passing score failed the screening exam and exited the mathematics acceleration eligibility determination process. Students who failed would be enrolled in the standard mathematics class for their grade level the following year.

Screening exam results. The mathematics coordinator emailed the results of the screening exam to parents (see Attachment N and Attachment O) by April 5, 2019. If a student failed the screener, parents were informed that their child "did not meet the required benchmark score on this exam to continue the testing process." The email further confirmed that the child would be placed in the standard grade level mathematics class for the following year. Students who failed the screening exam were exited from the mathematics acceleration eligibility determination process and did not participate in any further examinations. If a student passed the screener, parents were provided: information about the remainder of the mathematics acceleration exams including the date of those exams; a link to a new digital permission form for their student to take the three-hour battery of mathematics acceleration exams; and notification of the final results via email on Friday, May 4, 2019. Principals and IDCs were emailed a list of all students from their school who had taken the mathematics acceleration screening exam and whether the student had passed or failed.

Battery examination policy. Students who passed the initial screening exam could advance, with parent/guardian permission, to a three-hour battery of in-depth performance-oriented exams to determine if the student possessed the necessary depth and breadth of mastery of the mathematics standards of the grade level they would be skipping. Parents had to grant permission for students take the battery of mathematics acceleration exams by submitting a digital permission slip via a Google form by April 12, 2019. At this point, parents could choose to opt out of any further exams by either not submitting the digital permission form or by emailing the mathematics coordinator. By opting out of the battery of exams, the child would be enrolled in the standard mathematics class for their grade level the following year, even if the child had passed the screening exam stage of the eligibility determination process.

Administering the battery of exams. The battery of mathematics acceleration exams was administered by the mathematics coach in each elementary and middle school in GPSD on April 18, 2019 from 9:00 am until 12:00 pm. The mathematics coach is a classroom teacher whose primary role is to support the mathematics acceleration process at the building-level. The mathematics coach was provided with a substitute to cover their classroom teaching duties on the day of testing so they could proctor the three-hour battery of exams. On testing day, the mathematics coach was provided an envelope containing: a list of all students who would be testing and the grade-level test they needed to take; exams for each student pre-marked with student names'; a protocol document (see Appendix K) with detailed instructions for administering the test; extra blank paper; and extra pencils. The battery of exams consisted of three separate exams each focused on a particular domain of mathematics standards from the grade level the student was attempting to test out of. For example, a third-grader who was attempting to skip fourth-grade mathematics and accelerate to fifth-grade mathematics, would take the fourth-grade battery of exams consisting of the following three parts focused on the domains of the fourth grade mathematics standards: 1) Number and Operations in Base Ten and Operations and Algebraic Thinking; 2) Number and Operations - Fractions; and 3) Measurement, Data, and Geometry. These exams were open-ended and required students to solve problems, explain their solutions or justify the strategy they chose, and show their work. Students had exactly three hours to complete the exam. If students arrived late or needed to leave the test for any reason (e.g., to use the restroom), they forfeited that time. At the end of the allotted three hours, the mathematics coach who was proctoring the test collected all the tests and sent students back to class.

Grading the battery of exams. The team of elementary IDCs graded the elementary mathematics acceleration exams on April 22, 2019. The IDCs were trained by the mathematics coordinator and engaged in calibration exercises in order to ensure consistent grading practices. The IDC grading the exam was encouraged to provide comments about areas of strength and weakness they observed in the student's work. It is important to note that a cut-score was not utilized to determine whether a student passed the screening exam. The scores of all three exams were averaged. As a general rule, students scoring a combined average less than 80 percent failed the exam and were not eligible for acceleration the following year. In general, students scoring a combined average of greater than 80 percent passed the exam and were eligible for acceleration the following year. However, careful consideration was given to students scoring at or near 80 percent and an error analysis was performed in order to make a decision that was in the best interest of the student. If the errors were determined to be minor (i.e., minor or sporadic computational errors) and if the student's mathematics concepts, overall work, and ability to explain their thinking appeared strong, then the decision may have been made to accelerate the student. However, if the errors were determined to be based in deeper conceptual misunderstandings or were frequent and pervasive, then the decision may be made not to accelerate the student. Ultimately, acceleration decisions were carefully evaluated on a case-by-case basis. Comments about students' areas of strength and weakness were shared with students' parents to provide feedback and suggest areas for continued growth in mathematics. Particularly, these comments were useful in justifying the acceleration decision when a student narrowly missed the standard for qualification. In addition, if parents questioned the decision that was made, the mathematics coordinator could refer to the comments to explain the rationale for the acceleration decision that had been made. It is important to note that GPSD maintains possession of all mathematics acceleration tests and does not send them home with students or parents. This policy is in place for test security purposes. Parents could make an appointment with the GPSD mathematics coordinator if they wanted to look at their child's graded test(s), but they were not permitted to make copies, take photos, or take the test(s) with them when they left.

Final results. Principals, IDCs, and teachers were notified of the final results of the students in their school or class on May 3, 2019 via email. Parents were notified of the final acceleration results via email on May 3, 2019 via email (see Appendices N-R). If the student did not pass the battery of exams, parents received an email containing: the score of each exam, a list of the student's strengths and weaknesses, and a statement explaining that the student did not pass the mathematics acceleration exams and would be enrolled in the standard mathematics class for their grade level the following year. Students who passed the battery of exams with high scores were not provided comments because the scores were high enough not to need justification. Parents of students who passed with high scores received an email containing the score of each exam and a statement explaining that the student passed the exams and now has the option to be placed in an accelerated grade level of mathematics in the following school year. Parents of students who passed, but with low enough scores to necessitate justification of the decision, received the same email as students with high passing scores with the addition of comments regarding the students' strengths and weaknesses. All emails to parents of students who passed contained the following disclaimer, "Logistically, mathematics acceleration presents a number of challenges. If (student name) were to accelerate, this could create significant scheduling issues for (student name). Simply put, there is no way to predict the impact of mathematics acceleration on future curricular and extracurricular opportunities at all grade levels." All parent emails (pass or fail) included the following statement to explain the grading policy, "While you are probably wondering what scores guaranteed passing marks, please know that we do not set cut scores as we examine students' mistakes very closely and simply put, not all mistakes are equal." The finality and authority of acceleration decisions is made clear in this statement on the Mathematics Acceleration FAQ document, "The results of the acceleration exam are final. Acceleration is a decision with significant educational impact. As a result, we do not allow a student to skip a mathematics level if significant curricular gaps exist at that level."

Mathematics acceleration logistics. When an elementary student qualifies for acceleration into a middle school mathematics class, then transportation needs to be arranged for that student. Typically, the middle school will schedule that student to be in a first hour mathematics class at the middle school. In GPSD, middle schools start their academic day earlier than elementary schools. This is advantageous because the accelerated elementary school student can attend their first hour accelerated mathematics class at the middle school and miss very little of their elementary school day. In this case, the parents would drop the student off at the middle school before school and a bus would transport the student back to the elementary school after first hour. In some cases, where an elementary and middle school building share a campus, students are able to walk safely between the buildings without requiring any additional transportation. The same transportation considerations exist for middle school students who have been accelerated into high school mathematics classes. It is important to note that GPSD does not offer any re-tests during the summer or during the subsequent school year unless a student is new to the district.

Multiple acceleration policy. According to the Mathematics Acceleration FAQ document, students can be accelerated more than one grade level, but it is not recommended and strongly cautioned against.

> If you want a child to be accelerated more than once, ask yourself the reasons why. Consider whether the student desires to be accelerated to this extent and whether the student is equipped for any social, emotional, or logistical challenges brought about by multiple accelerations. Furthermore, a double accelerated student is usually taking a calculus course during their sophomore year of high school. Even though we offer a multivariable calculus course, a twice accelerated student would have at least one year without calculus before heading to college. This is potentially problematic if the student heads into any mathematics-related field.

GPSD mathematics acceleration implementation gaps. In the following sections, I identify and explore three interconnected implementation gaps which currently exist between policy and practice, based on observations and experiences of GPSD middle school counselors and district mathematics coordinators. These include inconsistent implementation of district mathematics acceleration policy, pressure from parents to accelerate students who do not meet the criteria for mathematics acceleration, and equitably informing parents about the mathematics acceleration process.

Inconsistent implementation of district mathematics acceleration policy. The purpose of mathematics acceleration, according to the GSPD Mathematics Acceleration Frequently Asked Questions (FAQ) document is, "to identify students who already possess a deep knowledge of the next grade level's material. A student who computes quickly but does not understand why their computations work and does not possess deep understanding of the next grade level's material is not a good candidate for acceleration." There is a high level of agreement with the GPSD purpose statement among participants. A nearly unanimous belief held by participants in this study was that the purpose of mathematics acceleration in GPSD is to meet the needs of students who are ready for more challenging mathematics content. Eleven participants described the purpose of mathematics acceleration as meeting student needs and challenging kids in mathematics. Blake stated, “I think probably the number one goal of parents and teachers is to make sure the students’ needs are being met.” Adrian agreed, “To really meet the level they [the student] are in their math and to make sure that they have rigor and are challenged.” Alex also supported the district goal by stating, “My goal is to take that kid who does have this ability in mathematics and this natural curiosity and this problem solving and reasoning that is beyond the grade level that they’re at. They need more. I need to move them to the next level so that they can continue that pursuit.”

However, seven participants (including all six mathematics coordinators) expressed frustration over multiple, similar experiences through the years whereby, they had made a data-informed decision that a particular student had not adequately mastered the required concepts and skills, and that mathematics acceleration was not in the best interest of the student at that point in time, and their decision was overridden by GPSD administration due to persistent parent pressure. GPSD communicates the district policy to parents that all mathematics acceleration decisions are final. However, Blake explained, “If a parent goes through the correct channels and they’re still going above us and above us, they’re eventually going to get what they want.” Blake then reiterated, “All in all, the parent really has the final decision.”

Based on the GPSD mathematics acceleration purpose statement, the mathematics acceleration process exists as a way to ensure that students who are eligible and in need of mathematics acceleration are able to be identified and provided access to more advanced mathematics classes, which meet their needs. According to their interview statements, mathematics coordinators tend to feel powerless and frustrated when the purpose of the mathematics acceleration process and the finality of their decisions get “overruled” by district administrators who reportedly “acquiesce” to the demands of parents who “go to the top” and “push hard enough” or “complain enough.” Morgan summarized this common frustration, stating:

> And then, if parents didn't like the results, they would usually make a meeting with me and I would go over it with them, giving them my perspective and what they needed to do and work on. If parents didn’t like my answer, they would go above me, and then usually they ended up accelerating. So, that’s when you really get frustrated, like – why are we doing all this work? And then all they have to do is go higher up the ladder and they’ll let him accelerate.

Ultimately, several of the mathematics coordinators expressed feeling a sense of defeat with regard to their lack of authority to uphold the district policy and the purpose for mathematics acceleration in the face of parent pressure, without consistent support from district administrators. Jordan described concern that a disgruntled parent may approach a school board member about their child not being accelerated, “Let’s be honest, we’re in a public-school district, and we have a school board, and our school board is fantastic. But if someone gets in a school board member’s ear […] and a school board member comes to someone [a district administrator] and says, ‘Gosh, why didn't we accelerate so-and-so?’ Like, what are we going to do?” Jordan alludes to a feeling of powerlessness to uphold the GPSD mathematics acceleration policies when parents push back. As an example, Jordan went on to tell the following story about an elementary student who tested for acceleration last year:

> He's tested for acceleration multiple times. He's very good at computing things, […] but he fails the acceleration test because he can't justify his reasoning. The parents are just, again, so convinced the kid needs to be accelerated. And again, we battled, and we battled, and we battled and finally you give in. Because, at what point is it worth risking your own job, if that's going to happen.

Participants believed that acceleration can be a benefit to students who are well prepared for the advanced mathematics content but were concerned it may be harmful if students were accelerated without having demonstrated mastery of the required mathematical concepts and skills. Alex expressed, “I have such a strong opinion on not moving a kid that doesn't pass the tests or does not score at our benchmark, because I really believe that we are doing what's best for the kiddo.” Regarding the quality of the examination and grading process, Blake said, “I feel like that process went really, really smoothly and it was really nice because we had expert teachers [IDCs] to discuss those exams and really make sure we looked at the student's answers and why they did it.” Kennedy also discussed the benefit of having the elementary IDC team grade the battery of exams collaboratively, stating: “…it’s almost a due process for the kids because look at the discourse and the conversation that we had about some of these kids. So, I think that is better than a hard and fast line [referring to a cut-score].” However, Alex describes a sense of internal conflict and self-doubt that such an important decision, which impacts a student for the remainder of their K-12 educational career, rests solely on the outcome of the mathematics acceleration process, stating:

> But I know on the flip side, that parent knows their kid the best and I hate saying one test makes a decision. … But I think sometimes that's a really hard conversation because I don't know, am I doing the right thing in the end? Could that kid have passed and been fine? Or if the parent finally does enough and we move the kid any way, am I hurting that kid later down the line? You know, stuff we'll never know. But it's hard because even though we have a test, even though we're looking at the work the kiddo did. We're still making a little bit of a subjective decision and that makes it hard.

Pressure from parents to accelerate students who do not qualify. Mathematics coordinators also described experiencing difficulty in dealing with parents whose children did not qualify for mathematics acceleration. Participants reflected that parents of students who enter the mathematics acceleration process typically believe their children should be accelerated. This belief often persists even after their children do not pass the mathematics acceleration exam, causing parents to have great difficulty accepting their child's results even if the mathematics coordinator has explained the rationale for the decision not to accelerate. The mathematics acceleration policy for GPSD states that the decision to accelerate a student or not is based on evidence of student mastery of the mathematical standards which would be skipped and that the decision of the mathematics coordinator is final. However, participants described experiencing pressure from parents to accelerate students whom did not meet the criteria for acceleration. Blake explained this occurrence, stating:

> A lot of parents just believe it's the right thing for their kid. … those ones that just kept pushing and pushing. We had to deal with parents whose kids didn't pass the battery test. And they thought that they should still be accelerated. So, we would meet as a team with those parents, go over the tests. 'Here's why they didn't pass. Here's our concerns.' Make a recommendation to still not accelerate. But, all in all, the parent really has the final decision.

Participants described the adverse responses of some parents to the news that their child did not pass the mathematics acceleration exam and would not be accelerated as, "angry," "extreme," and "irrational." Alex reflected on these difficult experiences with parents stating:

> They're always really nice at first and then if their child ends up being accelerated, then they're still really nice. If they do not get the results that they want, you can deal with all kinds of stuff. Anger, upset, they don't like the process, they don't think the test is right. I think in the end, what I continue to tell myself is they're really doing what they believe is best for their kiddo. So even though I might not think it's the best thing for their kid, I know that's what they think.

While Alex has been able to develop a sense of empathy and acceptance for the emotions of deeply disappointed parents, other mathematics coordinators described feeling overwhelmed, hurt, and morally conflicted to the extent that they were motivated to leave their position as mathematics coordinator. Dana said, "And so, that's really one of the main reasons I left [the district], was the parents. The parental interference just got to be way too much. I was so tired of them calling and complaining. It was just constant." Kennedy remained in the district but sought a new role after just two years as a mathematics coordinator. According to Kennedy,

> That's why I was only in that job for 2 years. My experience with parents was that there was no middle. There was both extremes. More extreme on the angry part, and 'I don't understand why they didn't pass.' And it did not matter, like it was almost an irrational, manic… it didn't matter what the lacking skills were. It was, 'My kid is good at math and this is what needs to happen.' And you had others who said, 'Thank you for the opportunity. We realize they're not ready.' So, very extreme. So, for me there was no middle ground. If parents complained enough, then it was taken care of. For me, in my ISFJ personality defender trait, like, that hurts me because this is something I truly believed was wrong. But there was nothing I could do about it. That moral dilemma for me; I was done.

As interview participants described their experiences with parents whose children did not pass the mathematics acceleration exam, an interesting pattern in the described behavior of some parents began to emerge. The parents described in the paragraphs above appeared to exhibit a certain savviness in their ability to navigate the mathematics acceleration process and circumvent the GPSD mathematics acceleration policies in order to get their child accelerated, even against the recommendation of the mathematics coordinator. However, participants also shared examples of parents who partnered with the school district cooperatively throughout the process, accepted the news of their child's scores without complaint, complied with the district's decision not to accelerate, and/or expressed gratitude for the opportunity. Blake said, "Usually parents are very appreciative, at least of the process." Cameron expressed, "I feel like most of our parents in our district understand that we have a process and they trust us that that process is researched." The story below illustrates this parent dichotomy and provides a detailed example of an instance where district mathematics acceleration policy was not implemented consistently due to parent pressure and the outcome of that circumstance.

Alex and Jordan both related the same story in their separate interviews as an example of a savvy parent maneuvering the GPSD system in such a way that they were able to override the mathematics coordinator's decision not to accelerate a particular student. The original stories have been consolidated and condensed, as follows. Last year, a situation occurred during the mathematics acceleration testing window where two fourth graders, who had already been accelerated once, were taking the mathematics acceleration exams again with the goal of skipping sixth-grade mathematics and taking seventh-grade mathematics in fifth grade. Both students failed. Jordan stated, "And to put this in perspective, the sixth-grade math acceleration tests have high pass rates (i.e., it is a test that students are more likely to pass than a test with a low pass rate). So, the fact that these kids didn't pass that test, meant we were pretty confident that they shouldn't be accelerated." The parents of one of the students pushed back against the decision. The mathematics coordinators shared data and discussed the concerns and disadvantages of accelerating too quickly with the parents of the student. After two or three phone conversations, email conversations, and an hour-and-a-half long meeting, Alex stated, "They pushed enough, we moved their kid." Jordan corroborated and added with emphasis, "We did accelerate one of those two kids because the parents just wouldn't let go. *They would not let go*." When school started the following year and both kids went to middle school for mathematics, one kid went to sixth grade mathematics and noticed the other student going to seventh grade mathematics even though he had not passed either. The student got home from school and told his parents what happened. Then, Jordan explained, "That mom hit the roof. She was mad and she was like, 'I didn't know parents could do that.'" Alex reflected:

> So, then we had huge backlash from that parent who, in all honesty, everything she was saying, she was right. She followed the protocol. Her kid didn't pass. She didn't do anything about it. But these people complained enough, they got it. And I have no leg to really stand on. And so, that was tough, but I learned a lot from it.

This story illustrates the impact of inequitable implementation of district policy as, ultimately, some students may be more likely to be accelerated on the basis of parent pressure rather than academic merit. The story above also highlights two types of parents which emerged from the descriptions of participants in this study; 1) parents who tend to be savvy at maneuvering within district policies in order to accomplish their goals; and 2) parents who tend to be more compliant and trusting of district policies and guidelines. Both groups have something in common. They are both aware of the mathematics acceleration opportunity and chose to engage themselves and their children in the process. Jamie explains, “I think the parents of the kids that are interested or if the parents really see that spark in their student that they need something else, will seek it out. I mean they'll call counseling. They'll call the mathematics teacher. They seek out the resources.” A third group of parents were identified and described by participants as “uninformed,” or “unaware” of the district’s mathematics acceleration process, their child’s mathematical abilities, or both. In contrast to the first two groups of parents, Shay states, “I think it's the diligence of the parent. I think some parents are very well versed and spreading the word, but others when you say acceleration, they don't really know what you're talking about.” Blake summarized the overall observation that there are groups of parents who are ‘in the loop’ and parents who are not, stating “I think if you asked a sample of parents, ‘Hey did you know that GPSD even has this [mathematics acceleration]?’ Most parents probably don't even know it's an option, but there is that community that keeps the spark alive for us. So yeah, it is important to certain community members.” Shay reflected on the differing levels of awareness of mathematics acceleration among parents in the community and reflected on the responsibility of the school to engage and inform parents, stating:

> I think some of it is that they're also unaware of just the intricacies of the process or maybe the small details because we get a lot of calls in May, "I think my student should be accelerated in math." Well, we really needed to start that process back in January. And then they're kind of like shocked and like, "Oh no, well I don't want them to be bored." And so, the parents know that their kids do well academically. I think sometimes we, as a team, don't let them know just how well they're doing. Because if we notice how well they're doing, maybe we start that conversation of acceleration instead of the parents starting it.

Equitably informing parents about the mathematics acceleration process. A formal mathematics acceleration process has been in place for over a decade in GPSD, however there is no formal method for equitably informing the GPSD parent community about the process. When asked how parents know that there is a mathematics acceleration process, the response from ten interview participants was "word of mouth." Participants described the GPSD community as "tight knit," and mentioned that people "spread the word" and "parents talk." Describing the community, Sawyer said, "If something happens, everyone knows about it immediately." When asked how parents know what mathematics acceleration options exist in the district, Kennedy stated, "Word of mouth from other parents. It is from sitting at the ballfields where Sally knows Suzie whose brother Jim had a kid who did that [mathematics acceleration]." According to Alex, "It's very community-driven with parents. So, if it starts in a community in one of our schools, a lot of times the word gets out and therefore our numbers can be bigger in different pockets of our district."

Several participants observed ethnic or cultural groups in the community where this 'word of mouth' phenomenon is more evident. Blake said, "Especially in certain cultures I think it's [mathematics acceleration] discussed a lot and shared with different parents. I think maybe depending on the place of worship for certain people, I think it's shared with them there in their neighborhoods and their after-school communities." Cameron explained, "They talk about it [mathematics acceleration] a ton. Especially the Indian and Asian cultures. They're comparing notes and talking about it from an early stage. Or they came specifically and researched our district and looked at our acceleration process and knew that our kids score well. They landed here for a reason and they will push their child." Kennedy had observed this as well, stating, "Being in the mathematics coordinator role, I had parents that would call 'shopping around' and they wanted to move to [GPSD] because we have a [mathematics acceleration] process because they had heard of it. It is 100% word of mouth."

Participants also observed that GPSD does not advertise or actively inform parents about mathematics acceleration. Ashton stated, "It's [mathematics acceleration] really not a well discussed or well taught thing to parents." Similarly, Adrian said, "To my knowledge, our district doesn't broadcast it." However, occasionally teachers do provide information about the mathematics acceleration process to a parent either because they are recommending a child for mathematics acceleration or in response to the parent asking about ways to challenge their child in mathematics. However, word of mouth was still referenced as the primary means for parents to become aware of mathematics acceleration. Morgan said, "We didn't really advertise it. It was one of those things that if parents brought it up or if a teacher brought it up that they felt like their student need to be accelerated - which really it was more of the parent that would bring it to our attention. So, we did not advertise that we were doing it [mathematics acceleration]. And then so, word of mouth got more and more." Similarly, Jordan explained, "Will a teacher necessarily bring it up? No. But I think if a parent goes like, 'Hey my kid is just flying through your class. What do you think?' Then I think it's more natural for that [mathematics acceleration] to come into conversation from the teacher. So, I think some comes from teachers, but more of it is word of mouth."

GPSD does post information about the mathematics acceleration process on their website. However, participants described that a parent would almost need to know the information was there to go looking for it. They wouldn't necessarily find it on the front page of the website. Blake explained, "We do have all the information available on our district website. However, it is not something that's advertised. We do not send an e-mail out. We put it on the web site, simply because there is no way we could possibly keep up with that if we advertised it." Kennedy remarked, "Some of them look at the website, but if you go to the website, it's not like it's in big flashy letters."

Participants also described experiences with parents being uninformed about the mathematics acceleration process and even unaware that it even exists. Shay explained, "I think some parents are very well versed and spreading the word, but others when you say acceleration, they don't really know what you're talking about." Two mathematics coordinators even mentioned that the acceleration process felt almost hidden or secretive through the years. Kennedy explained, "It was highly secretive at that time. Teachers didn't want to bring it up. Principals didn't want to bring up. Like, we're not advertising that we do this. Parents would be like, 'We didn't even know this existed.' That's why it had to be on the school website connected to the district information, but it wasn't really talked about it." Jordan reflected on the dilemma of whether or not to actively inform the GPSD parent community about the mathematics acceleration process by stating:

> So, this to me is a complete Catch 22, because if you advertise this, I think you're giving kids the false hope of we think you can do this, we think you're a great fit for this. When

> in fact, all you're probably doing, is putting more kids through the process of failing. So, to me, I think that enough parents find out about this anyway. That said, the goal should always be to be transparent. And playing this game where you're trying to hide this district level process simply because you see too many downsides to it, probably isn't great either.

Participants similarly voiced concern about equity and access to the educational opportunity of mathematics acceleration in GPSD. Participants described the importance of teachers being better able to identify the characteristics of mathematically talented students and to advocate for students, even if their parents weren't pushing or asking for mathematics acceleration. Cameron said, "So that's probably what we could do a little bit better, I think. It's just getting that information of what to look for and how to know whether this child is somebody that we might think about allowing to take this test, or at least the screener. It can't just come from their parents pushing because their parents may not or may not even be aware of their abilities." Jordan stated, "I think that word of mouth is probably why the demographic distribution of kiddos that are mathematics accelerated do not match our district demographics at all." Sawyer summarized:

> It is great that we have a community that will spread the word about those things. But if you're not in the loop; if you're a family that doesn't communicate with other families; if you're a family who is of low SES and doesn't have time to communicate with those types of things because you're working multiple jobs in order to keep your kid in [GPSD], I think that it's very possible that those students might be underrepresented because they don't have the same opportunity.

Summary of research question one. The formal mathematics acceleration policy for GPSD was described in the sections above. In early spring, approximately two weeks after parent-teacher conferences of each school year, teachers or parents/guardians may recommend that a student be screened and tested for eligibility for mathematics acceleration. For elementary students, the eligibility determination process begins with a multiple-choice screening exam which covers the full year of mathematics standards for the grade level the student is attempting to test out of. Students who pass this initial screening exam may advance, with parent/guardian permission, to a three-hour battery of in-depth performance-oriented assessments to determine if the student possesses the necessary depth and breadth of mastery of the mathematics standards of the grade level they would be skipping. Three significant mathematics acceleration implementation challenges were identified including inconsistent implementation of district mathematics acceleration policy, pressure from parents to accelerate students who do not qualify, and equitably informing parents about the mathematics acceleration process.

Research Question #2: Selecting Elementary Students for Mathematics Acceleration

In this section, I use data collected from interviews and from GPSD mathematics acceleration exam results to answer research question #2: *How are elementary students selected for mathematics acceleration in the GPSD?*

Selecting students for mathematics acceleration. In the sections that follow, I use statements and observations collected from current and former GPSD mathematics coordinators and current GPSD middle school counselors to describe the process of identifying and recommending students for mathematics acceleration in the Great Plains School District, as well as examine the results of the GPSD mathematics acceleration exam results from the spring of 2018.

Identifying and recommending students. This section focuses on interview participants' observations and experiences with the process of identifying and recommending elementary students for potential mathematics acceleration. The process of recommending students for mathematics acceleration is described using data collected from interviews and GPSD documents.

The mathematics acceleration process begins with the recommendation of particular students by teachers or parents. When parents want to recommend a student, they email the current mathematics coordinator who then provides a link to a registration form and an activation code. The parent completes the form and the student is registered to participate in the screening exam. When teachers want to recommend a student, they fill out an online form (see Appendix H). This form includes basic student information (i.e., contact information, school attended, grade level, etc.) This form also asks teachers to provide information about student characteristics which have been identified by the GPSD mathematics coordinator as ideal characteristics of successfully accelerated students. Figure 3 below illustrates this item on the teacher recommendation form.

Keeping in mind that the acceleration process attempts to predict how students will do in future levels of math, we have identified some characteristics of successfully accelerated students. Please check the characteristics that are consistently modeled by this student. *

- [ ] Initiative -- Does this student possess persistent intellectual curiosity?
- [ ] Maturity -- Does this student have academic and social skills needed if accelerated?
- [ ] Disciplined Habits -- Does this student display strong study skills and take responsibility for his/her learning?
- [ ] Motivation -- Does this student set high expectations for self and others?
- [ ] Perseverance -- Does this student stick with a task until the end, even when there is struggle?
- [ ] Academic Achievement -- Does this student show mastery and beyond of grade level expectations?
- [ ] Reaction to Setbacks -- Does this student react appropriately when things don't go as expected?
- [ ] The student does not consistently exhibit any of these characteristics.

Figure 3. GPSD teacher recommendation form student characteristic item.

The purpose of this item on the teacher recommendation form is to encourage teachers to carefully consider the whole child and to ensure that recommendations are based on more than just test scores and homework grades. Ideally, this question prompts teachers to reflect on whether the student they are recommending is truly a good candidate for mathematics acceleration. Alex said, “We wanted nothing about their grade in their class. We wanted nothing about their performance on tests. We didn't want any of that. We wanted more about the kiddo and how he relates to problem solving and reasoning and mathematics.” Blake explained:

> But I think even more important is - what are the characteristics? What does a good candidate for math acceleration have? So, we've added those qualities into the Google form we want teachers to fill out. We no longer wanted it to be a checklist of – yes, this kid gets 100% on every pre-test and every post-test. We really want to look at the student as a whole. Are they deep thinkers? Are they problem solvers? Do they have grit? Is there

> resilience? Those type of things - the intrinsic things that we really can't teach. Does your student have them? So, it goes beyond - what did they get on a worksheet? What do they get on their timed test? It's really, as a student and as a learner, is it [mathematics acceleration] the best choice for them? So, I think, going a little bit deeper with teachers makes them think in a sense they hadn't thought before about it.

Elementary is a unique context. While the mathematics acceleration process in GPSD includes students in grades two through seven, elementary was described by participants as a unique context which is distinguishable from middle school in important ways. First, participants described elementary teachers as generalists who are trained to teach all content areas at an elementary level, compared to secondary teachers who are certified and trained specifically to teach mathematics. Thus, positioning middle school teachers to more effectively extend the curriculum to meet the needs of students who need more rigor in mathematics. Alex explained, “a lot of our elementary teachers have had one semester of how to teach kids math, right? Whereas your secondary teachers have had more.” Similarly, Morgan said, “Middle school, I think, was able to do that better because you had just ‘math people’ teaching mathematics. With elementary, everybody teaches everything. So, I think that was a disconnect.” Kennedy shared a personal reflection, stating, “I taught first grade, so I could start to help them make those connections. But, because we’re not content people and don’t really have that level of training, that’s really hard. That’s why I got help from the gifted teacher with some of those higher-level things.”

Second, GPSD middle schools offer an Integrated Mathematics course, as well as an Advanced Integrated Mathematics course option for students in sixth and seventh grade. In the spring, GPSD fifth-grade teachers recommend which mathematics class each student should enroll in for sixth grade. However, in most cases, students and parents may self-select the advanced mathematics course in sixth grade, even without teacher recommendation. Dana explained, “It's open enrollment. If a student wants to go into that [advanced] class, they can. We don't have to do formal testing for it.” This self-advanced mathematics option provides students and parents with built-in options for meeting the needs of students who would benefit from being able to progress through mathematics content at a faster pace. Kennedy described the differences between the courses stating, “The content was 100% the same, the pacing was quicker in the advanced course.” Alex summarized this important difference between elementary and middle school by stating, “You also have a middle school advanced class versus a regular class so you could say that you have a type of built-in system to help with some of that - this kid can move quicker, faster, or deeper than the other kids.” However, advanced mathematics courses don’t exist at the elementary level.

Third, elementary students have different social-emotional needs and may require different supports than middle school students throughout the mathematics acceleration process. Ten participants described their experiences and observations of the overall social-emotional toll that the mathematics acceleration process can take on some students, particularly elementary students who have less maturity than middle school students. Kennedy explained, “We’re putting kids in these situations and putting all this pressure on them, when really that should not be happening, especially at the elementary school.” Alex described an experience of administering the mathematics acceleration exam for the first time with a group of elementary students, stating, “I never taught elementary, so the first year giving those tests and seeing the tears and the pressure and the stress on a nine or ten year old, I just think is insane.” Blake shared similar experiences with elementary students exhibiting extreme stress associated with the mathematics acceleration testing process. The example below illustrates the importance of the screening process in narrowing the group of students before administering a three-hour battery of exams. It also highlights the importance of establishing clear guidelines for teachers so they can recommend students who are academically prepared to take the screening exam, intrinsically motivated to accelerate in mathematics, and who are mature enough to handle the pressure of testing. Blake describes:

> My first year this role, I went and did the screeners at ten schools. So, I got to experience ten different schools, ten different environments, ten different groups of kids taking just the screening exam - which is only a multiple-choice exam. The apprehension of having to walk into this room. There was crying. There was a student at one school who literally barricaded themselves from walking into the room and put their hands up and their feet outside the door frame because they did not want to go in, crying and saying, "I don't want to do this. My mom's making me. I don't want to do this." Numerous kids saying, "I don't know what this is. I don't know what this is. What is this?" It was heartbreaking to watch. They didn't even know they were supposed to be taking this test. The parent didn't tell them. A lot of times it would be the fourth or fifth graders because the content they were looking at was just way too hard. Way too hard. And that was just the screening exam. Usually, once the kids got to the battery, I don't remember seeing quite as many tears. But the frustration level and the stress level of those kids when they walked in. It was just sky high.

Professional learning for elementary teachers. Particularly in light of the social-emotional needs of elementary students when taking the mathematics acceleration exams, participants expressed a desire for improving the teacher recommendation process to reduce the number of students who are needlessly exposed to adverse testing experiences. Blake said, "I think we still have a lot of work to do with our teachers as to what is a true candidate for math acceleration. We had some teachers from one single classroom that would recommend five or six kids. Those five or six kids didn't pass." Jordan articulated this concern and frustration by stating:

> I really think the goal is more - let's get the right kids to test. I had students whose MAP scores were below the district mean that were testing for math acceleration, and that's part of why we have a screener. But at the same time, that's a joke. That kid's not even necessarily on grade level as compared to their peers in [GPSD], and yet there's reason to believe according to someone that they should accelerate. And that's crazy to me.

In contrast to the goal of mathematics coordinators seeking to identify and recommend the “right” students, teachers may view the goal of mathematics acceleration as a means to increase efficiency and relieve the pressure associated with the demands on teachers to meet so many diverse learning needs. Teachers are responsible for meeting the needs of all students. Four participants described situations where a teacher has a “high-flyer” who “needs more” or when high-ability students report being “bored”, and teachers feel they have “tried everything” or “don’t know what else to do”. When teachers have exhausted their resources for meeting students’ needs for enrichment in the classroom, acceleration provides a solution to that problem. Ashton summarized this perspective by stating, “And there's so many demands on the classroom teacher trying to meet those needs and then we have a system like acceleration. It feels efficient, right? Well, you know, that makes it easier for me to do my job as the teacher and feel like I'm meeting everyone's needs.”

However, Jordan described the concern with this efficiency-oriented view of mathematics acceleration by stating, “I mean at a certain point, the responsibility is on us to figure out how to meet the needs of all of our kids in the classroom. And in some ways to me, acceleration seems like it's just passing that problem up a level. Like, ‘I can't meet the kid's needs. You try.’ That can't be our answer. That's not what's best for kids.” Participants discussed the importance of fostering high-quality instruction as a foundational element in the mathematics acceleration process. They described the GPSD vision for mathematics instruction that is less procedural and more focused on building depth of knowledge and making connections. Blake summarized this belief in this way, “I think until we truly change our instruction, the kids are just gonna keep going through classes and getting better at procedures and speed and not truly understanding the depth they need to be having because that's where our holes are right now as a district. We need to help our teachers be better teachers."

Four participants described efforts by GPSD mathematics coordinators and instructional coaches to better educate teachers, particularly elementary teachers, about the mathematics acceleration process, how to identify students for possible mathematics acceleration, and other ways to meet the needs of students with high mathematical abilities. Blake summarized this by stating:

> Teachers just don't know about it [mathematics acceleration] and they don't truly understand the process. I think most teachers, once they understand the entire process, are really, really selective on who they choose. I feel like that's something that we're definitely trying to get out there to help teachers understand. And help the teachers understand also, not all kids need to be accelerated. Here are some things you could do instead. Here's how you could challenge your kids and how you could teach deeper for those kids.

Participants described the need for teachers to be able to distinguish between students who are placed accurately in their own grade level for mathematics versus students who are in need of mathematics acceleration, as well as the ability to interpret student success (i.e., good homework and test grades) as evidence of correct placement rather than evidence of a need for mathematics acceleration. According to Alex:

> We have also over the last few years really pushed educating our teachers on what it means to think about a kid being accelerated versus I can get a 100 percent on my [math] tests. But I think a lot of times at our elementary, our teachers see these kids doing the math that they can do, and they do well, but they are doing well because they're in the right placement, not because they need to skip a year of math.

Participants described an observed need for elementary teachers to understand that acceleration isn't the only way to meet the mathematical needs of students who are successful in their grade level mathematics class. They explained a perceived need for teachers to receive professional learning in how to differentiate to meet the needs of all students. Participants reported experiencing a general sense that teachers don't appear to know what to do with students who do well with the grade level curriculum and turn to the acceleration process as the solution to meeting the needs of those students. Kennedy stated, "The goal of the teachers is, 'I don't know what else to do, so this is the alternative.'" Elementary teachers, in particular, see just one segment of the full continuum of mathematics standards. Participants described this 'elementary lens' as a challenge for teachers in deciphering between a successful student who picks up mathematics concepts quickly and a student in need of acceleration. Jordan explained:

> I think one of the hardest things for a classroom teacher is - you're a fourth-grade teacher, right? You have a kid that's really good in your fourth-grade math class. You don't know how well that kid understands the fifth-grade content. You may not spend that much time on the fifth-grade content, because frankly, you don't need to. Your focus needs to be on your class, right? So, I think it's easy as a teacher to overstate and say, 'Yeah he's totally an acceleration candidate.' And you're basing that completely off of the idea that your kid is accessing your curriculum quickly.

Student characteristics. It is clear that participants believe that student characteristics should be considered, in addition to achievement data, when recommending students for possible mathematics acceleration. Collectively, interview participants identified 20 characteristics or traits which they believed would make a student an ideal candidate for mathematics acceleration. These characteristics were condensed to create Table 4 below.

Table 4

Ideal Characteristics of Math Accelerated Students Described by GPSD Interview Participants

	Mathematics Coordinators (N)	Middle School Counselors (N)	Total Participants (N)
Self-Motivated	5	5	10
Deep Thinker	6	3	9
Makes Connections	6	1	7
Problem Solver	6	1	7
Applies Learning	4	2	6
Resilient	4	2	6
Explains Reasoning	4	1	5
Collaborative	1	3	4
Self-Disciplined	0	2	2
Leadership	0	2	2

Table 4 shows that the majority of participants believe that being self-motivated and a deep thinker are two of the most ideal characteristics for students who are accelerated in mathematics. The ability to make connections, solve problems, apply learning, and be resilient were also mentioned by at least half of the participants. It's interesting to note that nearly all of the counselors and coordinators identified being self-motivated as an important characteristic. It was the only trait identified by an equal number of counselors and coordinators. All the other traits appear to be valued more by one group or the other. For example, it appears that mathematics coordinators highly value engagement-oriented characteristics such as deep thinking, making connections, solving problems, application, resilience, and explaining or justifying their reasoning. Whereas counselors highly value social-emotional characteristics such as collaboration, self-discipline, and leadership.

The characteristic of *self-motivation* was described by participants as students who “crave challenge,” “stretch or push themselves,” “challenge themselves,” exhibit “natural drive,” and “you don’t have to spoon-feed them.” Morgan explained, “Those high achieving and high-level kids usually aren't bored. They can come up with other things that they can do to expand themselves.” Jamie described self-motivation as the passion and intrinsic drive of mathematics accelerated students, “You know, obviously they're passionate about math. That's something that's just an interest of theirs that they're willing to put in the work and a lot of times it comes very easily for kids that are accelerating.”

The characteristic of *deep thinking* was described by participants as students who “can think well,” “think in a different way,” “think deeply,” “dive deeper on your own,” “go deeper,” have “deep knowledge,” display “natural curiosity,” understand “why things work”, and exhibit “wonder at how mathematics works.” Jordan explained, “You want kids who don't view math as a series of algorithms. In other words, kids that understand the content at a deep level and not kids who can look at a problem and just be a calculator. We have calculators, we have computers. What we need are people who can think.” According to Alex, “A truly accelerated kid is a kiddo who gets math so deeply that when I'm in third grade, you show it to me once and I can take it at another level because of the way my mind sees that mathematics and what I can do with it. That's an accelerated kid.”

The characteristic of *making connections* was described by participants as students who “push past the procedures” and “look at it another way.” Morgan described students who “think about what they’re doing and not just follow a procedure, like why you do different things when you subtract numbers and different things when you add them.” Alex explained:

> Just the way that they see numbers and view numbers and work with numbers are different. And they go deeper with different things. I am a believer that no one's born with a ‘mathematics mind’. However, I believe the mind sees things differently and connects things differently. And a kid who's truly accelerated at a very young age starts making those connections.

The characteristic of *problem solving* was described by participants as students who “think critically,” “think outside the box,” “make it work,” “look for other ways,” and “think deeply about the problem.” Jordan explained the connection between problem solving and mathematical success by stating, “The accelerated students that I had that were the most successful, were successful because they could think well and think critically. We're talking about more than just the ability to compute quickly. We're talking about kids that already can think deeply, they can examine a task, and they can problem-solve their way through it.” Similarly, Morgan said, “It's more about thinking about the problem. It's not just getting the answer. They look at other ways to find an answer than to just follow a procedure or a trick that they learned at some point.”

The characteristic of *applying learning* was described by Kennedy as a student’s ability to “be flexible and apply their learning into different situations.” Blake explained that mathematics accelerated students need opportunities to go beyond knowledge-level learning experiences by stating, “I think those kiddos need more than just the worksheets and the packets. They need to really apply what they know about mathematics into the real world. They need to go deeper.”

The characteristic of *resilience* was described by participants as “grit,” “perseverance,” and “productive struggle.” Blake explained the importance of mathematics accelerated students being able to persevere through difficult tasks or complex problems by stating, “It's not about being a smart kid or a smart kid in mathematics. It's, are you the whole package? Can you really work on things that are above you and even if you don't know how to do it, can you tackle it?” Blake explained the need for grit in the mathematics acceleration exam process by stating, “The test itself is putting any child through a 3-hour battery. You can't go in there to that test if you are immature, not used to grit or trying, or giving up because it is such an intense test. You are dealing with high level questions, high level stakes. And those kids that don't have that, that haven't been taught that, or haven't gone through experiences - there's no way. No way.”

Pressure from parents. Participants frequently described their perception of the pressure teachers feel from parents to recommend students for mathematics acceleration. The parent recommendation process alleviates this pressure by providing parents with the ability to recommend their own children. Alex said, “I think in those pockets, that pressure from parents to teachers is strong, which is why we've continued to push. You [the teacher] can tell that parent you would not recommend their kid. But the parent is welcome to recommend. So, it takes some of that pressure off the teacher and it forces the parent to do the actual recommendation rather than the teacher.” Jordan summarized the complexity of the student identification and recommendation process, stating, “So to me, the whole issue in terms of figuring out what kids should be considered, is really pretty tricky. I mean I don't want to just test kids whose parents think they should be tested. But at the same time, I don't want to just start recommending kids left and right because they got 100 percent on the chapter five test.” Participants described having an overall sense that elementary teachers feel tremendous parent pressure to accelerate students and often feel that acceleration is their only option. Alex summarized this belief by stating:

> I think a lot of times, elementary teachers especially, but even middle school teachers, when a parent is talking to them about their kid in math and they're not being challenged or they're bored. I think teachers can feel defensive and not always be sure what to do for that kiddo. So, saying, "Oh I think they should test for acceleration" does a couple of things. One, all of a sudden, the parent's happy. And it also gets that parent maybe (quote) 'off that teacher's back' a little bit. So, I think there was some of that going on, which is understandable, just that pressure.

Six participants reported hearing from parents "over and over and over" that their "kids are bored", or "not being challenged", and teachers needed to "give them more." Parents want the best for their kids and are often, according to Alex, "afraid their kid is going to lose their love of math." When students come home from school and mention being bored in mathematics, parents often seem to jump to the conclusion that it must mean the student needs to accelerate, rather than exploring other strategies to engage and challenge them within the grade level curriculum. Jordan elaborated on the theme of boredom and acceleration in this way:

> So if a parent perceives that their kid is "really smart" or "really good at math" (I did air quotes there), if a parent perceives that, and if the kid mentions one time that he or she is bored, I think the likelihood of the parent then latching onto that and going […] "Great. Let's get you accelerated."

The GPSD parent community overall was described as "having their hearts in the right place" and "wanting the best for their kids", yet participants also described how "parents talk amongst themselves" about mathematics acceleration and described a sense of "parent rivalry." Six participants mentioned that when students are accelerated in mathematics, it becomes a "status thing" for parents, also. Cameron described the effect of the neighborhood chatter in this way, "if they [parents] find out that their neighbor's or the people in their social circle's child accelerated, then they jump on that acceleration bandwagon." Parents want to be able to say, 'I've got a really smart kid.' Mathematics acceleration is the "physical proof" or "bragging rights" that their kid is "extra smart." Jordan described the competitive nature of the GPSD parent community in this way, “I think we’re just in a community that’s always in the arms race. That’s always in the, ‘Oh, your kid did that? My kid did this,’ kind of thing. You know, the stuff to talk about at soccer games and neighbor chat.” Jordan reiterated, “I think being able to talk about it is a nice perk, for some of them. I think status plays in big.”

Seven participants also discussed numerous examples of parents “pushing” acceleration so students can “free up” up their schedule for more advanced mathematics classes in high school, “play the GPA game”, “get to Calc BC”, or “double accelerate” so they can be in Multivariable Calculus as a senior. Parents are described as wanting their students to “get a jump on college credits” and acceleration creates a course pathway where students can take college-level mathematics courses in high school. Alex illustrated an example of the determination of parents to ensure their children reach the highest levels of mathematics as quickly as possible in the statement below, describing a parent whose child had already been accelerated and was requesting double acceleration:

> The one whose kiddo now is already (quote) ‘on that advanced path’. So, they're in Algebra 1 [in seventh grade]. But now they say, "I want my kid to end in multi-variable. I want my kid to end in Calc BC." And you'll notice I've said, *'I want my kid...*' So, they'll tell you, "Suzy or Johnny or whoever, really wants to do this." But as I've told them before, when you're talking to them in eighth grade or a freshman, there's a lot of 13- and 14-year-olds that are like, "Please let me end in Calc BC." They don't even know really what Calc BC means. So, I think there's just a lot of education that way.

Mathematics acceleration exams. The sections below focus on the exam portion of the mathematics acceleration process. I describe and explain the screening exam and the battery of exams using data collected from interviews with current and former GPSD mathematics coordinators and current GPSD middle school counselors. I also present and analyze screening and battery exam data from the mathematics acceleration exams which took place in the spring of 2018 in the Great Plains School District.

Screening exam. All students who are recommended and granted parent permission for possible mathematics acceleration must take a one-hour multiple choice screening exam. Jordan described, “To me, the value in the screening test is that it gives you one more data point. I mean again, it's not a lot more data but gives you one more data point to help in evaluating the kid.” The purpose of the screening exam is to determine whether a student has sufficient mastery of the grade level mathematics standards which they are attempting to skip in order to proceed to the three-hour battery of mathematics acceleration exams. The goal is to develop a screening exam which is rigorous enough to effectively narrow the group of students and eliminate students who would not be likely to pass the battery of exams without being so difficult that it renders the three-hour battery of exams useless. Alex explained, “Now, it is a screening exam. We're trying to weed out some that really would not need to sit through a three-hour exam. So, it's not like we're trying to make it impossible.”

Battery of exams. Students who pass the screening exam may advance, with parent permission, to a three-hour battery of in-depth, open-ended exams over the mathematics standards of the grade level they are attempting to skip. The goal of this exam is to select students for mathematics acceleration in the following year who have demonstrated extensive mastery and depth of knowledge which are consistent and convincing enough to believe that mathematics acceleration is in their best long-term interests. Blake explained, “Because we know there's kids in our district who acceleration is the right answer for - a very small group of kids.” The purpose of the battery of exams is to determine the level of mastery the student has over the mathematics standards from that grade level, as well as to determine how deeply they understand those concepts by analyzing the students’ problem solving strategies and how effectively they were able to explain their work and justify their solutions. Alex described the nature of the questions on the test by stating, “Questions that took kids a little bit deeper, questions that maybe made them explain a little bit more.” Blake explained the intent of an open-ended test by stating, “Make the test open-ended to truly see what kids knew and not just procedures.”

Mathematics acceleration exam results from spring 2018. Table 5 below is a summary of the GPSD mathematics acceleration student results from the Spring 2018 acceleration exams broken down by grade level. While the focus of this research question is on elementary students, it is important to include grades three through eight in the table below because there may have been elementary students taking an acceleration exam over any of those grade levels. For example, a fifth grader who had already accelerated once before may be taking the seventh-grade mathematics acceleration exam in order to accelerate again and qualify to enroll in an eighth-grade mathematics class as a sixth grader.

Table 5

Spring 2018 GPSD Mathematics Acceleration Exam Results by Grade

Grade level of mathematics the student is attempting to skip	Number of students who took the screening exam	Percent of students who passed the screening exam	Percent of students who passed the 3-hr. battery of exams	Percent of students who entered the screening process who were eligible for mathematics acceleration
3rd grade	41	46.3%	47.4%	23.0%
4th grade	62	61.3%	34.2%	21.0%
5th grade	51	72.5%	37.8%	27.5%
6th grade	34	38.2%	61.5%	23.5%
7th grade	30	60%	5.6%	3.3%
8th grade	20	35%	28.6%	10%
3rd-8th grade combined	**238**	**55.5%**	**35.6%**	**19.75%**

As shown in Table 5, in the spring of 2018 approximately 20 percent of the students who entered the GPSD mathematics acceleration screening process, by either teacher or parent recommendation, were determined to be eligible for mathematics acceleration for the 2018-2019 school year. To be considered eligible, the student had to pass both the mathematics acceleration screening exam and the 3-hour battery of mathematics exams. Approximately 55 percent of the students who entered the screening process passed the screening exam and advanced to the 3-hour battery of mathematics acceleration exams. Of the students who passed the initial screening test and qualified to advance to the battery of exams, approximately 36 percent passed the final battery of exams and were considered eligible for mathematics acceleration the following year. These data suggest that the seventh-grade battery of exams is the most difficult exam, since 60 percent of students passed the seventh-grade screening exam, but just 3.3 percent of students who entered the screening process were determined eligible for mathematics acceleration. The sixth-grade exams present an interesting case, as it is the only instance where a higher percentage of students passed the battery of exams (61.5 percent) than passed the screening exam (38.2 percent). This could suggest that the screening exam is very rigorous and that students who pass the sixth-grade screener are likely to also pass the battery of exams. The inconsistency in pass rates at the middle school level suggests a need to audit the exams and calibrate them for appropriate rigor. By ensuring the validity, reliability, equity, and accessibility of the mathematics acceleration recommendation and testing process, district administrators and mathematics coordinators can feel more confident in the outcome of student selection decisions.

Figure 4 below is another representation of the Spring 2018 GPSD mathematics acceleration student eligibility results, focusing specifically on elementary results broken down by school.

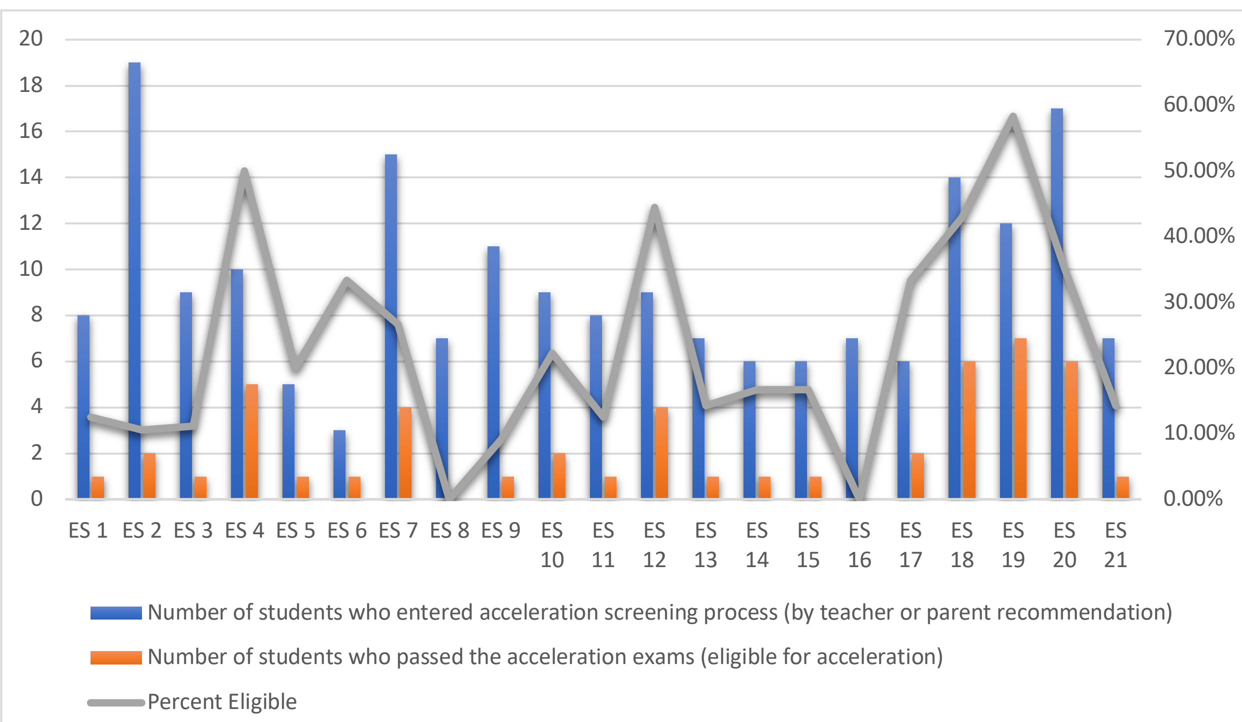

Figure 4. Spring 2018 GPSD acceleration results by elementary school (ES).

These data demonstrate a lack of consistency from school-to-school, particularly in the degree to which the percentage of students who are determined eligible for acceleration is consistent among the elementary schools in GPSD. It's reasonable to assume that the specific numbers of recommended students might vary from school to school based on the total enrollment size of the school, for example. However, one might expect, of the students who enter the screening process, the percentage of students who are determined to be eligible for mathematics acceleration would be fairly consistent across the district. However, the percentage of students who qualified for math acceleration ranged from zero to 58 percent across the 21 elementary schools in GPSD. Nine schools had at least 20% of the students who entered the screening process qualify for mathematics acceleration, which was approximately the district average pass rate for that year. Of those nine schools, just two (ES 4 and ES 19) had a pass rate of 50% or higher. When a school recommends 19 students (see ES 2) as good candidates for mathematics acceleration and just five percent qualify, or when zero students qualify (ES 8 and ES 16), it suggests that the teachers and parents who are recommending students may not really understand what to look for in a good candidate for mathematics acceleration. These data appear to support the findings of the interview data which identified a clear need for teacher professional learning in the area of identifying students who are good candidates for mathematics acceleration.

Summary of research question two. In this section, I used statements and observations collected from current and former GPSD mathematics coordinators and current GPSD middle school counselors to describe the process of identifying and recommending students for mathematics acceleration in the Great Plains School District, as well as examined the results of the GPSD mathematics acceleration exam results from the spring of 2018. Elementary grades were established as a unique context to study the student selection procedures because elementary teachers are generalists who may lack specialized mathematics content knowledge, there are no advanced mathematics courses available to elementary students, and young students have different social-emotional needs and require different practices to be in place to support their needs throughout the mathematics acceleration exam process. Particularly in light of the social-emotional needs of elementary students, there is a need to provide professional learning for teachers in effectively identifying students who are good candidates for mathematics acceleration in order in order to avoid exerting unnecessary pressure and stress on students who are not likely to qualify for mathematics acceleration. Teachers also appear to be in need of support to develop a repertoire of differentiation strategies to meet the needs of high-achieving mathematics students, rather than relying exclusively on the mathematics acceleration process. Participants described common student characteristics which they believe make students good candidates for mathematics acceleration. The four most frequently mentioned characteristics were self-motivation, deep thinking, making connections, and being a problem solver. Pressure from parents appears to be a factor in the recommendation of students for possible mathematics acceleration. Parents were described as pushing for mathematics acceleration for their students in order to prevent boredom, meet the instructional needs of their students with perceived high mathematical abilities, and establish a sense of status that seems to have been cultivated in the community.

There are two phases to the mathematics acceleration exam process in the Great Plains School District. The first phase is a one-hour multiple choice screening exam. Data from the spring of 2018 show that approximately 50 percent of students passed the screening exam and advanced to the second stage of the exam process, the three-hour open-ended battery of exams.

Of the students who took the battery, approximately 35 percent passed and qualified for mathematics acceleration in the following school year. Overall, approximately 20 percent of students who were initially recommended for possible mathematics acceleration ended up qualifying for mathematics acceleration through the district's selection process. Disaggregating the screening and battery exam data from the spring of 2018 by elementary building demonstrated a lack of consistency in the pass rates of the mathematics acceleration exams between the 21 GPSD elementary schools suggesting that there is a lack of consistency in the recommendation of students to enter the mathematics acceleration screening process. These data appear to support the findings of the interview data which identified a clear need for teacher professional learning in the area of identifying students who are good candidates for mathematics acceleration.

Research Question #3: Demographic Comparisons

In this section, I begin by presenting enrollment and demographic data collected from the GPSD *Synergy* Student Information System and KSDE to compare the demographic distribution of students currently participating in mathematics acceleration within the district to the overall district demographics to address research question #3: *What is the demographic distribution of students participating in mathematics acceleration compared to the overall district's demographics?*

In addition, descriptive data collected from semi-structured interviews with current and former GPSD mathematics coordinators and current GPSD middle school counselors is presented. This descriptive interview data served to enrich these enrollment and demographic findings with personal observations and experiences of the interview participants to create a more robust description of the demographic distribution of students participating in mathematics acceleration compared to the overall district's demographics.

Demographic and enrollment data. In the sections that follow, I use demographic and enrollment data displayed in frequency tables to describe the population (i.e., total GSPD student enrollment for 2019-2020) and sample (i.e., all GPSD mathematics accelerated students enrolled for 2019-2020). Then, I compare mathematics accelerated students to the overall GPSD student population on the basis of gender and ethnicity distributions. Next, I use crosstabulations to explore relationships between variables of gender, ethnicity, and mathematics acceleration. Finally, I use Chi-Square goodness of fit tests to determine whether the demographic distribution of students participating in mathematics acceleration is consistent with the demographic distribution of the overall GPSD student population.

Population. The population consisted of 23,026 students who were enrolled in GPSD for the 2019-2020 school year. Table 6 presents frequency and percentage data for gender. Approximately half of the students were female (n=11,081), while the rest were male (n=11,945). Table 7 presents frequency and percentage data for ethnicity. Approximately 70% of students were Caucasian/White (n=16,257), approximately 15% were Asian (n=3,313), approximately six percent were Hispanic (n=1,445), approximately five percent were multi-ethnic (n=1,128), and approximately three percent were Black/African American (n=781). Table 8 presents frequency and percentage data for mathematics acceleration categories. Approximately two percent of GPSD students were mathematics accelerated (n=500).

Table 6

Frequency and Percentage of Gender of GPSD Students (total) - 2020

Gender	Frequency	Percentage
Female	11,081	48.1%
Male	11,945	51.9%
Total	23,026	

Table 7

Frequency and Percentage of Ethnicity of GPSD Students (total) - 2020

Ethnicity	Frequency	Percentage
Asian	3,313	14.4%
Black/African American	781	3.4%
Caucasian/White	16,257	70.6%
Hispanic	1,445	6.3%
Multi-Ethnic	1,128	4.9%
Total	23, 026	

Table 8

Frequency and Percentage of Acceleration Categories of GPSD Accelerated Students - 2020

Mathematics Acceleration Categories	Frequency	Percentage
Single Accelerated	451	2.0%
Multiple Accelerated	49	0.2%
Total Accelerated	500	2.2%
Total GPSD Enrollment	23,026	

Sample. The sample was selected from the overall population of GSPD students enrolled in 2019-2020. The sample studied consisted of all 500 students who were enrolled in accelerated mathematics courses in GPSD for the 2019-2020 school year. Table 9 presents frequency and percentage data for gender. Approximately one-third of the mathematics accelerated students were female (*n*=167), while the rest were male (*n*=333*)*. Table 10 presents frequency and percentage data for ethnicity. Approximately 50% of the mathematics accelerated students were Asian (*n*=253*)*, approximately 40% were Caucasian/White (*n*=204*)*, approximately four percent were multi-ethnic (*n*=22), approximately 4 percent were Hispanic (*n*=19), and less than one percent were Black/African-American (*n*=2). Table 11 presents frequency and percentage data for mathematics acceleration categories. Single acceleration refers to students who have skipped one grade of mathematics (i.e., a fourth grader taking fifth-grade mathematics). Multiple acceleration refers to students who have skipped two or more grades of mathematics. For example, a fourth grader taking sixth-grade mathematics has skipped two grades of mathematics, while a fifth grader taking Algebra I has skipped three grades of mathematics. Approximately 90% of mathematics accelerated students in GPSD in 2019-2020 were single accelerated (*n*=451), and approximately 10% were multiple accelerated (*n*=49*)*.

Table 9

Frequency and Percentage of Gender of GPSD Mathematics Accelerated Students - 2020

Gender	Frequency	Percentage
Female	167	33.4%
Male	333	66.6%
Total	500	

Table 10

Frequency and Percentage of Ethnicity of GPSD Mathematics Accelerated Students - 2020

Ethnic Categories	Frequency	Percentage
Asian	253	50.6%
Black/African American	2	0.4%
Caucasian/White	204	40.8%
Hispanic	19	3.8%
Multi-Ethnic	22	4.4%
Total	500	

Table 11

Frequency and Percentage of GPSD Mathematics Accelerated Students - 2020

Mathematics Acceleration Categories	Frequency	Percentage
Single Accelerated	451	90.2%
Multiple Accelerated	49	9.8%
Total	500	

Demographic comparisons. The following tables and figures present comparisons of the GPSD total student population and the GPSD mathematics accelerated students based on demographic data (e.g., gender, ethnicity, and birth month) for 2019-2020.

Gender. Table 12 presents frequency and percentage data comparing the GPSD total student population to the GPSD mathematics accelerated students based on gender. Gender was relatively equally distributed in the GPSD student population with approximately half female (48%) and half male (51.9%). In comparison, approximately one-third (33.4%) of mathematics accelerated students were female and approximately two-thirds (66.7%) were male. This represents an approximate 2:1 ratio of male to female mathematics accelerated students.

Table 12

Frequency and Percentage of Gender - GPSD 2020

	GPSD Total Student Population		GPSD Mathematics Accelerated Students	
Gender	Frequency	Percentage	Frequency	Percentage
Female	11,081	48.1%	167	33.4%
Male	11,945	51.9%	333	66.6%
Total	23,026		500	

Ethnicity. Table 13 presents frequency and percentage data comparing the GPSD total student population to the GPSD mathematics accelerated students based on ethnicity. The majority of students in the district are Caucasian/White (70.6%), with all other ethnicities (i.e., Asian, Black/African American, Hispanic, Multi-Ethnic, and American Indian/Alaska Native) combined making up the other 30% of the student population. In contrast, approximately half of all mathematics accelerated students are Asian (50.6%), followed by approximately 40% Caucasian/White students. All other ethnicities combined represent less than 10% of all mathematics accelerated students. It is interesting to note that approximately one out of every seven students in the total student population is likely to be Asian. However, approximately one out of every two mathematics accelerated students are likely to be Asian.

Table 13

Frequency and Percentage of Ethnicity - GPSD 2020

	Total Student Population		Mathematics Accelerated Students	
Ethnicity	Frequency	Percentage	Frequency	Percentage
Asian	3,313	14.4%	253	50.6%
Black/African American	781	3.4%	2	0.4%
Caucasian/White	16,257	70.6%	204	40.8%
Hispanic	1,445	6.3%	19	3.8%
Multi-Ethnic	1,128	4.9%	22	4.4%
American Indian/Alaska Native	n/a*		<10*	
Total	23,026**		500	

* The *Family Educational Rights and Privacy Act* (FERPA) prevents the disclosure of personally identifiable student information. KSDE has determined that any quantities less than 10 may be personally identifiable.
**American Indian/Alaska Native population is included in the total.

Enrollment numbers for the American Indian/Alaska Native ethnic category were not disclosed by the Kansas State Department of Education (KSDE). In addition, there were no occurrences of students identified as American Indian/Alaska Native in the group of mathematics accelerated students. As such, the American Indian/Alaska Native ethnic category was not included in many of the reports that follow, as no numerical data was available to include in the analysis.

Mathematics acceleration. Table 14 breaks down the number of accelerated students into both single accelerated and multiple accelerated categories and displays the percentage of each out of the total GPSD student population. In addition, the percentage breakdown of single and multiple accelerated students out of the overall group of mathematics accelerated students is represented for descriptive and comparison purposes. Approximately two percent of the overall student population is mathematics accelerated. Among mathematics accelerated students, the majority (90%) are single accelerated, with approximately 10% of accelerated students being accelerated two or more years in mathematics.

Table 14

Frequency and Percentage of Accelerated Students - GPSD 2020

Mathematics Acceleration Categories	Number of Mathematics Accelerated Students	Percentage of GPSD Student Population	Percentage of Mathematics Accelerated Students
Single Accelerated	451	2.0%	90.2%
Multiple Accelerated	49	0.2%	9.8%
Total Accelerated	500	2.2%	100%
Total GPSD Enrollment	23,026		

Crosstabulation analysis. Crosstabulation (i.e., crosstabs) is a statistical analysis which analyzes the relationship between variables in a data set by recording the number (frequency) of records that have the specific characteristics described in the cells of the table. Crosstabs tables provide insight into the relationship between variables and are useful in finding patterns and trends within raw categorical data. The following tables and figures present crosstabulation analyses of the relationship between demographic variables (i.e., gender and ethnicity) and mathematics acceleration variables (i.e., single and multiple accelerated students).

Gender and mathematics acceleration crosstabs. Table 15 presents crosstabs analysis of gender and mathematics acceleration variables. Whereas gender was relatively equally distributed across the total GPSD student population, the table below illustrates the unequal representation of gender in both types of mathematics acceleration. Of the mathematics accelerated students in GPSD, approximately two-thirds (64.3%) of single accelerated students are male and approximately one-third (35.7%) are female. This represents an approximate 2:1 ratio of male to female single accelerated students. This gender gap increases among multiple accelerated students with approximately 90% male students and approximately 10% female students. This represents an approximate 9:1 ratio of male to female multiple accelerated students. Figure 5 presents a bar chart representation of the number of accelerated students in GPSD in 2019-2020 by gender and type of acceleration (i.e., single or multiple acceleration).

Table 15

GPSD 2020 Accelerated Students by Gender and Type of Mathematics Acceleration

Gender	Single Acceleration	Multiple Acceleration	Total
Male (*n*)	290	43	333
Male (%)	64.3%	87.8%	66.6%
Female (*n*)	161	6	167
Female (%)	35.7%	12.2%	33.4%
Total (*n*)	451	49	500
Total (%)	100%	100%	100%

Note. Count (*n*) and % within Gender

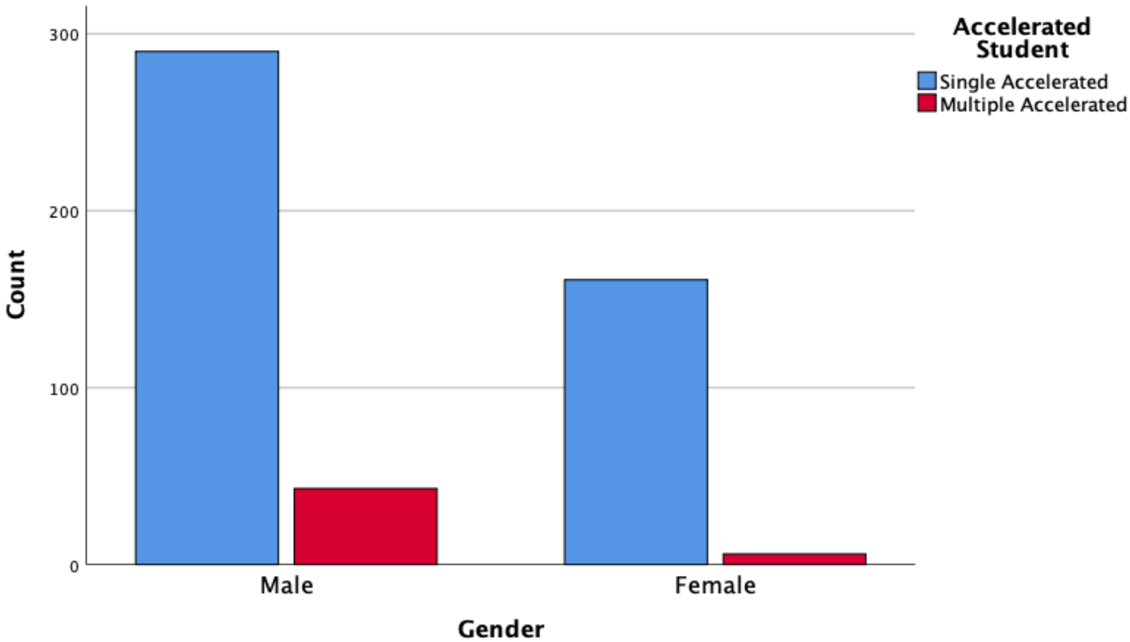

Figure 5. GPSD 2020 number of accelerated students by gender and type of mathematics acceleration.

Ethnicity and mathematics acceleration crosstabs. Table 16 presents crosstabs analysis of ethnicity and mathematics acceleration variables. Whereas the majority of the total GPSD student population was Caucasian/White (70.6%), approximately 50% of single accelerated students are Asian, approximately 40% are Caucasian/White, and the remaining 10% of single accelerated students is composed of Hispanic (about four percent), Multi-Ethnic (about four percent), and Black/African American (less than one percent) students. This ethnicity representation gap increases when analyzing the ethnicities of multiple accelerated students. Approximately three-fourths of multiple accelerated students are Asian (75.5%), approximately one-fifth are Caucasian/White (20.4%), and one twenty-fifth are multi-ethnic (4.1%). There are no Black/African American or Hispanic students represented in the group of multiple accelerated students. One of every seven GPSD students is likely to be Asian, one out of every two single accelerated students are likely to be Asian, and three out of every four multiple accelerated students are likely to be Asian. Figure 6 presents a bar chart representation of the number of accelerated students in GPSD in 2019-2020 by ethnicity and type of acceleration (i.e., single or multiple acceleration).

Table 16

GPSD 2020 Accelerated Students by Ethnicity and Type of Mathematics Acceleration

Ethnicity	Single Acceleration	Multiple Acceleration	Total
Asian (*n*)	216	37	253
Asian (%)	47.9%	75.5%	50.6%
Black/African American (*n*)	2	0	2
Black/African American (%)	0.4%	0	0.4%
Caucasian/White (*n*)	194	10	204
Caucasian/White (%)	43.0%	20.4%	40.8%
Hispanic (*n*)	19	0	19
Hispanic (%)	4.2%	0	3.8%
Multi-Ethnic (*n*)	20	2	22
Multi-Ethnic (%)	4.4%	4.1%	4.4%
Total (*n*)	451	49	500
Total (%)	100%	100%	100%

Note. Count (*n*) and % within ethnicity

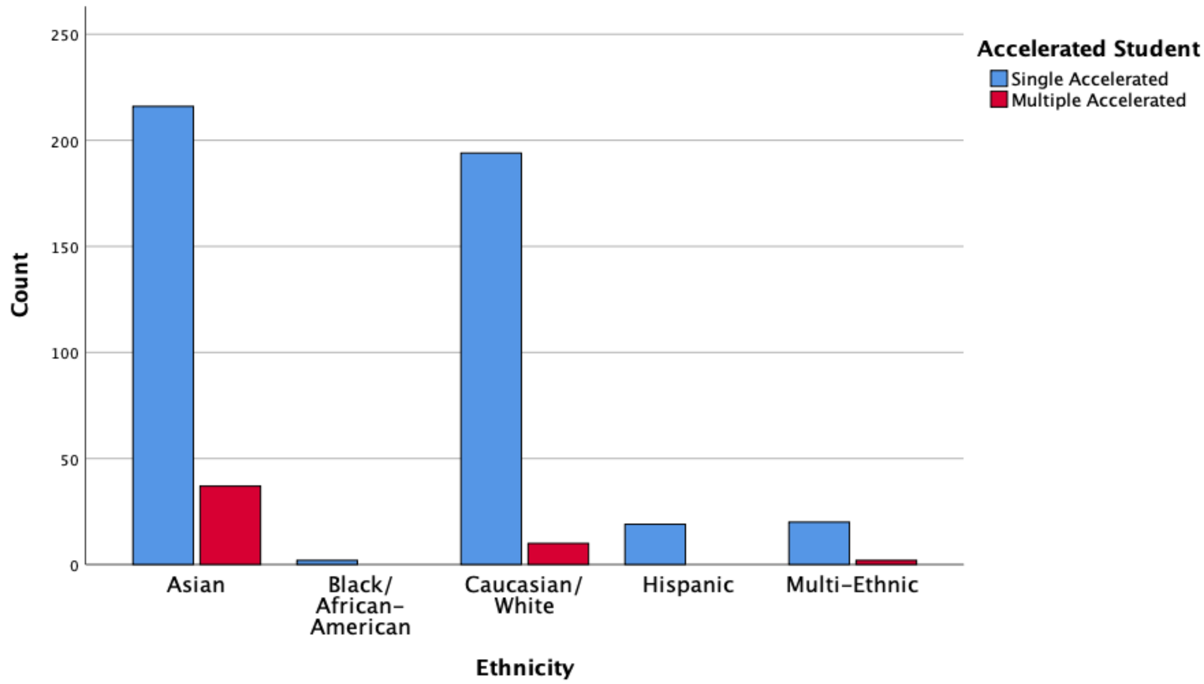

Figure 6. GPSD 2020 number of accelerated students by ethnicity and type of mathematics acceleration.

Chi-square goodness of fit test. The Chi-Square Goodness of Fit test is a single-sample non-parametric test used, in this study, to determine whether the distribution of mathematics accelerated students in a single categorical variable (e.g., gender or ethnicity) follows a known distribution (e.g., the proportion of gender and ethnic categories represented in the overall GPSD student population). The null hypothesis states that the data are consistent with the specified distribution. The alternative hypothesis states that the data are not consistent with the specified distribution.

Gender and mathematics acceleration chi-square. Table 17 presents crosstabs analysis of the expected number of male and female mathematics accelerated students based on the percentages of each gender represented in the overall GPSD student population and compares the expected number to the number of cases of each gender which were observed in the data set. In the overall GPSD student population, 48.1% of students were female and 51.9% of students were male. The table below demonstrates the observed number of male and female mathematics accelerated students, as well as the expected number if the overall district demographic percentages were constant across the sub-group of mathematics accelerated students. For example, in 2019-2020, 33.4% of mathematics accelerated students were female (*n*=167); compared to the percentage of female students (48.1%) in the overall student population, the expected number of female mathematics accelerated students is 240.5, which would round to approximately 241 female students., as opposed to the observed number of 167 students. Residual values (i.e., the difference between the observed and expected frequencies) suggest that male mathematics accelerated students are overrepresented by about 74 students, while female mathematics accelerated students are underrepresented by about 74 students.

Table 17

GPSD 2020 Observed and Expected Number of Mathematics Accelerated Students by Gender

Gender	Observed Number of Students	Expected Number of Students	Residual Value
Male (*n*)	333	259.5	73.5
Male (%)	66.6%	51.9%	
Female (*n*)	167	240.5	-73.5
Female (%)	33.4%	48.1%	
Total	500	500	

Gender and mathematics acceleration results. A Chi-Square goodness of fit test was calculated (Table 18) comparing the occurrence of gender in mathematics accelerated students with the known occurrence of 51.9% male and 48.1% female in the overall GPSD student population. Significant deviation from the known values was found: X^2 (1, N=500) = 43.280, $p <$ .05. Therefore, it can be reliably concluded that there are statistically significant differences in the representation of gender between the total GPSD student population and mathematics accelerated students in the Great Plains School District.

Table 18

Chi-Square Test Statistics for GPSD 2020 Mathematics Accelerated Students by Gender

	Gender
Chi-Square	43.280[a]
df	1
Asymp. Sig.	.000
Exact Sig.	.000
Point Probability	.000

a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 240.5.

Ethnicity and mathematics acceleration chi-square. Table 19 presents crosstabs analysis of the expected frequency of each ethnicity of mathematics accelerated students based on the percentages of each ethnicity represented in the overall GPSD student population and compares the expected number to the number of cases of each ethnicity which were observed in the data set. In the overall GPSD student population, 70.6% of students were Caucasian/White, 14.4% Asian, 6.3% Hispanic, 4.9% Multi-Ethnic, and 3.4% Black/African American. The table below demonstrates the observed number of ethnicities of mathematics accelerated students, as well as the expected number if the overall district demographics were constant across the sub-group of mathematics accelerated students. For example, in 2019-2020, 50.6% of mathematics accelerated students were Asian (n=253); compared to the percentage of Asian students (14.4%) in the overall student population, the expected number of Asian mathematics accelerated students is 72.3, which would round to approximately 72 Asian students, as opposed to the observed number of 253 students. Residual values (i.e., the difference between the observed and expected frequencies) suggest that Asian mathematics accelerated students are overrepresented by about 181 students, while every other ethnicity is underrepresented: Black/African American by about 15 students, Caucasian/White by about 150 students, Hispanic by about 13 students, and Multi-Ethnic about three students.

Table 19

GPSD 2020 Observed and Expected Number of Mathematics Accelerated Students by Ethnicity

Ethnicity	Observed Number of Students	Expected Number of Students	Residual Value
Asian (*n*)	253	72.3	180.7
Asian (%)	50.6%	14.4%	
Black/African American (*n*)	2	17.1	-15.1
Black/African American (%)	0.4%	3.4%	
Caucasian/White (*n*)	204	354.4	-150.4
Caucasian/White (%)	40.8%	70.6%	
Hispanic (*n*)	19	31.6	-12.6
Hispanic (%)	3.8%	6.3%	
Multi-Ethnic (*n*)	22	24.6	-2.6
Multi-Ethnic (%)	4.4%	4.9%	
Total	500	500	

Ethnicity and mathematics acceleration results. A Chi-Square goodness of fit test was calculated (Table 20) comparing the occurrence of ethnicities in mathematics accelerated students with the known occurrence of 70.6% Caucasian/White, 14.4% Asian, 6.3% Hispanic, 4.9% Multi-Ethnic, and 3.4% Black/African American in the overall GPSD student population.

Significant deviation from the known values was found: X^2 (4, N=500) = 534.204, $p < .05$. Therefore, it can be reliably concluded that there are statistically significant differences in the representation of ethnicities between the total GPSD student population and mathematics accelerated students in the Great Plains School District.

Table 20

Chi-Square Test Statistics for GPSD 2020 Mathematics Accelerated Students by Ethnicity

	Ethnicity
Chi-Square	534.204[a]
df	4
Asymp. Sig.	.000

a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 17.1.

Summary of demographic and enrollment data. In this section, I used demographic and enrollment data to explore relationships between variables of gender, ethnicity, and mathematics acceleration and to illustrate comparisons between GPSD mathematics accelerated students and the overall GPSD student population. Several important themes and insights emerged from the data analysis. First, GPSD is a large school district. So, while the percent of students who are accelerated in mathematics across the district is only approximately two percent of the overall student population, that amounts to 500 mathematics accelerated students. Second, of the mathematics accelerated students, the vast majority (approximately 90%) are single accelerated. Third, while gender is relatively evenly distributed across the overall student population, female students are largely underrepresented in mathematics acceleration. Among single accelerated students, males outnumber females approximately 2:1. Among multiple accelerated students, the gap widens with males outnumbering females approximately 9:1.

Fourth, while the majority of the student population is Caucasian/White (approximately 70%) and Asian students represent just 14.4% of the overall student population, Asian students are largely overrepresented (approximately 50%) among mathematics accelerated students. In the overall student population, other ethnicities outnumber Asian students approximately 6:1. However single accelerated Asian students outnumber other ethnicities approximately 2:1, and multiple accelerated Asian students outnumber other ethnicities approximately 3:1. Fifth, while Asian students are overrepresented among mathematics accelerated students, all other ethnicities are underrepresented. While the Black/African American student population in GPSD is small overall (approximately three percent), these students are underrepresented among mathematics accelerated students. Currently, there are two Black/African American students who are single accelerated, representing 0.4% of all mathematics accelerated students. The expected occurrence would be approximately 17 Black/African American students. A similar gap exists for Hispanic students with 19 students (3.8%) single-accelerated and an expected occurrence of 31.6 students (6.3%). There are zero Black/African American or Hispanic students who are multiple accelerated. Finally, the demographic distribution of mathematics accelerated students in both gender and ethnicity was found to deviate significantly from the demographic distribution of the overall GPSD student population.

Demographic descriptive interview data. In the sections that follow, descriptive data collected from semi-structured interviews with current and former GPSD mathematics coordinators and current GPSD middle school counselors is presented to contribute additional context and rich description regarding research question #3: *What is the demographic distribution of students participating in mathematics acceleration compared to the overall district's demographics?*

Disaggregating mathematics acceleration data. When asked about disaggregating mathematics acceleration data, five of the six mathematics coordinators agreed that systematically disaggregating mathematics acceleration data based on demographics was not something that had previously been done by any mathematics coordinator. Morgan said, "No, we didn't. I think we did gender, but I don't think we ever looked ethnicity. I don't think we ever put numbers to it and studied it." Similarly, Jordan stated, "We never went into that detail. We easily could, because that info is in Synergy. […] we never did it though. Could go male female. Could do a lot of disaggregation." Three participants also described a lack of data-tracking and record-keeping over the years as the role of the mathematics coordinator was reorganized and restructured. Alex described, "When we [Alex, Jordan, and Blake] came into the position [mathematics coordinator], there was really no results. So, we saw nothing, and we'd have to really look back and find some pieces of information. We've tried to really keep data over the last three years." Three participants described analyzing the results of mathematics acceleration exams and comparing to student MAP[8] scores. Previously, students could bypass the screening exam part of the mathematics acceleration process if their mathematics MAP score was two standard deviations above the district mean. Alex explained, "we noticed that these kids that we asked that were two standard deviations above the mean to test, their results were no different than the other kids that we tested. So that was the first thing we took out."

Gender. When asked about gender representation, nine of the participants responded that "we have more males than females" quite quickly without having to give it much thought, suggesting that the gender imbalance among mathematics accelerated students is a point-of-fact

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[8] *NWEA-Measures of Academic Progress (MAP)* is a computer adaptive test covering reading, language arts, and mathematics taken by students annually in grades K-8 in the district being studied.

that is taken for granted as expected or typical. One participant remarked, “I think that more often than not, they [mathematics accelerated students] were male. For whatever reason, it just, it was what it was.” To further support this theme, with no hesitation, participants described the overrepresentation of males among mathematics accelerated students as “boy heavy,” “many more males,” “lots more boys,” “Asian and Indian boys,” “more males,” “so many more boys,” “certainly more boys,” “probably more boys,” and “boys are much more represented.” Most participants stated their observation matter-of-factly without elaboration. Of the four participants who shared their observations or interpretations on this phenomenon, one mentioned culture as an important factor and three participants raised concern regarding “gender stereotypes,” the “stigma around mathematics and engineering,” and the “socialization of girls”. For example, Cameron stated:

> I see so many more boys […] So, by virtue of being a girl and society saying you're not good at mathematics or it's not cool to be smart - is that impacting our girls when they take their mathematics acceleration? I don't know. There's got to be some reason. Or, is it on the other side where our teachers aren't seeing them as these leaders in the class because they're not encouraged to be outspoken, raise their hand, argue about how you got this particular question?

Ethnicity. For clarification purposes, is important to note that in some cases participants referred to the Indian and Asian ethnic categories as mutually exclusive. When, in fact, both are represented under the ‘Asian’ category. When asked about ethnicity, 10 of the participants specifically and immediately identified Asian, Indian, or both as being the most highly represented ethnic categories among mathematics accelerated students. In general, participants were able to describe the representation of ethnicity across the GPSD student population, as well as mathematics accelerated students, with a fairly high level of accuracy considering they were not referencing any data to support their statements. Thus, signaling a high level of awareness of demographic distributions among mathematics coordinators and middle school mathematics counselors. For example, Sawyer explained, “I would say we have a large Southeast Asian population, but I think that the distribution of students who are accelerated are more… I wouldn't say we have a majority Southeast Asian population. We have a majority Caucasian population. But I would say the majority of individuals accelerated would be Southeast Asian individuals.” Blake stated, “I'm thinking it's probably the Indian culture and probably also the Asian culture. I think we've seen a rise in that. But I feel like the Caucasian is not as high, as well as African-Americans and Hispanics.” Jordan described the demographic distribution of mathematics accelerated students, offered a culture-based explanation for the differences in ethnic representation, and indicated that the current distribution of ethnicity among mathematics accelerated students points to an equity issue by stating:

> I would argue that maybe 50% of the kids we test are of Asian descent - either Chinese, Japanese, Korean, Indian - Indian probably being the biggest group out of all of those. And at the same time, I think if you were to look at our district demographics, 15% maybe for all those groups put together. And I think it's because in those cultures, it's just become a thing. They've just talked about it more. Again, it is what it is. And we're always going to test a kid that the family wants tested. But at the same time, that also indicates an equity issue.

Specifically, eight participants described the lack of Black/African American student representation among mathematics accelerated students. While participants acknowledged that the Black-African American subgroup is a small percentage in the overall student population, there was general agreement that Black/African American students were not represented equitably in mathematics acceleration. Cameron stated, “At [school name], I never saw a black student or Hispanic student accelerated or in gifted here.” Sawyer said, “I can't think of an African-American student that's in gifted or [mathematics] accelerated. There are [Black/African American] students in the advanced courses, but not accelerated.” Jordan explained, “I don’t recall ever having an African-American student in an accelerated mathematics class. Did I have them in an AP class or an honors class? Yes. But were they ever grade accelerated in mathematics? Not that I recall." In response to being asked about underrepresented groups, Kennedy responded:

> African American. I'm going to go out on a limb and say I don't know that I ever, when I was a mathematics coach, ever had one [Black/African American mathematics accelerated student]. Obviously, because of our population, that number is probably less. But, now that I say that, I don't know. And I never met with any families ever that were African American. They were not families that were ever calling to push for services. I never had a conversation or a meeting with an African American family.

In contrast to the rather perfunctory responses regarding gender, participants tended to elaborate and describe their observations and interpretations related to the ethnicity of mathematics accelerated students. Six participants identified culture as a factor in the overrepresentation of Asian/Indian students among mathematics accelerated students. Participants specifically described a perception of the Asian or Indian community as "tight knit" and highly valuing education, particularly mathematics and mathematics acceleration. Kennedy remarked, "Our Indian families have a very specific cultural tie to mathematics. There is a distinct, heavier cultural response to who wanted their children mathematics accelerated." Jordan said, "I think it's because in those cultures, it's just become a thing. They've just talked about it more." Ashton explained, "It [demographic distribution] doesn't match. Like I said, cultures that promote mathematics and science, those kids are more represented there. I think that is a product of parents' high expectations. So, if your expectation is that this [mathematics acceleration] is what you're [referring to the student] doing - that's what they're doing." Alex summarized these points by stating, "Our Indian population is the biggest. They do a lot of stuff with their kids outside of school with mathematics. […] Education is just very important. And so, they believe that they're really pushing their kids to be where they need to be." Three middle school counselors indicated that they had not observed either under- or overrepresentation of any one subgroup of mathematics accelerated students in their school. Adrian summarized this observation by stating, "I think ours matches pretty spot on because I think we have a pretty diverse population being accelerated."

Summary of demographic descriptive interview data. Data collected from semi-structured interviews with current and former mathematics coordinators and current middle school counselors yielded descriptive information regarding demographic data and trends related to mathematics accelerated students. The participants' descriptions of the demographic distribution of gender and ethnicity across both the GPSD student population and mathematics accelerated students was accurate and aligned with the enrollment and demographic data collected in this study. Participants shared their observations that many more male students than female students are mathematics accelerated. Participants described the majority of mathematics accelerated students as Asian and/or Indian. Participants described Black/African American and Hispanic students as being underrepresented among mathematics accelerated students. One of the most salient themes that emerged from these interview data was the high level of awareness of gender and ethnicity gaps among mathematics accelerated students coupled with an overall mindset of 'it is what it is' (i.e., acceptance of the status quo). Participants described having access to demographic data, as well as mathematics acceleration exam results, however little to no attempt to disaggregate data or investigate demographic trends had occurred.

Summary of Chapter Four Findings

The findings of this study were synthesized from a two-part process of data collection which included semi-structured interviews with purposefully selected participants (i.e., current and former GPSD mathematics coordinators and current GPSD middle school counselors), as well as analysis of enrollment and demographic data from GPSD and KSDE. These data were collectively analyzed for themes and patterns to contribute to the holistic understanding of the mathematics acceleration policies and practices in the Great Plains School District and to compare the demographic distribution of mathematics accelerated students to the overall district's demographics. The findings yielded a rich description of each of the three research questions, which are summarized in the following paragraphs.

The current GPSD mathematics acceleration policies govern the mathematics acceleration process which takes place each spring between February and May for second- through seventh-grade students. The mathematics acceleration process begins with teachers or parents recommending students, then all recommended students take a one-hour multiple choice screening exam as the first stage of qualifying for acceleration, followed by a three-hour open-ended battery of exams as the final step in a student being determined eligible for mathematics acceleration in the following year. As district policies are translated into practice, three interconnected implementation challenges emerged from the interview data. First, the mathematics acceleration policy which governs the selection of students for mathematics acceleration through a specified recommendation and student exam process is not implemented consistently because parents have been able to apply pressure on district administrators in order to get children accelerated who did not qualify for mathematics acceleration through the district process. Thus, GPSD mathematics coordinators report often feeling powerless to uphold mathematics acceleration policies and end up acquiescing to parent demands for acceleration at times, even for students who have not qualified. Second, and related to the first implementation challenge, analysis of interview data revealed descriptions of three parent-types including; 1) parents who tend to be savvy at maneuvering within district policies in order to accomplish their goals; 2) parents who tend to be more compliant and trusting of district policies and guidelines; and 3) parents who are generally unaware or uninformed about the mathematics acceleration process in GPSD. Third, and related to the first two implementation challenges, a pattern of communication emerged which suggests that mathematics coordinators and middle school counselors share a common concern about equitably informing parents about the mathematics acceleration process in GPSD. While a formal mathematics acceleration process has been in place for over a decade in GPSD, there has been no formal method for equitably informing parents about the process. According to interview data, most parents learn about mathematics acceleration through word of mouth in the community, which presents an equity concern regarding student access to mathematics acceleration as an educational opportunity.

The process of selecting elementary students for mathematics acceleration in GPSD begins with students being recommended by either a teacher or parent through an online form. Pressure from parents was described as a factor in the recommendation of students for mathematics acceleration. Thus, parents are provided with their own method of recommending students in an intentional effort to alleviate pressure on teachers to recommend students they may not have otherwise recommended. When teachers recommend students, they are asked to provide information about specific characteristics which GPSD believes to be ideal for mathematics accelerated students including initiative, maturity, discipline, motivation, perseverance, academic achievement, and appropriate reaction to setbacks. The purpose of this part of the teacher recommendation form is to encourage teachers to carefully consider the whole child to ensure recommendations are based on more than just test scores and other academic measures. A primary theme which emerged from the data was a need for professional learning for elementary teachers in effectively identifying students who may be good candidates for mathematics acceleration, as well as differentiated instructional strategies help teachers meet the needs of students with high mathematical abilities without over-relying on mathematics acceleration to meet those needs. Participants also described student characteristics which they believe make students good candidates for mathematics acceleration. The four most frequently mentioned characteristics were self-motivation, deep thinking, making connections, and being a problem solver.

Enrollment and demographic data from GPSD and KSDE were collected and analyzed to explore relationships between variables of gender, ethnicity, and types of mathematics acceleration (single accelerated or multiple accelerated) and to illustrate comparisons between GPSD mathematics accelerated students and the overall GPSD student population. The demographic distribution of mathematics accelerated students in both gender and ethnicity was found to deviate significantly from the demographic distribution of the overall GPSD student population. Approximately two percent of the overall student population is mathematics accelerated. Of mathematics accelerated students, approximately 90% are accelerated just one year ahead (i.e., single accelerated). While gender is relatively evenly distributed across the overall student population, females are largely underrepresented in mathematics acceleration, being outnumbered by males approximately two to one. While the majority of the student population is Caucasian/White (approximately 70%) and Asian students represent just 14.4% of the overall student population, Asian students are largely overrepresented (approximately 50%)

among mathematics accelerated students. While the Black/African American student population in GPSD is small overall (approximately three percent), these students are underrepresented among mathematics accelerated students with two currently accelerated Black/African American students representing just four-tenths of a percent of all mathematics accelerated students. A similar gap exists for Hispanic students representing approximately four percent of all mathematics accelerated students, compared to the expected representation of approximately six percent. One of the most salient themes that emerged from these interview data was the high level of awareness of the gender and ethnicity gaps which exist coupled with an overall sense that participants had largely accepted these gaps as the status quo.

Chapter Five

Discussion and Implications

This study explored the mathematics acceleration process in the Great Plains School District, including an examination of the policies and practices leading to the selection of students for mathematics acceleration and an analysis of the demographic distribution of students who are mathematics accelerated compared to the overall district demographics. Previous research on this topic has focused primarily on ability grouping, including tracking practices, at the middle and high school level (Giersch, 2018; Hallinan, 1994b; Kilgore, 1991; Ma, 2005; McClarty, 2015; Oakes, 1987), whereas the GPSD provided an interesting and unique location in which to study mathematics acceleration in an elementary context. The empirical literature on the topic of mathematics acceleration lacks a thorough examination of the policies, practices, criteria, and considerations for selecting students as early as elementary school for mathematics acceleration. This study sought to target this gap by providing a rich description and examination of one district's mathematics acceleration policies and practices specifically related to the acceleration of elementary students in mathematics. This study addressed three research questions:

1) What are the current mathematics acceleration policies and practices within the Great Plains School District?
2) How are elementary students selected for mathematics acceleration in the GPSD?
3) What is the demographic distribution of students participating in mathematics acceleration compared to the overall district's demographics?

In this chapter, I discuss the common themes and conclusions which emerged from the findings of this study, as well as policy implications, limitations, and recommendations for future research on the topic of elementary mathematics acceleration within GPSD.

Conclusions

After synthesizing data from semi-structured interviews, GPSD district documents, and enrollment and demographic data, four primary findings emerged:

1) Implementation gaps and problematic practices have persisted over time which have challenged the power of GPSD mathematics coordinators to uphold or make changes to the district mathematics acceleration policy.
2) There is evidence to suggest that mathematics acceleration in the Great Plains School District is a parent-driven process and that some students may be selected for mathematics acceleration on the basis of parent pressure rather than academic merit.
3) The implementation of mathematics acceleration in the GPSD is fundamentally different at the elementary and middle school level, which suggests that meeting the goals of acceleration may depend on the instruction in the classroom more than accelerated mathematics placement at the elementary level.
4) There are statistically significant differences in the representation of gender and ethnicity among mathematics accelerated students in GPSD compared to the overall student population, and these differences in both gender and ethnic representation were accurately identified and described by participants in this study.

The first finding concludes that a gap exists between the policies intended to govern the mathematics acceleration process in the Great Plains School District and the way those policies are translated into implemented practices. The most commonly cited belief of current and former

GPSD mathematics coordinators and current GPSD middle school counselors is that this perceived gap is created by the inconsistent implementation of mathematics acceleration policies, primarily in response to pressure from parents. These inconsistencies cause a break-down in the stated purpose of the mathematics acceleration process in GPSD, which is “to identify students who already possess a deep knowledge of the next grade level’s material.”

According to Rogers (2004), single-subject acceleration (i.e., mathematics acceleration) is a form of content-based acceleration where high-ability learners may “bypass the usual progression of skills and content mastery in one subject where great advancement or proficiency has been observed.” The mathematics acceleration process in GPSD exists in order to determine if students have mastered the mathematical content of the next grade level thoroughly enough to skip it. This process is supported by research stating that acceleration opportunities are provided to enable high-ability students to advance more quickly through, or even skip all or parts of, a grade level’s curriculum in order to cover more advanced content (Assouline & Lupkowski-Shoplik, 2010; Colangelo et al., 2010; Dare & Nowicki, 2018; James A. Kulik & Kulik, 1984).

However, when parents are dissatisfied with the results of the mathematics acceleration exam process, there is a history of district administrators acquiescing to the demands of parents to accelerate students who did not qualify for mathematics acceleration against the recommendation of the mathematics coordinator and in conflict with the stated purpose of mathematics acceleration. As a result, mathematics coordinators commonly expressed a sense of defeat about the overall process and in their lack of authority to uphold the purpose and policy for mathematics acceleration in the face of parent pressure.

Over time, as policy continued to be trumped by parent pressure, it appears that the mathematics acceleration process has become rather mechanical and perfunctory. Interviewed participants appear to be aware of implementation gaps and problematic practices, but do not seem inclined to act on those concerns out a belief that the mathematics acceleration system is so deeply entrenched in the culture and expectations of the GPSD community that it is untouchable. This effect is described by Tyack and Cuban (1995) as part of the *grammar of schooling*, or the generally-held beliefs and expectations about how schools should be organized for instruction and what schooling should look like. These societal beliefs and expectations tend to persist in spite of policy and are resistant to change.

In response to demand by parent groups in the community, the opportunity for students as young as second grade to be tested for possible mathematics acceleration in the following school year has been offered through a systematic student recommendation and qualification process. Over the last ten years, efficient mathematics acceleration systems have been developed and fine-tuned in GPSD and are replicated each spring like clockwork. This efficiency-oriented view of mathematics acceleration is supported by the proponents of ability grouping (Ansalone, 2000; Hallinan, 1994b). Though GPSD mathematics coordinators have expressed concerns about the equity of the mathematics acceleration process and whether it is really in the best interest of students, the process continues to be implemented year after year. Critics share this concern and contend that curriculum differentiation leads to disparate experiences for students in high- and low-track classrooms (Kelly & Carbonaro, 2012; Slavin, 1990).

The second conclusion is drawn from evidence which suggests that mathematics acceleration in the Great Plains School District is a parent-driven process and that some students may be selected for mathematics acceleration on the basis of parent pressure rather than academic merit alone. A commonly belief held by current and former GPSD mathematics coordinators is that, although district policy states that mathematics acceleration decisions are based on a student's demonstrated mastery of mathematical standards, in reality parents have the final decision when it comes to whether or not their child will be accelerated in mathematics.

Responses from interview participants suggested that parents are key players in the mathematics acceleration process, particularly at the elementary level. Even as someone who works in the district and works closely with the mathematics acceleration process, I was surprised by the pattern which emerged from participants' descriptions of the common tactics deployed by parents in the pursuit of persuading district administrators and mathematics coordinators to accelerate students whom had not qualified. The three types of parents which emerged from participants' responses suggested that both *parent awareness* of the mathematics acceleration process, as well as *parent efficacy* in navigating the GPSD mathematics acceleration process may be predictive factors in the selection of students, particularly elementary students, for mathematics acceleration. Further, there was a general acknowledgement among participants that a large group of parents exist in the district who are either unaware or uninformed about the mathematics acceleration process or lack the efficacy to engage themselves or advocate for their children in the selection process. This makes sense given the fact that only approximately two percent of the overall student population are mathematics accelerated.

However, there appears to be a deliberate effort by the GPSD not to broadcast information about the mathematics acceleration process to parents or to the community, thus leaving it up to parent and community social networks to spread the word. It should be noted that this decision not to advertise or promote mathematics acceleration comes out of a desire protect the best interests of students and from a belief that mathematics acceleration is not appropriate for, and may even be harmful to, most elementary students. This concern is supported by Domina et al. (2016) in their report of the potential unintended negative effects of enrolling students in advanced or accelerated courses for which they are academically unprepared. Experts recognize that students (especially very young students) need time to develop deep conceptual understanding, procedural knowledge, and the ability to reason and apply mathematics to solve complex problems; and that rushing ahead before they are ready can result in large gaps in students' mathematical backgrounds (Assouline & Lupkowski-Shoplik, 2010; Boaler, 2016; Larson, 2017).

Even if mathematics coordinators have concerns about the appropriateness of the mathematics acceleration process for most students, minimizing communication excludes some parents and their students from equitably accessing information about district programs and academic resources. This raises the question: how can a practice which exists to meet the academic needs of students with high mathematical abilities, and which relies at least partially upon parent recommendations in order for students to be considered, be equitably implemented if all parents are not informed?

The third finding of this study was that the implementation of mathematics acceleration in the Great Plains School District is fundamentally different at the elementary and middle school level, which suggests that meeting the goals of acceleration may depend on the instruction in the classroom more than grade level placement at the elementary level. At the middle school level, when students are accelerated in mathematics, they are placed into an advanced version of the grade level mathematics course (i.e., Advanced Integrated Mathematics instead of Integrated Mathematics) where the class is taught by a teacher who is highly-qualified in mathematics, the curriculum is compacted, instruction moves at a faster pace, and most peers in the class tend to also perform at high levels of mathematical proficiency. However, at the elementary level in the GPSD, there are no advanced mathematics classes offered. Thus, a mathematics accelerated student merely skips a grade and attends a general elementary mathematics class in the next grade level, taught by a teacher who is an elementary content generalist, covering the standard curriculum for that grade, taught at a standard pace, and in a class with peers representing a spectrum of mathematical proficiency. These observations are explained by the *opportunity to learn* framework defined by Wang (1998) as a multi-dimensional concept at the classroom level which reveals how classroom teaching practices (i.e., content coverage, content exposure, content emphasis, and the quality of instructional delivery) affect students' academic achievement. These dimensions and variables assist in understanding the widening gap in academic achievement over time between upper and lower tracks (Ansalone, 2000; Wang, 1998).

It is worth noting that participants commonly believed that elementary teachers often lack content expertise in mathematics instruction, thus do not necessarily have the training or skill to challenge students with high-mathematical abilities and may have become reliant on mathematics acceleration to meet those needs. This indicates a clear need for professional learning for elementary teachers in delivering high quality, differentiated instruction in mathematics.

The degree to which the content of a course is adjusted to meet the ability of the group of learners has been identified as a key factor of effective grouping (James A Kulik & Kulik, 1992). As such, an accelerated student who typically accesses new mathematical content quickly and learns at a faster pace will likely still require a level of differentiation that is not typically occurring in elementary mathematics instruction in the GPSD currently. High-ability learners need daily challenge in their specific areas of talent to facilitate learning and achievement (Lubinski, 2004; Rogers, 2007). In short, the mathematics acceleration process currently cannot guarantee that elementary students with high mathematical abilities will have their academic or instructional needs met simply by skipping a grade. As a result, one might wonder: Is there really a need for mathematics acceleration at the elementary level or could increasing the instructional skill and mathematics content knowledge of GPSD elementary teachers enable them to meet the needs of students with high mathematical abilities within the students' assigned grade level classroom?

The fourth and final conclusion was that statistical analyses revealed significant differences in the representation of gender and ethnicity among mathematics accelerated students in GPSD compared to the overall student population, and these differences in both gender and ethnic representation were accurately identified and described by participants in this study. These representation gaps became even more pronounced among multiple accelerated students. While gender is relatively evenly distributed across the overall student population, female students are largely underrepresented in mathematics acceleration outnumbered by males approximately 2:1. Among multiple accelerated students, the gap widens with males outnumbering females approximately 9:1. This finding is supported by Hallinan and Sørensen (1987) who reported that sex is a factor in the assignment of students to ability groups. While the majority of the student population is Caucasian/White (approximately 70%) and Asian students represent just 14.4% of the overall student population, Asian students are largely overrepresented (approximately 50%) among mathematics accelerated students and all other ethnicities are underrepresented. While the Black/African American student population in GPSD is small overall (approximately three percent), these students are underrepresented among mathematics accelerated students accounting for just 0.4% of all mathematics accelerated students. A similar gap exists for Hispanic students, and there are zero Black/African American or Hispanic students who are multiple accelerated. This key finding is supported by critics whom argue that tracking and ability grouping result in unequal access to knowledge, inequality of educational opportunity, and the differential academic treatment of students on the basis of race, gender, and social class (Ansalone, 2009; Hallinan, 1994b; Loveless, 1999; Oakes, 2005; Oakes & Guiton, 1995; B. C. Rubin, 2006; Slavin, 1990).

I appreciated the honesty and vulnerability of the participants in this study to speak about their observations of the representation of gender and ethnicity without having access to any data from which to base their statements. I was surprised by how closely their observations matched the enrollment and demographic findings which emerged from the statistical findings of research question three. I was also surprised that most participants appeared to agree that gender and ethnic representation gaps exist among mathematics accelerated students, and yet had not previously disaggregated mathematics acceleration data in a systematic manner to investigate and explore those concerns, especially considering the long-term educational impact of mathematics acceleration. Tracking practices have been found to sort students along lines of race, gender, and social class which set students on different academic trajectories and have long-lasting effects on student achievement (Giersch, 2018; Slavin, 1990). Participants quickly and easily identified the gender gap between mathematics accelerated males and females. Nearly all participants described most mathematics accelerated students as being either Asian or Indian (which are both classified under the Asian ethnic category). Many spoke about culture as a factor in the overrepresentation they had observed and explained that Asian and Indian families, in their experience, had typically placed a high value on education and mathematics. Participants appeared to accept this explanation of representation gaps among mathematics accelerated students as the status quo in GPSD and something to be expected. The demographic findings of this study tie together all of the other findings and conclusions and the overall pattern which emerges from these collective data indicate that there is a concern with the equity of the mathematics acceleration process in the Great Plains School District, as well as a concern regarding equal access to mathematics acceleration as an educational opportunity. As stated by Carbonaro (2005), “Curricular tracking is a social structure that differentially provides opportunities and imposes constraints upon what students have the potential to learn.”

The goal of this qualitative case study was to explore the mathematics acceleration process in the Great Plains School District, including an examination of the policies and practices leading to the selection of elementary students for mathematics acceleration and an analysis of the demographic distribution of students who are mathematics accelerated compared to the overall district demographics., “The distinctive need for case study research arises out of the desire to understand complex social phenomenon (Yin, 2014).” Given that elementary mathematics acceleration is an understudied topic in the empirical literature, the four conclusions discussed in this chapter, while focused on one district, can contribute to the greater scholarly conversation and overall knowledge of mathematics acceleration as an educational policy and practice. As Merriam (2009) explains, “There are certainly good reasons for studying a particular situation because of its uniqueness. And one would study the particular because there is something that can be learned from it that contributes to the horizontal accumulation of knowledge,” (p. 228).

Limitations

This study has several acknowledged limitations. First, this case study is focused on the mathematics acceleration policy and practices of one purposefully selected school district, and thus the findings are not generalizable. It would be difficult to replicate this study because the methods were designed to fit the specific context and unit of analysis of this study.

Second, as this qualitative study relied partly on self-reported data in the form of interviews, there is potential for bias from participants' selective memory, lack of firsthand knowledge, incorrect transmission of facts, exaggeration or omission. Interview data was limited to the 12 interview participants, and while this number was my participation goal, there may be opinions and perspectives of other people or stakeholder groups who are not included in this research. Because there is only one current mathematics coordinator in the GPSD, it was necessary to interview previous mathematics coordinators about their experiences. Thus, up to a decade may have passed since some former mathematics coordinators were actively engaged in the daily duties of the mathematics coordinator job in GPSD. Interviewing people several years after a lived experience leaves room for error. Also, some interview participants experienced shifting roles and responsibilities from year to year, and in some cases for several years in a row. For those reasons, it's possible that interview participants may have had some level of difficulty in recollecting the details of events or observations with complete accuracy.

Third, a limitation of document analysis is that qualitative research treats documents similarly to transcripts (i.e., they are collected as people's interpretations, rather than literal facts.) It may not have been clear how or when a particular document was created, who created it, or what might have been omitted or left incomplete. In addition, the availability of archived documents and artifacts is likely not to be exhaustive, but rather incomplete or spotty.

Fourth, the GPSD student enrollment and demographic data I was able to access was limited to what was available in the *Synergy* student information system or the KSDE Data Central website. For example, for confidentiality purposes, free or reduced lunch information was not available. Thus, socio-economic status, while it could certainly contribute to understanding these demographic data more thoroughly, was not able to be included as a variable in this study. In addition, the records contained within the demographic and enrollment data sets were likely initially entered into the database at an earlier point by a person, and thus are subject to human error. I made an effort to carefully examine all data sets for accuracy, completeness, and consistency in an attempt to reduce the potential for human error.

Finally, as an employee of the Great Plains School District, I have worked closely with the mathematics acceleration process and with four of the interview participants in the study. Thus, my connection to this case is a source of bias. As a qualitative researcher, I have made every effort to minimize the effect of my own lived experience on the findings and conclusions of this study by maintaining a neutral and open mind while collecting information and actively guarding against my own preconceived ideas or expectations. However, it is impossible to completely eliminate the possibility that my own unconscious biases, views, beliefs, or observations may have influenced my interpretation of the data collected in this qualitative case study. As stated by Peshkin (1988), "One's subjectivity is like a garment that cannot be removed. It is insistently present in both the research and non-research aspects of our life." As a qualitative researcher, I made every attempt to remain aware of what Peshkin (1988) refers to as "distorting hazard" where qualitative researchers may tend to value that which they personally hold dear and potentially ignore diverse perspectives which may conflict with their own values, beliefs, or personal experiences. Thus, I made a deliberate effort to tell the full story of mathematics acceleration in the GPSD, including alternative or contradictory findings, by including the full range of data collected from participant interviews, as well as enrollment and demographic data as they related to the specific research questions in this study.

Policy Considerations

Where policy exists, there is an assumption that it will be implemented and practiced. Mathematics acceleration policies are intended to guide and govern the implementation of acceleration practices and ensure that the academic needs of students with high mathematical abilities are met (Colangelo et al., 2010). However, interest groups and affected individuals often attempt to influence the implementation of policy creating disruptive tension within an organization, like a school district. In the case of mathematics acceleration policy in the Great Plains School District, some parents were described as exerting pressure on district administrators, mathematics coordinators, principals, counselors, and classroom teachers in order to increase the likelihood that their child would be mathematics accelerated. While GPSD policy states that the outcome of the mathematics acceleration qualification process and the decision of the mathematics coordinator is final, this study revealed that decision to be negotiable based on the amount of pressure a parent is willing or able to exert on the district. To minimize the disruptive tension associated with the inconsistent implementation of GPSD mathematics acceleration policy, I recommend that the Great Plains School District conduct an audit and update the district mathematics acceleration policy. Colangelo et al. (2010) recommend the following guidelines when developing an academic acceleration policy:

> The policy is characterized by accessibility, equity, and openness. Access to referral for consideration of acceleration is open to all students. All student populations are served. Student evaluation is fair, objective, and systematic. Parents or guardians are allowed open communication about the policy and procedures. The community has ready access to the policy document and procedure guidelines (including making the policy available in the languages served by the school.)

I would recommend that an updated GPSD mathematics acceleration policy should include detailed guidelines for: open parent communication; referral and screening procedures which are equitable, accessible, and open to all students; valid and reliable assessment and decision-making protocols; as well as clarifying the role of parents as partners in the process. Mathematics acceleration policy should be informed by both empirical research as well as feedback from key stakeholders like students, teachers, parents, counselors, administrators, and district administrators. By ensuring the validity, reliability, equity, and accessibility of the mathematics acceleration recommendation and testing process, district administrators and mathematics coordinators can feel more confident in the outcome of student selection decisions. With increased confidence that the mathematics acceleration qualification process reliably identifies students who should be mathematics accelerated and disqualifies students who are not ready for mathematics acceleration, the district can more consistently uphold its policy when faced with pressure from parents. Consistent implementation of mathematics acceleration policy could potentially empower mathematics coordinators to lead with more influence and authority, thus alleviating the pressure and strain on district administrators to handle parent complaints about mathematics acceleration and enable them to focus more of their attention on district priorities and initiatives. Additionally, consistent implementation of mathematics acceleration policy could promote equity by clarifying the role of parents in the mathematics acceleration process, thereby eliminating the opportunity for some parents to take advantage of loopholes or strategically maneuver around district policy and setting a new and purpose-driven precedent.

Currently, there is one mathematics acceleration process for both elementary and middle school students. However, this study has shown that there are important organizational, academic, and instructional differences between elementary and middle school mathematics programs in the GPSD. Keeping the *opportunity to learn* framework (Wang, 1998) in mind, the GPSD might consider that mathematics acceleration may be most effective at meeting the needs of students with high mathematical abilities at the middle school level due to several factors: 1) the availability of advanced mathematics classes where curriculum is compacted so accelerated students cover more mathematics content in an academic year; 2) instruction moves at a faster pace so that accelerated students can more quickly learn and apply new skills or procedures; 3) the most essential content can be emphasized so that accelerated students can think more deeply about complex concepts and mathematical problems; and 4) middle school mathematics teachers are mathematics content experts and can deliver high-quality, targeted mathematics instruction based on their knowledge of the progression of mathematical skills and concepts. I would recommend limiting mathematics acceleration to students in grades five and up. This means, fourth grade would be the earliest a student could enter the acceleration process (i.e., a fourth grader could potentially skip fifth-grade mathematics and accelerate into a sixth-grade advanced mathematics class at the middle school level as a fifth grader.)

A third policy consideration is to allocate time and fiscal resources to professional learning for elementary teachers focused on: how to recognize students who are in need of more rigorous learning experiences in mathematics; the progression of concepts and skills in mathematics; differentiation strategies including enrichment and extension for students with high mathematical abilities; and effective, research-based instructional strategies for teaching mathematics to elementary students.

A final policy consideration, which undergirds all of the policy recommendations discussed above, is for GPSD educators (i.e., district administrators, mathematics coordinators, principals, instructional coaches, and teachers) to commit to systematically analyzing mathematics acceleration, enrollment, and demographic data on an ongoing basis and to develop action plans to target the gaps which currently exist for underrepresented populations among mathematics accelerated students. I recommend that the gender and ethnicity representation gaps which were identified in this study are closely monitored and that open discussions and conversations focused on issues of equity, implicit bias, and access to educational opportunities of all kinds are generated among district leaders, within professional learning communities of teachers, and in the community.

Future Research

The aim of this study was to examine the mathematics acceleration practices within the Great Plains School District, as well as explore the criteria used to select students as young as elementary school for mathematics acceleration and compare the demographic distribution of mathematics accelerated students to the overall district demographics. The findings of this study not only present a better understanding of the mathematics acceleration process in the GPSD, but also contribute to the greater scholarly conversation about the topic of mathematics acceleration and ability grouping. In addition to generating new findings targeting the understudied topic of elementary mathematics acceleration, this study has also enlightened several opportunities for future research.

This research utilized enrollment and demographic data and focused on the gender and ethnicity distribution of GPSD students who were mathematics accelerated in the 2019-2020 school year. However, many additional outcomes in the enrollment and demographic data from both GPSD and KSDE remain unexplored. For example, the GPSD data set contains detailed enrollment information dating back nine years to the 2011-2012 school year. It would be interesting to conduct a longitudinal study involving tracking a cohort of students who were initially accelerated in mathematics during elementary school to examine their course trajectory, how long they remained on an accelerated track, what mathematics class they took last during their K-12 academic career, and during which semester of high school they took their last mathematics class. Steenbergen-Hu and Moon (2011) called for investigation of the impact of acceleration on high-ability learners during their transition from high school to college. This longitudinal enrollment data would provide an opportunity to potentially determine the post-secondary outcomes of GPSD students who were mathematics accelerated and contribute to a better understanding of the long-term impact of accelerating students in mathematics as early as elementary school.

An expressed concern of participants in this study was regarding the potential for multiple accelerated students to essentially run out of mathematics courses to take before they graduate high school, thus leaving them either with at least one full year of not taking an accelerated mathematics course before enrolling in college or requiring them to enroll in mathematics at the college level while still in high school. Parents were also reported to be motivated to push for mathematics acceleration with the long-term goal of their child being on a course pathway to take Calculus by 12th grade, which is possible by accelerating at least one year in mathematics, as supported by Domina et al. (2016). I would personally be interested in a deeper analysis of the GPSD enrollment data to determine how many accelerated students stay on an accelerated course pathway and enroll in Honors Multivariable Calculus (i.e., the most advanced calculus class offered by the GPSD) by 12th grade. Additionally, it would be interesting to determine how many students over the nine years of available enrollment data actually did run out of mathematics courses to take in high school and, if so, how many semesters long was the gap before they would take mathematics again in college? This study would be enriched by interviewing college professors to find out what they might say about students with high mathematical abilities experiencing a gap of a year or more in their mathematics course pathway prior to enrolling in the next calculus or other college-level mathematics course? If there is a sense of urgency at the elementary level for students to be single or multiple accelerated and they end up running out of mathematics classes to take before they even graduate from high school, then mathematics acceleration feels like a race to nowhere.

Steenbergen-Hu and Moon (2011) and Hamilton et al. (2018) encouraged future research to examine the effect of school context, student socio-economic status, cultural and/or linguistic diversity, ethnicity, and gender distribution on the nomination and identification of students for acceleration or gifted education services. The GPSD and KSDE enrollment and demographic information provide a rich data source for examining the relationship of many of these demographic and acceleration variables. For example, future research may investigate long-term trends over time in demographic distributions, or make comparisons between levels (i.e., elementary, middle, and high school) and the demographic distributions of mathematics accelerated students, or examining and comparing the demographic distributions of 'feeder systems' (i.e., each individual high school and the associated middle and elementary schools which feed into it) within the GPSD. As discussed by Domina et al. (2016), careful examination of demographic variables can reveal new insights and understandings into the "complex and interacting mechanisms through which schools produce, reproduce, and even ameliorate social inequality." Ultimately, educators share a collective responsibility to advocate for the establishment of highly effective education policies which ensure equitable outcomes for all students regardless of gender, race, ethnicity, or socio-economic status.

Appendices

Appendix A
Institutional Review Board (IRB) Approval

THE UNIVERSITY OF KANSAS
Research

Date: May 24, 2019

TO: Amy Swan, (amyswan@ku.edu)

FROM: Alyssa Haase, IRB Administrator (785-864-7385, irb@ku.edu)

RE: **Approval of Initial Study**

The IRB reviewed the submission referenced below on 5/24/2019. The IRB approved the protocol, effective 5/24/2019.

IRB Action: APPROVED	**Effective date: 5/24/2019**	**Expiration Date : 5/23/2024**
STUDY DETAILS		
Investigator:	Amy Swan	
IRB ID:	STUDY00144082	
Title of Study:	Elementary Mathematics Acceleration: One District's Policies and Practices	
Funding ID:	None	
REVIEW INFORMATION		
Review Type:	Initial Study	
Review Date:	5/24/2019	
Documents Reviewed:	• BV Approval.pdf, • Math Accel Interview Questions.docx, • Swan KU HRPP Human Research Protocol.docx, • Swan_HRPP_signed_consent.docx, • Swan_Introduction email.docx	
Exemption Determination:	• (2)(ii) Tests, surveys, interviews, or observation (low risk)	
Additional Information:		

KEY PROCEDURES AND GUIDELINES. Consult our website for additional information.

1. **Approved Consent Form:** You must use the final, watermarked version of the consent form, available under the "Documents" tab, "Final" column, in eCompliance. Participants must be given a copy of the form.
2. **Continuing Review and Study Closure:** You are required to provide a project update to HRPP before the above expiration date through the submission of a Continuing Review. Please close your study at completion.
3. **Modifications:** Modifications to the study may affect Exempt status and must be submitted for review and approval before implementing changes. For more information on the types of modifications that require IRB review and approval, visit our website.
4. **Add Study Team Member:** Complete a study team modification if you need to add investigators not named in original application. Note that new investigators must take the online tutorial prior to being approved to work on the project.
5. **Data Security**: University data security and handling requirements apply to your project.
6. **Submit a Report of New Information (RNI):** If a subject is injured in the course of the research procedure or there is a breach of participant information, an RNI must be submitted immediately. Potential non-compliance may also be reported through the RNI process.
7. **Consent Records:** When signed consent documents are required, the primary investigator must retain the signed consent documents for at least three years past completion of the research activity.
8. **Study Records** must be kept a minimum of three years after the completion of the research. Funding agencies may have retention requirements that exceed three years.

Human Research Protection Program
Youngberg Hall | 2385 Irving Hill Rd | Lawrence, KS 66045 | (785) 864-7429 | research.ku.edu/hrpp

Appendix B
GPSD Research Review Board Approval

Hi, Amy-
The [redacted] Research Review Board met today to review and discuss your request to conduct research about Math Acceleration Practices in [redacted] as part of your doctoral work. **Your request has been approved!**

The Review Board did share that you will want to be cognizant of the timing when seeking the interviews with the counselors. As you can imagine, they have busy windows during the school year. You may want to steer clear of enrollment, schedule changes, etc. (Likely…after Labor Day might be best.)

We are excited to see your results. As you are aware, this particular topic has implications for our work in [redacted] Please send a copy of your findings to Holly [redacted] Adam [redacted] Kelly [redacted], Jennifer [redacted], and Kelly [redacted] within 30 days of the conclusion of your research.

Best wishes for your upcoming research,
Amy & Kelly

[redacted]

Note. The school district being studied requested anonymity, so I have redacted any potentially identifiable information.

Appendix C

Interview Participant Request Email

Dear (insert name),

My name is Amy Gaughan-Swan and I am a K-5 Instructional Design Coach at and . I am currently working on a dissertation through KU and will be interviewing district curriculum coordinators and secondary guidance counselors about their experiences with the district's mathematics acceleration process.

The interview will focus on the current mathematics acceleration policies and practices and how those may have evolved over time, the overall goals of acceleration, as well has the process for selecting students. I am most interested in talking with the curriculum coordinators and counselors who have worked closely with this process to learn more about your unique experiences and perspectives regarding the mathematics acceleration process.

Would you be willing to take part in a 30-minute interview about your experiences, preferably within the next 2-3 weeks? If so, please *reply to this email* to schedule the interview at a date and time that is convenient for your schedule.

Participation in this study is voluntary, but I would greatly appreciate your help as you can share a unique perspective that will help create a richer understanding of the mathematics acceleration process.

If you choose not to participate in an interview, you may respond to this email at amyswan@ku.edu and I will remove your name from the distribution list.

If you have any questions or concerns, please contact me at amyswan@ku.edu. You may also contact my dissertation chair, Dr. Thomas DeLuca at tadeluca@ku.edu, or the Human Research Protection Program at the University of Kansas, irb@ku.edu.

Attached to this email is additional Informed Consent information from the University of Kansas Institutional Review Board Department.

Thank you for your time, I know it is valuable.

Regards,

Amy Gaughan-Swan

Ed.D Candidate, Educational Leadership and Policy Studies
University of Kansas

Appendix D
Adult Informed Consent Statement, page 1 of 2

Adult Informed Consent Statement
Mathematics Acceleration: One District's Polies and Practices

The Department of Educational Leadership and Policy Studies at the University of Kansas supports the practice of protection for human subjects participating in research. The following information is provided for you to decide whether you wish to participate in the present study. You may refuse to sign this form and not participate in this study. You should be aware that even if you agree to participate, you are free to withdraw at any time. If you do withdraw from this study, it will not affect your relationship with this unit, the services it may provide to you, or the University of Kansas.

PURPOSE OF THE STUDY

This study focuses its attention on the mathematics acceleration process, particularly as it pertains to the immediate and ongoing experiences of students who initially accelerate while still in elementary school. Data will be collected through interviews to explore the current mathematics acceleration policies and practices, as well as the process of determining eligibility for mathematics acceleration within a large, suburban, highly regarded school district in the Midwest. Ultimately, the discoveries and insights gained from this study could inspire innovation in the way schools structure mathematics curriculum pathways, not just for the highest-ability students, but in a way that provides equal access to rich mathematical learning experiences.

PROCEDURES

We are conducting this study to better understand mathematics acceleration and will entail your participation in an interview. Your participation is expected to take approximately 30 minutes to complete. The content of the interview questions should cause no more discomfort than you would experience in your everyday life. There are no risks anticipated within this study. Participants will not be compensated to participate in this study.

Although participating may not benefit you directly, we believe that the information obtained from this study could potentially reveal important insights about the practice of elementary acceleration, as well as to inform policy in the future. Your participation is solicited, although strictly voluntary. Your name will not be associated with any publication or presentation with the information collected about you or with the research findings from this study. Instead, I will use a study number or pseudonym rather than your name. Your identifiable information will not be shared unless (a) it is required by law or university policy, or (b) you give written permission.

This interview will be audio recorded though recording is not required to participate. You may stop talking at any time. Interviews will take place in-person, via Zoom over the internet, or over the phone. It is possible, however, with internet communications that through intent or accident, someone other than the intended recipient may see your response if recorded via Zoom. The recordings will be transcribed by me. Only my faculty advisor and I will have access to the recordings, which will be stored on the student researcher's computer and destroyed after six months.

Permission granted on this date to use and disclose your information remains in-effect indefinitely. By signing this form, you give permission for the use and disclosure of your information for the purposes of this study at any time in the future.

You are not required to sign this Consent and Authorization form and you may refuse to do so without affecting your right to any services you are receiving or may receive from the University of Kansas or to participate in any programs or events of the University of Kansas. However, if you refuse to sign, you cannot participate in this study.

You may withdraw your consent to participate in this study at any time. You also have the right to cancel your permission to use and disclose further information collected about you, in writing, at any time, by sending your written request to Amy Gaughan-Swan (contact information below).

If you cancel permission to use your information, the researcher will stop collecting additional information about you. However, the research team may use and disclose information that was gathered before they received your cancellation, as described above.

Questions about procedures should be directed to the researcher(s) listed at the end of this consent form.

I have read this Consent and Authorization form. I have had the opportunity to ask, and I have received answers to, any questions I had regarding the study. I understand that if I have any additional questions about my rights as a research participant, I may call (785) 864-7429 or (785) 864-7385, write the Human Research Protection Program (HRPP), University of Kansas, 2385 Irving Hill Road, Lawrence, Kansas 66045-7568, or email irb@ku.edu.

I agree to take part in this study as a research participant. By my signature I affirm that I am at least 18 years old and that I have received a copy of this Consent and Authorization form.

______________________________ ____________________

Type/Print Participant's Name Date

____

Participant's Signature

Researcher Contact Information:

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Appendix E

Semi-Structured Open-Ended Interview Protocol, page 1 of 2

Semi-Structured Open-Ended Interview Protocol

Research questions

1) What are the current mathematics acceleration policies and practices within the Great Plains School District?
2) How are elementary students selected for mathematics acceleration in the GPSD?
3) What is the demographic distribution of students participating in mathematics acceleration compared to the overall district's demographics?

Routine opening

Can you tell me a little about your background in education?
What is your current role in the (district/school)?
How long have you been doing this work?

Interview questions

1. Can you tell me about your experiences with the mathematics acceleration process? (RQ1, RQ2)
    a. Experiences working with parents?
    b. Experiences working with teachers?
    c. Do you enjoy working within the current acceleration process? Why or why not?
2. From your perspective, what is the overall goal of accelerating students in mathematics? (RQ1)
    a. For students?
    b. For teachers or administrators?
    c. For the school or district?
    d. For parents/guardians?
    e. For the community?
3. In terms of the acceleration process, what appears to be working well? What are the challenges? (RQ1)
4. Has the protocol for acceleration testing or the qualifying process been modified during your time in this role? If so, how and why? What was the outcome of that work? (RQ1)
5. Can you think of a time when the district's acceleration policies or guidelines may not have been followed when making an acceleration decision? Talk to me about that. (RQ1)
6. What would you tell someone who is new to your role about how to navigate the mathematics acceleration process? (RQ1)
7. In your opinion, how effective is mathematics acceleration at meeting the academic needs of students with high mathematical abilities? Why do you think that is the case? (RQ1)

Appendix E, continued
Semi-Structured Open-Ended Interview Protocol, page 2 of 2

Semi-Structured Open-Ended Interview Protocol

8. Describe the process of selecting students for mathematics acceleration. (RQ2)
    a. What sources of information or data are used most often to determine the potential need for mathematics acceleration?
    b. How do teachers determine which students to recommend for mathematics acceleration?
    c. What data or evidence is considered? Which data are the most useful?
    d. What other factors, if any, do you think should be considered?
9. To what degree are you confident in the reliability of the selection process? What factors influence your confidence? (RQ2)
10. When a student is not selected for mathematics acceleration, what have you experienced? (RQ2)
11. Are there ever times when a student meets all the criteria and is not accelerated? Tell me about that. (RQ2)
12. What do you believe are the instructional needs of students with high mathematical abilities? Do you believe acceleration currently meets those needs? Are there needs that may not be met? Please give examples. (RQ2)
    e. Pacing
    f. Level of rigor or challenge
    g. Higher order thinking
13. If a student does not qualify for acceleration or the parents opt-out, what other enrichment or supplemental learning opportunities are provided? Who is responsible for designing or developing an individualized program to meet this child's needs? (RQ2)
14. How do parents know what mathematics acceleration opportunities are available in this district? (RQ3)
15. How closely do you believe the demographic distribution of students who are mathematics accelerated matches the overall demographics of the district? (RQ3)
    h. Do you believe there are groups or subgroups who are over- or under-represented?
    i. Into what groups and subgroups are acceleration results disaggregated?
    j. What is done with disaggregated results?
    k. Who is involved in this process?

Routine closing

Is there anything else I should know to help me better understand your experiences with mathematics acceleration?

Appendix F
GPSD Mathematics Acceleration Protocol

Mathematics Acceleration Protocol 2019

February

- IDC will present information to their staff about the mathematics acceleration process
- If a teacher wants to recommend a student for acceleration, the teacher will complete a Google form by February 22, 2019. The mathematics coordinator will collect the information and send out e-mails and permission for the screener testing to parents. (QR Code and Link will be provided by IDC)
- To make a parent request, the parent must contact the mathematics coordinator, via email at _________.
- The parent will then be sent a link and activation code to complete the parent recommendation Google form.
- IDC will discuss with principals to find a date and time between March 19 – 29, to administer the screening exam at their building(s). IDC will give staff QR codes for teachers and also a QR code to the FAQ's about acceleration.

March

- The electronic permission slips to take the screener exam are due on March 8, 2019.
- The screening exam will occur in a student's home building and will be administered by the building's instructional design coach sometime between March 19 and March 29, 2019.

April

- Screener results will be sent from the district, via email, to parents by April 5, 2019.
- Building administrators will be notified of screener results by the district, via email, by April 5, 2019.
- If a student passes the screener, the student's parents will receive a new permission slip to take the remaining exams. These are due on April 12, 2019.
- On April 18, 2019, acceleration tests will be administered in the morning in the student's home school by the building's mathematics coach.

May

- Administrators, teachers, parents, and students will be notified of acceleration results, via email, on Friday, May 3, 2019.
- No re-tests will be administered during the summer or during the subsequent school year unless a student is new to the district.
- Affected schools are made aware of transportation needs.

For other specific questions, please consult the Acceleration FAQ document.
For other questions, please contact the K-12 Mathematics Coordinator

Appendix G

GPSD Mathematics Acceleration FAQs, page 1 of 4

1) *What is the purpose of mathematics acceleration?* The purpose of mathematics acceleration is to identify students who already possess a deep knowledge of the next grade level's material. A student who computes quickly but does not understand why their computations work and does not possess deep understanding of the next grade level's material is not a good candidate for acceleration.

2) *When can a student accelerate?* There is a district acceleration process for students whose are currently in 2nd grade mathematics through 7th grade mathematics. The process occurs each spring in order to have students set up in their mathematics coursework for the fall.

3) *My student is performing very well at grade level standards. Is acceleration the right option for my child?* Potentially. If a student has deep knowledge of the next grade level's curriculum, acceleration may be the right option. However, if a student gets 100% on every test at the current grade level, there is no guarantee that the child knows the next grade's curriculum. If you have questions about whether pursuing acceleration may be a good option for your student, your child's teacher may be a helpful resource.

4) *Last year, I heard that some students were automatically invited based on MAP score. Is this still true?* No. Our data from the 2017 acceleration testing indicated little to no correlation between MAP score and a student's ability to pass the acceleration exams. This is because the MAP exams are largely skill based and our acceleration tests focus on a combination of skill mastery and conceptual understanding.

5) *What is the timeline?* The timeline is best described by utilizing the following link: https://____________.org/ParentsAndStudents/Pages/MathAcceleration.aspx

6) *How does my child enter the acceleration process?* A student can enter the acceleration process in one of two ways, via parent recommendation or via teacher-recommendation. If a teacher believes that a student is a candidate for acceleration, the teacher fills out a Google Form, and the mathematics coordinators notify the family. For a parent to recommend a student for acceleration, the parent needs to e-mail the district mathematics coordinator indicating interest.

7) *We are transferring into _______, and my son/daughter has been previously accelerated in another district. Can we assume that our child will be automatically accelerated in ____________?* No. Curricula differs widely from district to district and from state to state. If a child has been accelerated in another district, we are happy to test that child for acceleration.

   What happens if my child doesn't pass the acceleration exams? If a student doesn't pass the acceleration exams, it means that the student does not possess a deep enough understanding of the subsequent grade's curriculum in order to be accelerated. At that point, the family and classroom teacher will work together to find opportunities to go deeper within the current grade level's standards. Furthermore, we ask that you consider the mental and emotional toll that not passing an acceleration exam may have on your child before pursuing it.

8) *Will my child lose curricular opportunities without mathematics acceleration?* Non-accelerated students can participate in advanced mathematics classes starting in middle school, meaning that a nonaccelerated 6th grader could take 6th grade Advanced Mathematics without taking any sort of test. All Advanced Placement (AP) courses (Calculus AB, Calculus BC, and Statistics) are accessible to any __________ student without acceleration.

9) *How will results be communicated and permissions be given?* All communication is done via e-mail. In order for a child to test, parents have to provide permission by completing the link to a Google Form, which can be found in the e-mail.

10) *What do the acceleration exams test?* The acceleration exams test the complete curriculum that the student is trying to skip. For example, if a student wants to skip 4th grade mathematics, the acceleration exams will test the entirety of the 4th grade mathematics curriculum.

11) *If I want my child to take 6th grade advanced mathematics as a 6th grader, do I need to have them participate in this process?* No. A student may participate in an on-grade-level advanced mathematics course without any acceleration testing.

12) *What happens to accelerated 5th graders and 8th graders?* A student who is in 5th grade but has accelerated to take 6th grade mathematics will go to the feeder middle school to take 6th grade mathematics. This could result in the student missing some component of the 5th grade school day, possibly including specials. For further specifics, please contact the elementary school and/or the feeder middle school.

    A student who is actually in 8th grade but has already taken Algebra 1 or accelerated out of Algebra 1, will go to the feeder high school to take Honors Geometry. This will result in the student missing some component of the 8th grade school day. For further specifics, please contact the middle school and/or the feeder high school.

13) *How does transportation work for accelerated students?* Transportation for accelerated students is coordinated between the two schools affected. If an elementary student is going to middle school for mathematics, the elementary and middle schools would coordinate transportation. For middle school students going to high school for mathematics, the middle and high schools coordinate transportation.

14) *Once my child is accelerated, is this forever?* Ideally, yes – this is why our process is so thorough and detailed. It is important to keep this in mind as families make decisions about mathematics acceleration. There are certainly social factors to consider as well as academic coursework options before graduation. Please consider long-term decisions and the possible positive and negative consequences as you determine if the process is best for your child. In the end, if a child accelerates and later needs to decelerate, the acceleration probably should not have happened in the first place.

15) *Can my child be accelerated be more than once?* Yes, but we don't recommend it. If you want a child to be accelerated more than once, ask yourself the reasons why. Consider whether the student desires to be accelerated to this extent and whether the student is equipped for any social, emotional, or logistical challenges brought about by multiple accelerations. Furthermore, a double accelerated student is usually taking a calculus course during their sophomore year of high school. Even though we offer a multivariable calculus course, a twice accelerated student would have at least one year without calculus before heading to college. This is potentially problematic if the student heads into any mathematics related field.

16) *When can my child test?* All screening tests are done shortly after spring break. Students that pass the screening exams have their second round of testing (battery testing) in mid-April. All tests are given at the child's home school during a school day.

17) *Can my child test again?* The district testing process happens each spring. No re-testing occurs.

18) *Will there be other students accelerated in mathematics from my child's current grade level?* This is possible, but not guaranteed.

19) *Does my child need to bring anything on the day of testing?* Only a writing utensil – we provide scratch paper and a calculator when necessary.

20) *Does the district provide feedback on how students do on acceleration exams?* We will provide the scores only. Our exams are for acceleration purposes and cannot be used as diagnostic to identify what a child still need to learn.

21) *Do we need to inform the schools that our child is testing?* No. This communication all happens between the district and the school.

22) *Once I submit acceleration forms online, how do I know the district has received them?* After submitting the Google Form, a screen will display that says something to the effect "We have received your form." As long as you see this message, we have received the form.

23) *How does taking accelerated mathematics affect my child's schedule?* The impact of taking mathematics at a different grade level will vary by building. Please contact your child's building to figure out how exactly this will work with your child's schedule.

24) *Will my child lose access to high school courses if they do not participate in accelerated mathematics?* Students do not lose access to any College Board approved Advanced Placement (AP) course. The only course a student cannot take in this situation is Multivariable Calculus, which does not come with AP credit, is the equivalent of college Calculus III, and is usually taken by college sophomores.

25) *What if we don't agree with the results of the acceleration exam?* The results of the acceleration exam are final. Acceleration is a decision with significant educational impact. As a result, we do not allow a student to skip a mathematics level if significant curricular gaps exist at that level.

26) *What scores are needed to pass the exams?* We consider the combined mistakes and patterns of errors that students make in deciding whether or not to accelerate a student. For that reason, we don't set particular scores.

27) *How can we help our child prepare for each of these assessments at home?* Additional practice should not be required to demonstrate mastery of grade level standards for those students who are ready for acceleration. For parents or students who wish to become more familiar with the GPSD curriculum, please visit the following link:
https://   .org/ParentsAndStudents/Pages/MathAcceleration.aspx

28) *How does high school acceleration work?* Per board policy, high school acceleration is handled within each building. Please contact your building's high school if this applies.

Appendix H

GPSD Mathematics Acceleration – Teacher Recommendation Form

(Note: these questions were copied and pasted from a Google form by the researcher)

Teacher Recommendation for Mathematics Acceleration

Use this form to recommend a student for mathematics acceleration. If recommending more than one student, you will need to complete this form for each student. Due by the end of the school day on Feb. 22, 2019. * Required

Email address *

Enter your last name, first name (Example: Last, First) *

Enter the student's first name. *

Enter the student's last name. *

Enter the student's ID number. *

Enter the parent e-mail address. *

If necessary, please enter a secondary parent e-mail address.

Give the student's home school. *

What is the student's CURRENT grade level? *

What is the student's CURRENT mathematics grade level? *

What level of mathematics would the student be attempting to test out of? *

Keeping in mind that the acceleration process attempts to predict how students will do in future levels of math, we have identified some characteristics of successfully accelerated students. Please check the characteristics that are consistently modeled by this student. *

- ☐ Initiative -- Does this student possess persistent intellectual curiosity?
- ☐ Maturity -- Does this student have academic and social skills needed if accelerated?
- ☐ Disciplined Habits -- Does this student display strong study skills and take responsibility for his/her learning?
- ☐ Motivation -- Does this student set high expectations for self and others?
- ☐ Perseverance -- Does this student stick with a task until the end, even when there is struggle?
- ☐ Academic Achievement -- Does this student show mastery and beyond of grade level expectations?
- ☐ Reaction to Setbacks -- Does this student react appropately when things don't go as expected?
- ☐ The student does not consistently exhibit any of these characteristics.

Please insert any comments here.

Appendix I

GPSD Mathematics Acceleration – Parent Recommendation Form

(Note: these questions were copied and pasted from a Google form by the researcher)

Parent Recommendation for Mathematics Acceleration

Please complete the following form.

* Required

Email address *

Enter your child's first name. *

Enter your child's last name. *

Enter your child's ID number. *

Enter your first name. *

Enter your last name. *

Please enter the one-time activation code as provided in your e-mail. *

Please select your child's school. *

Enter the last name of your child's current mathematics teacher. *

What is your child's CURRENT grade level? *

What is your child's CURRENT mathematics level? *

What grade level of mathematics do you wish to have your child attempt to test out of? (NOTE: This is NOT your child's current mathematics level; it is the level he/she wishes to skip.) *

Please explain why you would like your child to be accelerated in mathematics. *

I give permission for my child to take the acceleration screening exam at his or her school. *

YES

Acceleration Testing Protocol – Screening Exam

BEFORE TESTING

- Each IDC will be given an envelope with the names of all students testing and all needed materials. There will be an extra test in each envelope per grade level in case a student shows up to test and are not on your list. If this happens, do test the student and we will figure it out later.
- Students have **1 HOUR** to complete the screening exam.
- Remind students they have a time limit. If they get stuck on a problem, please encourage them to skip it and move on. Please give your students a time check every 15 minutes.
- Not all students will need the entire time, however, keep all students in the room until the time limit is over. If students finish before the end of the hour, you may collect their test and they can read silently.
- Proctor needs to have sharpened pencils, erasers and scratch paper available for students. (This will be provided in your envelope.)
- Remind students to check the spelling and school on their test. If something is incorrect, have them change it.
- Remind students to neatly show all work.
- Remind students if they erase to make sure they erase completely.
- Give option for restroom break before testing begins. If a student needs to use the restroom during testing, let them go, but no extra time is given to them.
- Do not place students taking the same test next to each other or provide privacy screens when needed.
- Explain that the standard listed at the end of each question is **NOT** part of the problem, it is for teacher use only. (MS tests only)
- Explain to students that you cannot help them solve a problem. You can only clarify directions. If they get stuck, they should skip it and come back. (Don't spend all their time on one problem.)
- If students use scratch paper have them put their name on the paper and the problem number. **Staple the scratch paper to the test.**
- All students will take the screening exam at their **home building**. Elementary IDCs you could have elementary students taking a middle school exam.
- Students **MAY NOT USE A CALCULATOR** on any elementary, 6th or 7th grade screening exams.
- Students taking the 8th grade screening exam **CANNOT USE A CALCULATOR** on **Part 1** of the exam. **They CAN USE A NON-GRAPHING CALCULATOR on Part 2 of the exam.**
- No phones, calculators or Apple watches should be out.

DURING TESTING

- Monitor that students are not talking.
- Monitor time remaining and make students aware as necessary.
- Keep students quiet if they finish early.
- Walk around periodically.

AFTER TESTING

- Collect all tests with stapled scratch paper and put back in your envelope.
- IDCs please bring your envelopes to DO and give them to the Mathematics Coordinator or place them on her desk as soon as you can after testing.
- **PLEASE KEEP TESTS IN A SECURED PLACE UNTIL RETURNED TO DISTRICT OFFICE!**

Appendix K

GPSD Mathematics Acceleration Testing Protocol – Battery of Exams

Acceleration Testing Protocol 2019

BEFORE TESTING

- The proctor needs to have sharpened pencils, erasers, scratch paper and graph paper available. We have provided some in your envelope. Middle school proctors need to have non-graphing calculators available for 7th and 8th grade testers when allowed.
- Remind students to double check their first and last name and school one every test.
- Remind students to neatly show all work.
- Remind students to raise their hand after they have completed each test.
- Do not place students taking the same test next to each other.
- Explain that the standard listed is NOT part of the problems; it is for teacher use only.
- Explain to students you cannot help them solve a problem but can clarify directions. If they get stuck, they should skip it and come back if time permits. Remind them not to spend too much time on one problem.
- If students use their scratch paper, they must include the problem number and staple to the test.
- Students taking the accelerations test in an elementary school (even if they are taking a middle school test) will begin promptly at 9:00 a.m. All directions must be administered before the 9:00 start time. **All students must stop testing promptly at 12:00. NO EXCEPTIONS!**
- Students taking the accelerations test in middle school will begin promptly at 8:00 a.m. All directions must be administered before the 8:00 start time. **All students must stop testing promptly at 11:00. NO EXCEPTIONS!**

DURING TESTING

- Monitor that students are not talking and walk around periodically.
- No calculators can be used on any test EXCEPT for 7th grade Geometry, 7th grade Ratios and Proportional Reasoning and part of the 8th grade Geometry/Statistics test.
- Students may use the bathroom as needed throughout the testing, but no extra time will be given.
- Every 30 minutes state the following, “You have (insert time remaining) left.” As an example, you will say: “You have 2 hours and 30 minutes left.”

AFTER TESTING

- Collect tests with ALL scratch paper stapled to each test and paper clip the student’s group of tests together.
- Middle school mathematics coaches return the tests to their building IDC immediately after the test. IDC will return to DO on the 19th.
- Elementary mathematics coaches will need to return them to the front office. Each building IDC will pick them up on the 18th. IDC will return to DO on the 19th.

Appendix L

GPSD Mathematics Acceleration Teacher Recommendation – Email to Parents

To the parents of (Student),

Your child has been identified as a possible candidate for mathematics acceleration by his or her current mathematics teacher.

Please read through the frequently asked questions (FAQ) document regarding mathematics acceleration
https://.   .org/ParentsAndStudents/Pages/MathAcceleration.aspx

The process for determining eligibility for mathematics acceleration consists of two phases, both of which are described below.

The first phase is a screening exam. The screening exam has a strict one-hour time limit and will occur within the window of March 19 to March 29, as decided by each school. Results of the screening exam will be sent via e-mail by April 5th.

If a student passes the screening exam, the student proceeds to the second phase, where he/she is eligible to take a three-hour battery of tests. The battery assesses a student's readiness to skip a grade level worth of mathematics content.

Please either accept or decline this invitation at the following link:
https://goo.gl/___________

If you have any questions, please contact: (mathematics coordinator)

Sincerely,
K-12 Mathematics Coordinator

Appendix M

GPSD Mathematics Acceleration Parent Recommendation – Email to Parents

Dear Parents,

Thank you for your interest in mathematics acceleration.

Please read through the frequently asked questions (FAQ) document regarding mathematics acceleration in https://   .org/ParentsAndStudents/Pages/MathAcceleration.aspx

The process for determining eligibility for mathematics acceleration consists of two phases, both of which are described below.

The first phase is a screening exam. The screening exam has a strict one-hour time limit and will occur within the window of March 19 to March 29, as decided by each school. Results of the screening exam will be sent via e-mail by April 5th.

If a student passes the screening exam, the student proceeds to the second phase, where he/she is eligible to take a three- hour battery of tests. The battery assesses a student's readiness to skip a grade level worth of mathematics content.

To register your child to participate for this year's acceleration eligibility process, starting with the screening exam, you must fill out the following Google form: https://goo.gl/____________

In the Google form, you will be asked for a one-time activation code. Your code is: _________

Sincerely,
K-12 Mathematics Coordinator

Appendix N
GPSD Screening Exam Results Email to Parents - PASSED

To the family of (student name),

(Student) completed the initial Mathematics Acceleration Screening Exam for grade 4 and met the required benchmark score on this exam to continue the testing process.

(Student) will complete the remainder of the acceleration tests on April 18 at ___________ Elementary. Have (Student) report to the front office at the beginning of the school day on April 18 for further directions (time, location, etc.…).

Much like the screening exam, we do not provide any study guides for the remaining tests. The remaining tests are all open-ended, meaning that students need to show work.

To officially sign (Student) up for the remaining tests, please provide permission at the following link: https://goo.gl/___________

Please know that when you complete the Google Form, that a screen will pop-up providing confirmation of registration. This is the only confirmation that you will receive before the testing date. If you don't receive any further emails from us, this also means that your child is signed up.

Final results will arrive via email on Friday, May 3, 2019.

If you have any further questions, please feel free to contact any of the district mathematics coordinators: (listed below)

Sincerely,
K-12 Mathematics Coordinator

Appendix O
GPSD Screening Exam Results Email to Parents – DID NOT PASS

To the Family of (Student),

(Student) has completed the initial Mathematics Acceleration Screening Exam for grade 4 mathematics. (Student) did not meet the required benchmark score on this exam to continue the testing process.

(Student’s) placement will be in 4th grade mathematics for the 2019-20 school year.

If you have any further questions, please feel free to contact the district mathematics coordinator.

Sincerely,
K-12 Mathematics Coordinator

Appendix P

GPSD Battery Exam Results Email to Parents – PASSED (no comments)

To the family of (Student):

(Student) was assessed recently for mathematics acceleration. At this time, the testing is complete and a committee of GPSD mathematics teachers has met to score (Student's) Acceleration Mathematics Assessments.

A committee approach to scoring these assessments was adopted for two main reasons. The first is to provide a broader-based perspective regarding the student's readiness to skip a full grade of mathematics instruction. The second is to be able to provide consistency across the district when deciding that a student has demonstrated readiness for an accelerated program of study in mathematics.

Here are (Student's) scores:
Operations & Algebraic Thinking – ___%
Measurement, Data, & Geometry – ___%
Numbers & Operations Base 10, Fractions – ___%

While you are probably wondering what scores guaranteed passing marks, please know that we do not set cut scores as we examine students' mistakes very closely and simply put, not all mistakes are equal.

(Student) has passed the exams, and now has the option to be placed in 4th grade mathematics for the 2019-2020 school year.

While we understand the desire to obtain as many details as possible, including diagnostic information regarding (Student's) strengths and weaknesses, we have to keep our exams secure and therefore, do not release any information other than the scores.

Logistically, mathematics acceleration presents a number of challenges. If (Student) were to accelerate, this could create significant scheduling issues for (Student). Simply put, there is no way to predict the impact of mathematics acceleration on future curricular and extracurricular opportunities at all grade levels.

By the end of business today, all schools will have been notified of these results, and the affected buildings will handle transportation where applicable and any other logistical needs. We know this result may lead to many questions, and, for this reason, we have placed a document on our acceleration website, called "Mathematics Acceleration FAQs." You can link directly to those here: (website)

Sincerely,
K-12 Mathematics Coordinator

Appendix Q
GPSD Battery Exam Results Email to Parents – PASSED (with comments)

To the family of (Student):

(Student) was assessed recently for mathematics acceleration. At this time, the testing is complete and a committee of GPSD mathematics teachers has met to score (Student's) Acceleration Mathematics Assessments.

A committee approach to scoring these assessments was adopted for two main reasons. The first is to provide a broader-based perspective regarding the student's readiness to skip a full grade of mathematics instruction. The second is to be able to provide consistency across the district when deciding that a student has demonstrated readiness for an accelerated program of study in mathematics.

Here are (Student's) scores:
Expressions & Equations – ___%
Geometry & Statistics – ___%
Ratios & Proportions – ___%

While you are probably wondering what scores guaranteed passing marks, please know that we do not set cut scores as we examine students' mistakes very closely and simply put, not all mistakes are equal.

(Student) has passed the exams, and now has the option to be placed in 8th grade Algebra 1 for the 2019-2020 school year.

While we do recommend that (Student) accelerate, please be aware that (Student) did show some weaknesses in the following areas: *Needs work on volume concepts.*

To ensure the greatest success in 8th grade Algebra 1, we recommend that (Student) spend time reviewing resources to fix the above weaknesses.

While we understand the desire to obtain as many details as possible, including diagnostic information regarding (Student's) strengths and weaknesses, we have to keep our exams secure and therefore, do not release any information other than the scores.

Logistically, mathematics acceleration presents a number of challenges. If (Student) were to accelerate, this could create significant scheduling issues for (Student). Simply put, there is no way to predict the impact of mathematics acceleration on future curricular and extracurricular opportunities at all grade levels.

By the end of business today, all schools will have been notified of these results, and the affected buildings will handle transportation where applicable and any other logistical needs. We know this result may lead to many questions, and, for this reason, we have placed a document on our acceleration website, called "Mathematics Acceleration FAQs." You can link directly to those here: (website)

Sincerely,
K-12 Mathematics Coordinator

Appendix R
GPSD Battery Exam Results Email to Parents – DID NOT PASS

To the family of (Student):

(Student) was assessed recently for mathematics acceleration.

Here are (Student's) scores:

Number and Operations Base 10/Algebraic Thinking - ___%
Geometry, Measurement, and Data - ___%
Number and Operations Fractions/Algebraic Thinking - ___%

(Student's) strengths:

- Place value - comparing decimals
- Adding & Subtracting fractions
- Visual representations of fractions (adding and subtracting)
- Area
- Number sense

(Student's) weaknesses:

- Understanding and finding volume
- Characteristics of quadrilaterals
- Line plot/outliers - statistics
- Multiplying decimals
- Multiplying and dividing fractions
- Reasonableness of her answers - incorrect procedures lead to unreasonable solutions.

While you are probably wondering what scores guaranteed passing marks, please know that we do not set cut scores as we examine students' mistakes very closely and simply put, not all mistakes are equal.

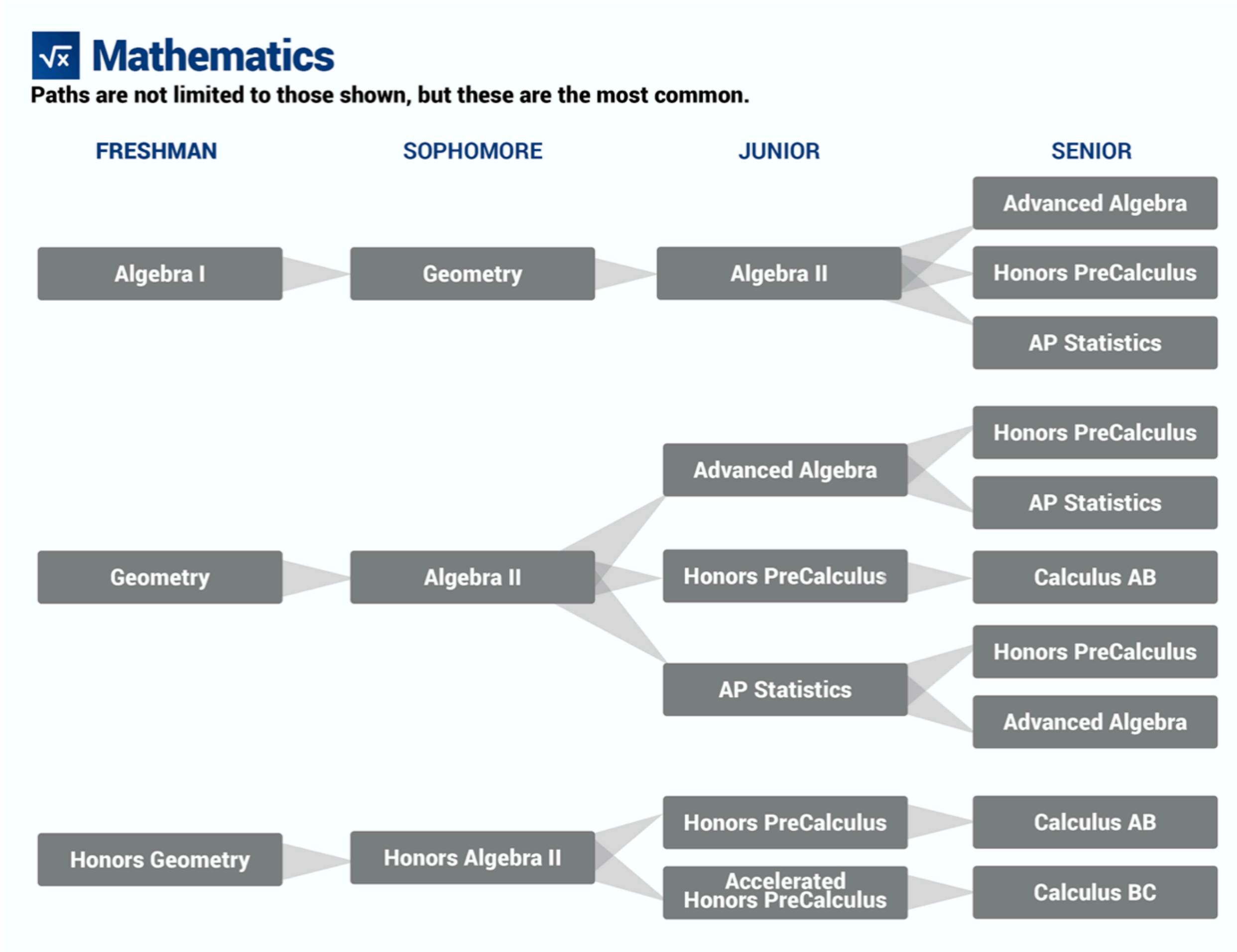
(Student) did not pass the exams, and (Student) will thus stay in in 5th grade mathematics for the 2019-2020 school year.

For the 2020-2021 school year, she will have the option to enroll in 6th grade Integrated Mathematics or 6th grade Integrated Advance Mathematics. In the spring of 2020, she would have the option to take the acceleration exams to skip 6th grade mathematics.

Sincerely,
K-12 Mathematics Coordinator

Appendix S

GPSD High School Mathematics Course Paths



Appendix T
GPSD Mathematics Timeline

Timeline of Mathematics Coordinator Tenure and Changes to the Mathematics Acceleration Process

Year(s)	**Name & Title** *(pseudonyms)*	**Changes to the GPSD Mathematics Acceleration process**
1992-2008	Dana, *K-12 Mathematics DCT*	• Elementary mathematics acceleration exams conducted by Dana in the student's school (case-by-case basis)
2008-2013	Morgan, *K-12 Mathematics DCT*	• Formal mathematics acceleration process (grades 3-8) • Mathematics acceleration exams administered and graded on a Saturday in the spring at a GPSD middle school
2013-2014	Morgan, *K-12 Mathematics DCT*	• Screening exam administered in schools by Title I Mathematics Coaches
2014-2015	Kennedy, *ESST: K-5 Mathematics* Morgan, *ESST: 6-12 Mathematics*	• Eliminated the Saturday testing/grading day • Mathematics coaches administered the mathematics acceleration exam in their own school and graded exams with ESSTs
2015-2016	Kennedy, *ESST: K-8 Mathematics* Casey, *ESST: 6-12 Mathematics*	• Students scoring two standard deviations or more above GSPD mean on MAP mathematics test were automatically invited to take the mathematics acceleration exam (bypassed recommendation and screening)
2016-2017	Blake (K-5) Alex (6-12) Jordan (6-12) *Mathematics Coordinators*	• Mathematics Coordinators administered the mathematics acceleration screening exam in each school
2017-2018	Blake (K-5) *Amy* (K-5)* Alex *(6-12)* Jordan *(6-12)* *Mathematics Coordinators*	• Instructional Design Coaches (IDCs) administered the mathematics acceleration screening exam in the buildings they served • All students required to take the screening exam (no automatic invites based on MAP score) **Note: Amy (the researcher) was a K-5 mathematics coordinator*

2018-2019	Alex, *K-12 Mathematics Coordinator*	• Elementary IDCs graded elementary mathematics acceleration exams, supervised by Alex. (i.e., elementary mathematics coaches no longer grade acceleration exams)
2019-2020	Alex, *K-12 Mathematics Coordinator*	• IDCs administer mathematics acceleration screening exam and mathematics acceleration exam in the buildings they serve (i.e., mathematics coaches no longer administer any mathematics acceleration exams.)

Note. DCT=District Coordinating Teacher. ESST=Education Services Support Team.

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