Improving Gifted and Talented Education in Arkansas: Identification, Academic Benefits, and Local Norms

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by

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Abstract

In the United States, education policies differ from state to state. Local research, therefore, is important to inform educators, policymakers, and researchers on the ground. This dissertation leverages ten years of administrative data to study three questions about gifted and talented (G/T) identification and education in Arkansas: does the current system identify the right students? Are gifted and talented programs beneficial for students? And, how can we improve diversity in gifted and talented education? Leveraging logistic regression, mixed-effects models, and descriptive statistics, I sought to provide answers to these three questions. First, are academically ready students from low-income families being missed in the current gifted and talented education system? Second, do gifted and talented services benefit high aptitude students academically? And finally, does using the local norm approach necessarily improve diversity in the G/T pool of students? This study has important implications for Arkansas's G/T identification and education policies.
Keywords: gifted and talented identification, gifted education, high aptitude, mixed-effects, logistic regressions, descriptive statistics, Arkansas

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Table of Contents

List of Published/Submitted Papers

Chapter 1

Tran, B. T. N., Wai, J., McKenzie, S., Mills, J., & Seaton, D. (2022). Expanding Gifted Identification to Capture Academically Advanced, Low-Income, or Other Disadvantaged Students: The Case of Arkansas. *Journal for the Education of the Gifted*, *45*(1), 64–83. https://doi.org/10.1177/01623532211063936

Chapter 2

Tran, B. T. N., Wai, J., & McKenzie, S. C. Gifted education in Arkansas: a longitudinal study of gifted status and academic achievement among high aptitude students. *Gifted Child Quarterly*. (under review)

Introduction

rDespite having a long history, gifted education still has critical issues to address regarding limited public support, definitions or terminology, measurement, methodology, and representation. The first issue regards public opinion. The Institute for Educational Advancement (IEA) conducted a survey in 2019 to study public attitudes towards gifted education. In this survey of 1,414 respondents, the majority *disagreed* with the statement that "Gifted students are so smart, they do just fine without special programs." The American public also believes that "gifted students need funding and support at the levels equal to students with learning disabilities" (p. 23-4). At the legislative level, it is reported in the 2018-19 State of the States report that 38 of 51 states and Washington D.C. have state mandates for identifying gifted and talented students. However, funding is still a challenge. In a similar State of the States report in 2014-15, respondents listed funding for professional training in gifted and talented education and funding for gifted education among areas that need more attention. Going back to the 2018-19 State of the States report, many respondents also mentioned funding as among the factors that impact gifted education. Similarly, an Education Week survey in 2019 of 1,284 educators indicated that lack of resources, such as funding or staff, are among the common reasons why students did not receive gifted services in their districts[1]. In short, while the public opinion survey may show strong support for gifted education, in reality, such support does not translate into policies at the state and school district levels.

The second issue is a definition of giftedness. In reviews of gifted identification and programming, it is common to find no universally agreed-upon definition of giftedness and talents (McBee & Makel, 2019; Subonik et al., 2011). Nor is there a universally agreed-upon

[1] Educators may always want more resources, so this finding must be considered in context.

model to develop gifted and talented individuals (Subotnik et al., 2011). For example, NAGC defines giftedness as "Students with gifts and talents perform - or have the capability to perform - at higher levels compared to others of the same age, experience, and environment in one or more domains. They require modification(s) to their educational experience(s) to learn and realize their potential" (n.d, p. 1). The federal government itself also provides a definition of giftedness and talents in the federal Elementary and Secondary Acts: "Students, children, or youth who give evidence of high achievement capability in areas such as intellectual, creative, artistic, or leadership capacity, or in specific academic fields, and who need services and activities not ordinarily provided by the school in order to develop those capabilities fully." However, reflecting a federal system in which public education is largely a state and local responsibility, the federal government does not legislate how states define giftedness. That is why there are many variations in defining giftedness and talents across states. More importantly, definitions of giftedness lack sufficient specificity and internal consistency, i.e., NAGC's definition of giftedness, which worsens the identification accuracy of gifted students (McBee & Makel, 2019). Identification rates also vary from state to state. According to the *2018-19 State of the States in Gifted Education* published by NAGC, South Carolina identified the most gifted students with 17.58% of all public school students, and West Virginia identified the least gifted students with 1.76% of all public school students. Therefore, the definitional challenge remains un-tackled both within research and policy arenas.

Relatedly, G/T identification and education also face measurement and identification issues. Ceiling or headroom effects happen when it is challenging to distinguish gifted students using standardized instruments because many students often score at the highest level. This measurement challenge is tough to overcome in program evaluations, where only standardized tests are available. Therefore, attempts to evaluate in-school gifted services are particularly challenging for states where acceleration is not an option. Some states, including Arkansas, have used the ACT-Aspire® tests since 2016[2], suggesting limited ceiling effects on student achievement. Such an approach may help with program evaluation and the identification process. Given that testing is not uniform across all states, measurement remains a challenge in studying gifted education.

The field also lacks causal studies. The road to causal inferences or closer to causal inferences has drawn much attention from researchers in the field and joint researchers from other fields, especially economics. Some researchers have attempted to draw causal inferences for gifted identification and educational effectiveness using econometric techniques in recent years. Card and Giuliano (2016) used regression discontinuity to show that universal screening could benefit underrepresented minority students. Bui et al. (2014) also used regression discontinuity to suggest that gifted services had a zero impact on student achievement at a charter school. Set-ups for a good causal inference study may be rare in gifted education unless there is the presence of a lottery or a cut score. The evaluation may be more challenging when referrals and/or subjective evaluations are components of the identification process. Thus, causally studying gifted education will remain a challenge in the near future.

In addition, there has largely been a concern about the underrepresentation of students from low-income and minority groups and how to address that (Grissom & Redding, 2016; Gubbins et al., 2020; Harris et al., 2009). Many researchers have advocated for using local norms in concert with universal screening (Lohman & Gambrell, 2012; Peters et al., 2019; Peters et al., 2021; Peters & Engerrand, 2016; Wai & Worrell, 2020). However, this has received some push-

[2] Arkansas education agency selected Cambium Assessment to replace ACT Aspire exams in 2023-24

back from critics of testing and scholars of other giftedness concentrations that tests may not cover.

Regarding policies on G/T education, not much has changed despite the long history of the field. For example, gifted programs still suffer from a lack of funding and continue to be neglected at the federal level (Beisser, 2008; Wai & Worrell, 2015). Some methodological challenges remain significant in the field, including definition, measurements, and causal inferences. However, it is important to recognize that the field is seeking to address such challenges. The welcoming of interdisciplinary research, activism like the NAGC, IEA, the Thomas B. Fordham Institute, or the Education Week Research Center, and the reflection of researchers such as this piece continue to help make the field better as a whole.

At the same time, it is crucial to acknowledge that there is a wide range of policies regarding gifted and talented (G/T) identification and education varying from one state to another, such issues require local research to inform educators and policymakers. Against this background, I investigated gifted and talented (G/T) identification and education in Arkansas, a state with easily accessible data. My research revolves around three questions: first, are we identifying the right students? Second, are gifted and talented programs beneficial for students? And finally, how can we improve diversity in gifted and talented education? Using administrative data between 2009 and 2019, I examined these three questions for Arkansas. In the first question, I found that free-and-reduced-priced lunch students in the top 5% in 3rd-grade assessments were 50% less likely to be identified as gifted. In short, students from low-income families, even though they are academically ready, are not receiving the services they could benefit from.

Next, I studied the effectiveness of gifted services in Arkansas. In order to do this, I followed the same groups of students who scored in the top 5% in math and reading separately from their third grade to eighth grade. I found that consistently across five cohorts, students identified as gifted scored on average 0.1 standard deviations higher in math than those who were not. For reading, the most recent three cohorts also show that those identified as gifted scored between 0.03 and 0.05 standard deviation higher than those who were not. In short, gifted services seem to benefit students' academic performance, which somewhat stronger impacts on math, as is common for many school based interventions.

Finally, I looked into improving diversity in gifted and talented education. I compared the student demographics using the current system and a local norm approach. The local norm approach uses test scores and student rankings to select students at the school district level. I found that the local norm approach did not consistently increase diversity in gifted and talented education in Arkansas at the district level.

This series of papers relies on the assumption that highly developed academic aptitude or achievement can be considered one important indicator of giftedness (Subotnik et al., 2011). We agree that measures of academic accomplishments (which include, but are not limited to, norm-referenced achievement tests) should be the primary criteria for defining academic giftedness" and that the developed symbol systems of numbers (related to math achievement) or words (related to literacy achievement) were both an important product of education (Lohman, 2005, p. 132). The premise of this series, therefore, is that all students with high academic aptitude should be identified and challenged at schools to fulfill their gifted abilities, regardless of their ethnic and socioeconomic status.

There are three important takeaways from my research: first, we are missing academically ready low-income students in the current gifted and talented education system. Second, gifted and talented services indeed seem to benefit students academically. And finally, using this local norm approach, we will be able to identify academically ready students and still maintain the diversity we currently have.

The following three chapters will describe each question and its answers in detail. The three chapters are as follows

1. Expanding gifted identification to capture academically advanced low income and disadvantaged students: the case of Arkansas
2. Gifted education in Arkansas: a longitudinal study of gifted status and academic achievement among high aptitude students
3. Local norms and gifted and talented identification in Arkansas: Do they help with student diversity?

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Chapter 1: Expanding gifted identification to capture academically advanced, low income, or other disadvantaged students: The case of Arkansas

Co-authored with Jonathan Wai, Sarah McKenzie, Jonathan Mills, and Dustin Seaton

Abstract

We examine the state of Arkansas, empirically testing how focusing on high achieving students using state tests might expand the pool of gifted identified students. From a broader sample of 173,133 students, we compared the degree to which students who were academically talented in the top 5% on 3rd grade state literacy and math assessments were identified as gifted in Arkansas. Across five independent cohorts, we replicated the finding that roughly 30% of the students in the top 5% in both 3rd grade literacy and math were not identified as gifted. Logistic regression (N = 3,992) indicated that high achieving students participating in the Federal Free/Reduced Lunch program were 50% less likely to be identified. These findings suggest that using state math and literacy assessments as universal screening tools could improve gifted identification of high achieving students, many from low-income or other disadvantaged backgrounds.

Keywords: gifted education, gifted identification, disadvantaged high achievers, policy research, Arkansas

Introduction

Broadly, one core broad purpose of gifted identification is to be able to match students to educational need (e.g., Assouline et al., 2015; Steenbergen-Hu & Moon, 2011). There are a wide range of definitions of what it means to be gifted (e.g., McBee and Makel, 2019), however, high developed academic aptitude or achievement can be considered one important indicator of giftedness (Subotnik et al., 2011). Lohman (2005a, 2005b; also see Lakin, in press) argued that the core purpose of gifted programming should be to provide appropriately challenging curricula for students who have exhibited high accomplishment in one or more domains. Specifically, Lohman noted that “measures of academic accomplishments (which include, but are not limited to, norm-referenced achievement tests) should be the primary criteria for defining academic giftedness” and that the developed symbol systems of numbers (related to math achievement) or words (related to literacy achievement) were both an important *product* of schooling and also important to learning in school (Lohman, 2005a, p. 132).

Specifically in this paper, we draw from the conceptualization of high academic achievement as one indicator of giftedness to examine the identification process in the state of Arkansas. The identification policy and process in Arkansas is unique to the state, and largely draws from the gifted conceptualization model described by Renzulli (1978), which includes, among other aspects, an emphasis on creativity. We fully acknowledge that gifted identification in Arkansas may not necessarily have had the original aim to primarily serve students specifically advanced in math and literacy achievement. However, recent research focused on finding ways to capture a broader array of talented but disadvantaged students illustrates that universal screening (Card & Giuliano, 2016), expanding measures used in academic services (Wai & Lakin, 2020), and considering other ways of making the cut in gifted selection such as local norms (Lohman, 2009; Lakin, 2018; Peters et al., 2021), can be effective ways of capturing a broader array of students from low income and other disadvantaged backgrounds. Here we examine whether expanding gifted identification to capture a broader group of academically advanced low income and other disadvantaged students is also an effective strategy. Many school systems may already be set up for providing academic challenge for students with demonstrated high academic achievement, thus this might be a reasonable way to further expand gifted programming access.

The roadmap of our paper is as follows. We first provide a brief summary of gifted identification in Arkansas. We then provide an empirical test of how focusing on high achieving students might expand the pool of identified students in Arkansas, especially those from disadvantaged backgrounds. We conclude by discussing our findings in the broader context of the literature and provide policy suggestions, limitations, and ideas for future research directions.

Gifted Identification in Arkansas

The Arkansas Department of Education notes: "Gifted and talented children and youth are those of high potential or ability whose learning characteristics and educational needs require qualitatively differentiated educational experiences and/or services" (Arkansas Department of Education, 2009). Arkansas' gifted and talented (G/T) identification process follows the tradition that looks at giftedness and talents as multifaceted and should be accommodated with appropriate educational services (Renzulli, 1978; for more detail, see Arkansas Department of Education, 2009). The identification process has several stages and can occur at any grade level from Kindergarten to 12th grade. Typically, students must be referred for consideration from various sources, including teachers, parents, counselors, and students. Next, data must be collected on the nominated students using, per state requirement, at least two objective and two subjective measures with at least one of those being a creativity assessment. Objective measures include standardized cognitive aptitude tests or standardized achievement tests, such as the ACT-Aspire or the Iowa Test of Basic Skills (ITBS), or tests of creative ability. Subjective measures include behavioral checklists (parent and/or teacher), rating scales, evaluations of products, student interviews, biographical inventories, grades, or auditions.

A committee consisting of at least five professional educators chaired by a trained specialist in gifted education then makes the placement decision for appropriate programs based on the collected information. This committee can be per campus within the districts and/or at the district level with representatives from each campus. Districts can determine their individualized process, and identification status may not be retained if students transfer districts. Each district's gifted program must have an annual evaluation through a state program approval report.

In terms of serving students that are identified, districts must meet the minimum requirements of services. From Kindergarten through 2nd grade, districts generally provide weekly whole-group enrichment classes. Between 3rd and 12th grade, once students are identified as in need of the G/T program, they are required to receive a minimum of 150 minutes a week of G/T services. Those services vary widely across the state, especially in the secondary setting from G/T seminar and Honors courses to AP/Pre-AP/Concurrent classes. However, there is not necessarily consistency in how districts meet the needs of G/T students as local decisions lead to the implementation of services in a wide variety of ways. G/T teachers are required to attain the minimum required score, which varies across states, on the Gifted Education Praxis Examination, and meet licensing standards for an add-on endorsement/licensure in gifted education (Robinson et al., 2014).

Some studies have focused on training for G/T teachers and early interventions in Arkansas (Robinson et al., 2018; Robinson et al., 2014; Robinson et al., 2009). However, research on Arkansas's identification process and representation is limited even though Arkansas has a state mandate on G/T identification and services. On the other hand, Peters et al. (2019) found that simply having a state mandate does not "appear to translate to proportionality" (p. 280). Moreover, there has been an existing concern about the underrepresentation of low income or other disadvantaged students in G/T education in public schools (e.g., Card & Giuliano, 2016; Grissom & Redding, 2016; Payne, 2010). There are several reasons for such disproportionality in representation, including teacher-student ethnicity congruence (Grissom & Redding, 2016), the use of different tests, and ways students are being identified (Peters & Engerrand, 2016), such as the two-phase identification process (e.g., Hamilton et al., 2017; McBee et al., 2016). Considerable research also suggests cultural differences in child-raising practices which may make giftedness non-uniform across economic and demographic groups (Lareau, 2011). Knowing that Arkansas has a state mandate and two-phase identification for G/T students, district, districts vary in their identification rates and measures, and the lack of research on this specific topic stimulated us to conduct this study.

The Current Study

Our study focused explicitly on the identification process of G/T students in Arkansas across the entire state. This descriptive analysis examined whether students currently demonstrating high academic achievement at the time of G/T identification are fully captured by the current G/T identification process in the state. The analysis was intended to examine how focusing on already high achieving students might expand the identified pool of G/T students, in particular those from low income and other disadvantaged backgrounds.

Data and Sample

In this study, we examined the alignment between students identified G/T in 4^{th} grade and those who performed in the top 5% of the state in both math and literacy on their 3^{rd} grade assessments. Although G/T students can be identified at any grade, we found that in practice 96% of Arkansas school districts identify the majority of G/T students by the fall of 4^{th} grade. Students complete the first state-wide assessment of math and literacy in the spring of their 3^{rd} grade year. Test score availability is a core reason why almost all school districts in Arkansas identify their G/T students by 4^{th} grade, reflected in the fact that there is a significant jump in the number of gifted students between 3^{rd} and 4^{th} grade across Arkansas. Particularly, by 4^{th} grade, 87% of all gifted students are identified.

We assumed that those students who scored in the top 5% of state standardized tests were high achievers and could be considered academically talented (e.g., Lakin & Wai, 2020; Wai et al., 2012). The Acceleration Institute (n.d) recommends using the 95^{th} percentile threshold to define “who has mastered the classroom curriculum and needs an intervention that provides more advanced work in a specific subject.” Though other more inclusive cutoffs such as at the 90^{th} percentile could have been used, in this study, we selected students who scored at or beyond the 95^{th} percentile in state standardized tests in both math and literacy to ensure that we captured a reasonable group of the most academically gifted students in our analytic sample. Our reasoning was that if the 95^{th} percentile cut could capture more students, then we would have pinpointed an important group that may need academic challenge.

We used student 3^{rd} grade literacy and math achievement in the years 2013, 2014, 2016, 2017, and 2018 and their 4^{th} grade G/T indicator in the years 2014, 2015, 2017, 2018, and 2019.

Our analysis did not include the cohort of 4th graders from 2016, as the G/T indicator was not included in the data provided for that year.

The data we used were anonymized student-level assessment and demographic data from the Arkansas Department of Education. Publicly available district-level characteristics were then matched with student-level data. We included five years of data with 173,133 students total. Table 1 reports summary statistics of the five cohorts. Across our sample, 65% of students were Free/Reduced Lunch (FRL) eligible, 49% were female, 12% had Special Education (SPED) status, 9% were English Language Learners (ELL), 61% were White, 20% were Black, 13% were Hispanic, and 12% were identified as G/T.

Within the group of top 5% achievers, 70% of students were identified as G/T by 4th grade, whereas 30% were not. White, female, and students from other race other than Black and Hispanic were overrepresented in the group of students who scored in the top 5% on 3rd grade assessments. In contrast, Black and Hispanic students, as well as those participating in FRL, identified as SPED, or identified as ELL were less likely to be in the high achieving group relative to their share of the 4th grade population.

<Table 1 about here>

Method

We used both descriptive statistics and logistic regression as our analytical strategies. In the descriptive statistics part, we investigated four different groups of students. These groups were:

1. G/T: Students identified as G/T in 4th grade.
2. Top 5%: Students scoring in the top 5% in both literacy and math on 3rd grade state assessments.

3. G/T & Top 5%: Students identified G/T in 4th grade who scored in the top 5% on 3rd grade state assessments.
4. G/T but not Top 5%: Students identified G/T in 4th grade but who did not score in the top 5% on 3rd grade state assessments.

Next, we predicted the probability of being assigned to the G/T category based on observable characteristics among academically gifted students. In particular, we ran logistic regression to predict the likelihood that students who scored in the top 5% on 3rd grade state assessments would be identified as G/T by 4th grade. We limited our investigation to only those who scored at and beyond the 95th percentile on 3rd grade assessments. We ran two separate models, one focused on accounting for student level characteristics and the second accounting for both student- and district-level characteristics.

$$log(\frac{gifted_i}{1-gifted_i}) = \beta_0 + \beta_1 X_i + \varepsilon_i \text{ (1)}$$

$$log(\frac{gifted_i}{1-gifted_i}) = \beta_0 + \beta_1 X_i + \beta_2 D_i + \beta_3 year_i + \varepsilon_i \text{ (2)}$$

In model 1, we included student-level characteristics. In model 2, we added district-level characteristics. In the two models, $gifted$ takes the value one if the student i was identified as G/T in 4th grade and zero otherwise; X_i is a matrix of student-level binary variables including low-socioeconomic status, special education status, English learners, female, Black, Hispanic, or another ethnicity (White as the reference group). Characteristics such as socioeconomic status may impact the likelihood of being identified as G/T. Parents of high socioeconomic students may be more active in seeking and providing services for their children.

However, as district characteristics may also impact the likelihood of G/T identification, we added district level fixed-effects and year fixed-effects to control for across district and across year policy variations. In particular, D_i is a matrix of district-level fixed-effects, including regions, poverty levels, district enrollment sizes, and urbanicity (Schmidt, 2014). We used robust standard errors clustered at the district level. The decision to select logistic regression is because logistic regression estimates are not confined within the range of zero and one, which happened when we ran linear probability models as a robustness check.

There are five regions in Arkansas, including Northwest, Southwest, Northeast, Southeast, and Central Arkansas. In this paper, we used the Northwest as the preference region when comparing with other regions. Poverty levels are divided into four categories based on the numbers of students on free-and-reduced-price lunch: low (0-43%), lower middle (43-52%), upper middle (52-66%), and high (>66%). In this paper, we used lower-middle level of poverty as the reference group because the majority of school districts in Arkansas were in this category. Similarly, we used medium enrollment size (1,001-2,600 students) as the reference for district enrollment against very small (0-500 students), small (501-1,000 students), large (2,601-6,000) and very large (>6000 students). Finally, we used locale provided by the National Center for Educational Statistics, where city was the reference group. For a non-technical guide to economics of education methods, see Schlotter et al. (2011).

Findings

Figure 1 presents an illustration of the relationship between the populations, the top 5% of achievers, and G/T identification for 4th graders in the 2019 cohort. We provided this year as an example for visual illustration since this pattern replicated across the other year cohorts examined. For more detail on the other years, please see the Appendix.

<Figure 1 about here>

In 2019, 4,067 students were identified as G/T by the 4th grade (see Figure 1); 1,011 students scored in the top 5% on both math and literacy assessments at the state level. Among the top 5% students, 721 (or 71.31%) were identified G/T. Among 4,067 G/T students, 3,346 (or 82.23%) did not score in the top 5% on both assessments. Thus, 28.68% of the top 5% scoring students were not identified as G/T.

Table 2 presents more detailed information regarding the four groups mentioned in our methods, using 2019 4^{th} graders' G/T status matched with their top 5% status in 3^{rd} grade. Patterns were consistent and replicated across other years (see Appendix).

<Table 2 about here>

Next we describe some noteworthy data patterns from Table 2. First, 11.5% of all 4^{th} graders were identified G/T. Among them, roughly 70% were White, 15% Black, 10% Hispanic, and 5% from another ethnicity. There were more female than male G/T students. In addition, 49% of G/T students had FRL status. On the other hand, only 2.9% of all students were in the top 5% on state assessments in 3^{rd} grade. Among this group, 79% were White, 4% were Black, 7% were Hispanic, 10% were another ethnicity, 32% had FRL status, and 50% were female. White students and those from backgrounds of higher SES were more likely to be in the top 5% on both literacy and math state assessments.

The 721 students who were identified G/T and in the top 5% on state assessments accounted for 2% of all students in the 2019 $3^{rd}/4^{th}$ grade cohort. Among them, 78% were White, 5% were Black, 7% Hispanic, 10% from another ethnicity, 31% had FRL status, 2% were SPED, 0.1% were identified as ELL, and 53% were female. There were 3,346 students (9.4% of all students in Arkansas) who were identified as G/T in 4^{th} grade but did not score in the top 5% on state assessments in the 3^{rd} grade. Among them, 66% were White, 17% were Black, 10% were Hispanic, 7% were from another ethnicity, 53% had FRL status, 2.6% had SPED status, 2.3% had ELL status, and 53% were female.

Overall, we observed that about 70% of students who scored in the top 5% on both literacy and math on 3rd grade state assessments were identified as G/T. The current G/T system in AR appears to overidentify certain students when considering the top 5% achievers in math and literacy. On the one hand, we found that students from certain ethnic and lower SES backgrounds, ELL, and SPED students had been identified for the gifted program though there were fewer of them in the top 5% of math and literacy achievement.

In addition, comparing the two columns "G/T & Top 5%" and "G/T not Top 5%," we found that even though only 4.7% of the "G/T & Top 5%" were Black, these students made up 20.5% in the "G/T not Top 5%" group. Similarly, we saw higher rates in "G/T not Top 5%" for Hispanic, FRL, SPED, and ELL students compared with the "G/T & Top 5%" group.

<Table 3 about here>

Table 3 reports the number of total students, G/T students, students in the top 5% on both math and literacy assessments, students identified G/T and in the top 5%, and students who were identified G/T but not in the top 5%, by geographic region, district enrollment, and district poverty levels for 253 school districts in 2019. Sixty-five percent of the student population was located in the Northwest and Central regions. We consistently found that 68% of G/T identified students and 78% of top 5% students lived in these regions. Central Arkansas had the highest number of G/T students whereas Northwest Arkansas had the most students in the top 5%. There were consistent regional differences in identifying the top 5% of students as G/T across the five years examined. For example, in 2019, although 71% of the top 5% scoring students were identified as G/T statewide, regional G/T identification rates for high achieving students ranged from 67% for students in the Northeast to 88% in the state's Southeast region.

While a reasonable critic might be concerned that the top 5% of students may not be identified as G/T due to a lack of available resources (class space, personnel, etc.), we found this was not the case. As presented in Table 2, over 82% of students identified G/T in 4th grade did not demonstrate high academic performance on 3rd grade state assessments. In Northwest Arkansas, 75% of G/T students were not in the top 5%, which reached a high of 93% for the Southeast. In short, we observed that some regions were more likely to label top 5% students as G/T to accommodate them, but they also over-accommodated the service to students who are not in the top 5%, which did not indicate a lack of available resources.

Second, examining the four groups by district poverty rates provided additional insight. Districts with the highest level of poverty (>66% FRL) also identified the highest percentage of students as G/T (12%) and were also most likely to identify students in the top 5% as G/T (79%). Districts in the lowest level of poverty had the highest percentage of students in the top 5% but only identified about two-thirds of those students as G/T.

Third, the largest districts had the highest percentage of students identified G/T (15%) and students identified in the top 5% (4%). Small districts (501-1000 students) and the largest districts identified the highest percentage of top performers as G/T at rates of 78% and 77%, respectively. We again observed the phenomenon of more broadly identifying G/T students and under-accommodating the top 5% across all district sizes.

Fourth, compared with cities, suburbs, and towns, rural districts enrolled the most students in Arkansas, approximately 38% of all 4th grade students in 2019. Together with school districts in cities, rural school districts had the most G/T students and top 5% students on all state assessments. However, under-accommodating the top 5% of students and more broadly identifying G/T students was again replicated when examining urbanicity. For example, in 2019, rural school districts had the most G/T students, but 83% of them did not score in the top 5% on the math and literacy state assessments. The number was 82% for cities, 79% for suburbs, and 83% for towns. Simultaneously, in rural schools, 70% of the top 5% of students were also G/T students. The number was 73% for towns, 63% for suburbs, and 75% for cities. It appears that high achieving students in urban school districts were somewhat more likely to be identified for and receive G/T services. See my Little Rock comment on p. 26.

In short, from a descriptive synthesis of Tables 1, 2, and 3, we identified three core considerations regarding existing G/T programs in Arkansas. First, around 30% of students who objectively scored in the top 5% on both math and literacy assessments were not identified as G/T by 4th grade. This academically high achieving group of students is not provided a service that may help their further talent development. Second, a high percentage of identified G/T students did not demonstrate high achievement (at least defined as the top 5%) on state assessments. Finally, because the percentage of students in the G/T group that were not academic high achievers was quite large, efficiency and adequacy of resource usage and distribution are worth thinking more deeply about. If we could improve or expand the identification process to provide more alignment and/or matching, ensuring that students identified as G/T are in need of the services, resources might be more appropriately allocated. Again, we note this consideration with an understanding that G/T identification in Arkansas may not have been designed to focus on high achieving students on math and literacy tests.

The student- and district-level characteristics that we examined descriptively in Tables 1, 2, and 3 were often correlated. Thus, in step 2 of this study, we used logistic regression to predict the likelihood of being identified G/T by 4th grade, given that the student was in the top 5% of performers on the 3rd grade state assessments. In other words, what student and district characteristics were related to a high performing student being identified as G/T?

Column 1 reports the estimated coefficients of being identified as G/T in 4th grade for students in the top 5% of state assessments in 3rd grade controlling for student demographics. The odds ratios transformation formula is $OR = e^{\beta}$, where β is the estimated coefficient. We found that, holding other things constant, the odds of being identified as G/T for FRL students was 0.650 times that of non-FRL students. In other words, low SES students were 35% less likely to be identified as G/T even though they were academically gifted ($p < 0.001$). We did not find any differences between SPED, ELL, Black or Hispanic, or other ethnicity compared with White students, and female students and peers.

Column 2 reports the probability of being identified as G/T in 4th grade for students in the top 5% of state assessments in 3rd grade, controlling for both student- and district-level characteristics. We found that controlling for district-level factors further reduced the likelihood that academically high performing FRL status students were identified as G/T. In particular, FRL status students in the top 5% on 3rd grade assessments were 50% ($OR = e^{\beta} = e^{-.689} = .502$) less likely to be identified as G/T ($p < 0.001$), all else equal. We continued to find no differential identification probabilities among SPED, ELL, female, or students from Black, Hispanic, or other ethnicities.

When examining the relationship between district size and the likelihood of identifying top 5% students as G/T, we found that large school districts were more likely to identify their top 5% students as G/T compared with medium-sized school districts, perhaps since they have more full time GT staff. Holding other variables constant, large districts (2,601 – 6,000 students) were twice as likely ($p < 0.001$) to identify their top 5% students as G/T compared with medium size

(1,001 – 2,600 students) school districts. Very large school districts were also more likely to identify their top 5% as G/T, however, despite being statistically significant, this number was very small (almost 0), all else equal.

<Table 4 about here>

There were significant differences by geographic region in the likelihood of high achieving students (top 5%) being identified as G/T. We found that, all else equal, the odds of being identified as G/T for the top 5% in Central Arkansas school districts were twice the odds of the students in Northwest AR ($p < 0.005$). Urbanicity also played a significant role in the likelihood of high achieving students being identified as G/T. Compared with school districts in cities, we found that school districts in suburb areas were 37% ($OR = e^{\beta} = e^{-.455} = .634$) less likely to identify their top 5% students as G/T ($p < 0.01$), all else equal. We did not find significant differences regarding poverty levels.

Discussion

The purpose of this study was to examine to what extent broadening the G/T identification process as it exists in Arkansas to include academically high achieving students might be able to expand the pool of G/T identified students, and in particular uncover more disadvantaged talented students who clearly are ready for more advanced academic challenge. Overall, we uncovered that about 30% of 4th grade students who scored in the top 5% on both literacy and math state assessments in the 3rd grade were not identified as G/T. We also found that many currently G/T identified students were not performing in the top 5% of the achievement distribution of literacy and math across the state. To be clear, we are not arguing that these relatively lower-scoring students identified are not gifted. To some extent, G/T is a somewhat arbitrary designation on various continuums that depend on definitions of various developed aptitudes or talents (e.g., McBee & Makel, 2019; Wai & Lakin, 2020). We are simply noting that G/T identification could indeed be expanded by using math and literacy state assessments (or other similar assessments) which already serve as a universal screener to capture a broader array of talented students, especially those from low-income and other disadvantaged backgrounds, who are ready for greater academic challenge (Lohman, 2005a; Lohman, 2005b). Logistic regression indicated that the odds of high achieving students participating in the Federal Free/Reduced Lunch program to be identified as G/T was half of those who are not. This may be due to a lack of teacher, parent, or counselors' likelihood of referring these students for G/T assessments, or other factors such as program availability or access to testing services. Even though Arkansas is a state with mandated G/T identification and services, this may not translate into an increase in the representation of economically or other disadvantaged students in the G/T category. Some groups may still have greater access to educational opportunities compared with others (Peters et al., 2019). Using student achievement on the 3rd grade state assessment in literacy and math as a universal screening tool could help these students receive the academic services they need to develop their talents more fully.

On a positive note, we found no statistically significant differences in the likelihood of G/T identification of high achieving students by ethnicity, gender, or special program status (SPED, ELL). In other words, FRL was the only subgroup that we detected a potential misalignment in the G/T identification process in Arkansas. In addition, although some student groups were less likely to be in the top 5% of achievers, all student groups were represented in the G/T population. We found no consistent patterns between the likelihood of G/T identification of academically high achieving students and district characteristics.

Using universal screening in Arkansas (Card & Giuliano, 2016), in concert with local norms (Peters et al., 2021), in addition to expanding measures used in identification as proposed here could potentially increase alignment between district identification and identifying more academically high achieving students from economically or other disadvantaged backgrounds as G/T. Utilizing universal screening and local norms would likely capture a larger pool of talent, and as a result, also identify more students from diverse backgrounds.

In particular, using state assessments as a universal screener may be cost-effective and relatively low hanging fruit to leverage. Even though state assessments may not be a perfect proxy for students' developed academic aptitude, in our study, we tried to limit the sample to only those who were highly academically gifted. Even so, we still saw a significant number of those students missing in the G/T category. By simply using this approach, we may be able to serve and benefit a greater number of qualified students in the state without inflicting significant cost to other students and school district budgets.

We found that larger districts may already tend to use math and literacy type achievement assessments as an objective indicator in the existing identification procedure. We found that medium school districts (between 1,001 and 2,600 students) were more likely to identify their top 5% students as G/T students. These big school districts may use test scores more consistently as a screening tool to identify their academically gifted students because of the high demand of G/T services as well as for efficiency.

Limitations and Future Directions

We still face several limitations in our study. First, we limited our analysis to the top 5% of achievers on 3rd grade assessments in literacy and math. We assumed this restriction would create two comparable groups within the highest achieving students: those identified G/T by 4th

grade and those not identified as G/T. We admit that this approach may have left out a significant portion of *talented* students (Gagné, 1995). However, with our purpose of examining academically gifted students, we still favor our reasonable cut of the top 5% in both math and literacy.

We controlled for a rich set of both student level and district level observable characteristics. However, other unobservable factors may have influenced students' G/T identification, such as parental involvement, student classroom performance, or teacher quality (Hanushek et al. 2019). In addition, we did not have data to look into the identification of a broader array of student aptitudes, including, but certainly not limited to measures such as spatial reasoning (Wai & Lakin, 2020; Lakin & Wai, 2020). Perhaps most importantly, G/T identification in Arkansas is a process informed by Renzulli's (1978) model of giftedness (for a critique, see McBee & Makel, 2019). This model highlights the importance of creativity, among other factors, and may necessarily not be designed to capture academically advanced students on math and literacy assessments. For the case of Arkansas, future similar studies should include, if available, measures of creativity to address this missing piece in the current study.

Given that recent discussions about the effectiveness of gifted program evaluation have centered around math and literacy achievement growth as a measure of G/T programming effectiveness (e.g., Redding and Grissom, 2021; Tran et al., 2021), however, expanding consideration to math and literacy in both G/T identification and programing may be important in that scholars such as Lohman (2005a, 2005b) and Lakin (in press) have emphasized better aligning G/T identification to actual G/T programming provided. Additionally, test scores as outcomes are commonly used in program evaluation and policy research, thus using these test score outcomes would allow better alignment between gifted education and education policy research and practice.

Conclusion

Our study uncovered what we think are some reasonable ideas for improving the G/T system in the state, but also broader considerations for expanding gifted identification to capture and serve more high achieving but disadvantaged students who could benefit from greater talent development through academic challenge. The current G/T identification system in Arkansas could be expanded to capture a noticeable proportion of talented math and verbal achievers scoring in the top 5% of the state achievement distribution. This group of students could then be provided better aligned G/T programming, educational acceleration, or educational dosage matched to their domain specific achievements and needs (e.g., Assouline et al., 2015; Dixson et al., 2020; Wai et al., 2010). By expanding identification procedures to more universally capture students who have high developed talents in mathematical and verbal symbol systems which are important to school as currently structured (Lohman, 2005a), this is relatively low hanging fruit given that state assessments are already often universally provided and such data can be leveraged as part of the G/T identification process, no matter the specific requirements of the state policy. Additionally, gifted education needs better alignment between identification procedures, programming offered based on identification (Lakin, in press), and program evaluation (Plucker & Callahan, 2020; Redding & Grissom, 2021; Tran et al., 2021) to demonstrate the importance of such programming to meet academic needs. We illustrate here one way to easily expand the identification process to include talented students from low-income and other disadvantaged backgrounds who are already high achieving and ready to learn something new in schools as they exist today (Stanley, 2000).

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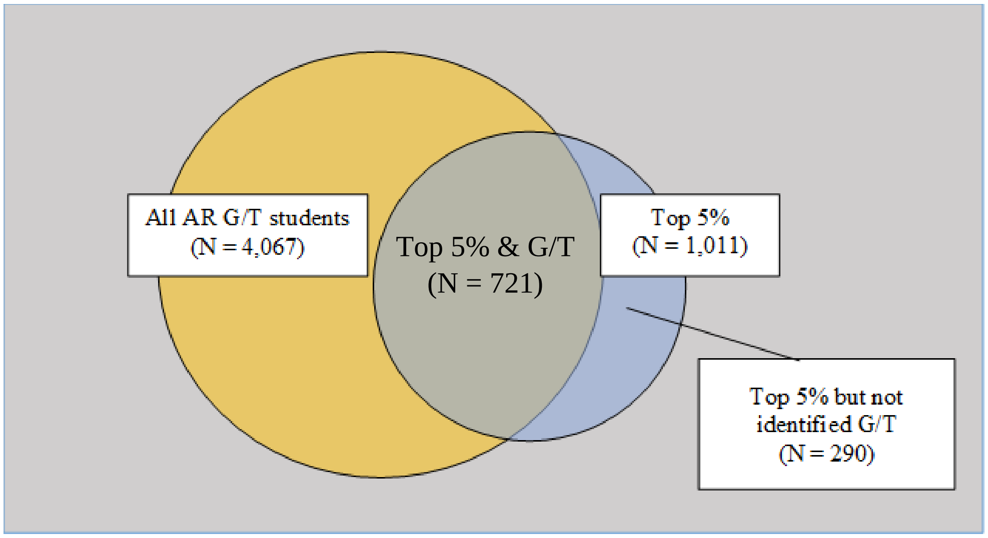
Figures

Figure 1

Venn Diagram for 2019 4th Grade G/T Students and Top 5% Students on 2018 3rd Grade Literacy and Mathematics Assessments



Note. The yellow circle represents all AR G/T students. The light blue circle represents all top 5% students. The overlapping area of the two circles is the number of top 5% students who were identified as G/T.

Tables

Table 1

Summary Statistics of Matched 4th Grade Demographics and 3rd Grade Literacy and Mathematics Achievement, Full Sample

	State (4th Grade) N=173,133		Top 5% (3rd Grade) N=4,330		Mean Difference
	Mean	Std	Mean	Std	(Top 5%-State)
FRL	.653	.476	.298	.458	-.354***
SPED	.121	.326	.016	.124	-.105***
ELL	.087	.282	.016	.124	-.071***
Female	.491	.500	.578	.494	.087***
White	.614	.487	.800	.400	.185***
Black	.201	.401	.038	.192	-.163***
Hispanic	.130	.336	.067	.250	-.063***
Other ethnicity	.054	.226	.095	.293	.041***
Gifted	.122	.327	.697	.459	.575***

*** p<.001, ** p<.01, * p<.05

Note. Other ethnicity is as an umbrella term for all other ethnicities other than White, Black, and Hispanic.

Table 2

Student Demographic Breakdown by G/T Status in 4th Grade and Top 5% Status in 3rd Grade, 2018-2019 Cohort

	State	G/T	Top 5%	G/T & Top 5%	G/T not Top 5%
Total N	35,471	4,067	1,011	721	3,346
FRL	23,721	2,003	324	221	1,782
SPED	4,715	99	16	12	87
ELL	2,823	77	1	1	76
Female	17,270	2,160	555	383	1,777
White	21,264	2,768	797	564	2,204
Black	7,069	606	44	34	572
Hispanic	5,004	393	72	48	345
Other ethnicity	2,134	300	98	75	225

Note. Column 1 shows student demographics, including ethnicity, FRL status, SPED and ELL status, and gender. Column 2 presents the number of students in each category across the full sample. Column 3 shows the demographic breakdown for G/T students. Similarly, column 4 shows the breakdown for the top 5% scoring students. Column 5 shows the breakdown for students identified as G/T and in the top 5%. Lastly, column 6 presents G/T students' demographic breakdown for students who did not score in the top 5% on the state assessment in the 3rd grade.

Table 3
4th Grade G/T Status Matched 3rd Grade Top 5% Status and District Characteristics in 2019, Cohort 2018-2019

	School District N	Total Students	G/T	Top 5%	G/T & Top 5%	G/T not Top 5%
Region						
Northwest	76	12,728	1,317	466	323	994
Northeast	67	7,081	696	147	98	598
Central	48	10,502	1,453	323	236	1,217
Southwest	38	3,372	401	59	50	351
Southeast	24	1,788	200	16	14	186
Poverty level						
Low level (0; 43%)	25	6,621	695	318	210	485
Lower middle (43%; 52%)	27	5,177	573	175	115	458
Upper middle (52%; 66%)	61	7,441	786	202	145	641
High (66%; 100%)	140	16,232	2,013	316	251	1,762
District Enrollment						
Very small (0; 500)	46	1,292	140	27	16	124
Small (501; 1,000)	87	4,620	515	73	57	458
Medium (1,001; 2,600)	77	8,982	847	193	114	733
Large (2,601; 6000)	31	8,782	801	231	160	641
Very large (>=6001)	12	11,795	1,764	487	374	1,390
Urbanicity						
City	27	9,629	1,289	307	231	1,058
Suburb	17	4,946	503	164	104	399
Town	55	7,566	790	181	133	657
Rural	154	13,330	1,485	359	253	1,232

Table 4

Logit Regression Estimated Coefficients of High Achieving 3rd Grade Students Being Identified as G/T in 4th Grade, Full Sample

Variables	**Student-level characteristics (1)**	**Student and District-level characteristics (2)**
FRL	-.431***	-.689***
	(.120)	(.092)
SPED	-.221	-.308
	(.277)	(.298)
ELL	.225	-.439
	(.387)	(.244)
Female	-.019	.004
	(.064)	(.075)
Ethnicity		
Black	.471	.147
	(.313)	(.232)
Hispanic	.016	.012
	(.135)	(.124)
Other ethnicity	-.002	-.065
	(.159)	(.075)
Region		
Northeast		-.828
		(.511)
Central		2.269**
		(.726)
Southeast		.708
		(.536)
Southwest		.218
		(1.171)
Poverty level		
Low level (0%; 43%)		.655
		(.460)
Lower middle (43%; 52%)		.173
		(.348)
High (66%;100%)		-.354
		(.377)
District Enrollment		
Very small (0; 500)		1.597
		(1.440)
Small (501; 1000)		1.597

Table 4

Logit Regression Estimated Coefficients of High Achieving 3rd Grade Students Being Identified as G/T in 4th Grade, Full Sample

Variables	**Student-level characteristics (1)**	**Student and District-level characteristics (2)**
		(1.131)
Large (2,601; 6,000)		.828***
		(.109)
Very large (>= 6001)		-13.600***
		(1.005)
Urbanicity		
Suburb		-.455*
		(.172)
Town		.415
		(.341)
Rural		-.368
		(.150)
Constant	.964***	.198
	(.121)	(.512)
Observations	4,330	3,992
Pseudo R-squared	.0074	.125

Clustered robust standard errors in parentheses
*** p<.001, ** p<.005, * p<.01
Note. The reference group for race is White, for region is Northwest AR, for poverty level is upper middle (52 – 66% FRL), for district enrollment size is medium (1,001 – 2,600 students), and for urbanincity is city (according to NCES classification). Logistic regressions dropped observations with perfect prediction). The reference group for the constant is White, non-SPED, non-ELL, male, not from Northwest AR, not in upper middle level of poverty, not from city locale, and not from medium size school district.

Appendix

Table 1

Student demographic breakdown by G/T status in 4th grade and top 5% status in 3rd grade, Cohort 2018, 2017, 2015, 2014

Year 2018	State	G/T	Top 5%	G/T & Top 5%	G/T not Top 5%
Total N	35,854	4,110	1,134	760	3,350
FRL	23,668	1,895	344	219	1,676
SPED	4,374	76	15	11	65
ELL	3,075	122	13	10	112
Female	17,650	2,192	631	424	1,768
White	21,572	2,725	893	604	2,121
Black	7,397	697	39	30	667
Hispanic	4,814	395	84	51	344
Other ethnicity	2,071	293	118	75	218
Year 2017	State	G/T	Top 5%	G/T & Top 5%	G/T not Top 5%
Total N	35,864	4,210	865	595	3,615
FRL	23,841	1,958	280	178	1,780
SPED	4,302	73	16	9	64
ELL	3,356	173	25	18	155
Female	17,693	2,281	461	328	1,953
White	21,822	2,896	685	475	2,421
Black	7,225	709	32	24	685
Hispanic	4,859	360	59	42	318
Other ethnicity	1,958	245	89	54	191
Year 2015	State	G/T	Top 5%	G/T & Top 5%	G/T not Top 5%
Total N	32,698	4,238	637	469	3,769
FRL	20,795	1,773	147	95	1,678
SPED	3,873	76	9	5	71
ELL	2,963	149	10	5	144
Female	15,969	2,248	393	284	1,964
White	20,585	3,039	526	380	2,659
Black	6,530	692	24	21	671
Hispanic	4,005	289	38	29	260
Other ethnicity	1,578	218	49	39	179
Year 2014	State	G/T	Top 5%	G/T & Top 5%	G/T not Top 5%
Total N	33,246	4,499	683	475	4,024
FRL	20,978	1,773	197	110	1,745
SPED	3,682	91	12	4	84
ELL	2,889	165	19	14	151
Female	16,400	2,418	464	325	2,093
White	21,141	3,154	562	390	2,764
Black	6,665	787	27	17	770
Hispanic	3,803	309	37	24	285
Other ethnicity	1,637	249	57	44	205

Note. G/T identification was not available for 2016. Other ethnicity is as an umbrella term for all ethnicities other than White, Black, and Hispanic.

Chapter 2: Gifted Education in Arkansas: A Longitudinal Study of Gifted Status and Academic Achievement Among the High Aptitude Students

Co-authored with Jonathan Wai and Sarah McKenzie

Abstract

This study leverages achievement and demographic data of third through eighth grade students to assess the effectiveness of gifted programs in Arkansas. The study adds understanding Arkansas gifted education programming, and to the broader literature on the efficacy of gifted education. Leveraging administrative data between 2009 and 2019 and mixed-effects modelling, we investigate the association between gifted services and student academic outcomes for students who scored at or above the 95th percentile for math or literacy on state assessments in third grade. We found that students with exposure to gifted services experienced significant academic performance on math achievement across the time period and literacy in the most recent relevant cohorts examined. We discuss these findings in the context of Arkansas' gifted and broader gifted programming literature and conclude with policy suggestions.

Keywords: gifted identification, gifted program, academic achievement, Arkansas

Introduction

Broadly, the purpose of gifted education programming is to help talented students learn something new each day and further their talent development (e.g., Subotnik et al., 2011). Lohman (2005a, 2005b) suggested that the core purpose of gifted and talented programs should be to provide appropriately challenging instruction for students who have exhibited high accomplishment in one or more skill and knowledge domains. Lohman (2005a) argued that "measures of academic accomplishments (which include, but are not limited to, norm-referenced achievement tests) should be the primary criteria for defining academic giftedness," noting that in many cases the symbol systems of numbers and words were important to school performance, but also that these developed abilities were an important product of schooling (p. 32). Using this lens of academic giftedness, we might expect gifted education programming to improve students' academic achievement. Supporting this idea is the accumulated empirical evidence in gifted education, suggesting a positive correlation between gifted programming and gifted students' academic achievement (Assouline et al., 2015; Henfield et al., 2017; Kim, 2016; Steenbergen-Hu et al., 2016; Wai et al., 2010).

The Arkansas Department of Education, Division of Elementary and Secondary Education focuses on the development of potential ability of giftedness and talent. On their website, they define gifted and talented students as those with "high potential or ability whose learning characteristics and educational needs require qualitatively differentiated educational experiences and/or services." Furthermore, the identification of giftedness and talent "will be evidenced through an interaction of above average intellectual ability, task commitment and/or motivation, and creative ability" (Division of Elementary and Secondary Education, n.d.). Developed abilities in the symbol systems of words and numbers (verbal and mathematical aptitudes) through schooling or other means can be considered an important component of giftedness (Lohman, 2005a), even if they are not by any means the only conceptualization of giftedness (e.g., Renzulli, 1978; see Subotnik et al., 2011 for a review). The specific identification process in Arkansas and the wide range of programming provided to students identified as gifted may be unique, but overall, we would reasonably hypothesize that gifted programming might benefit identified students academically at least in some core ways, such as on literacy and mathematics achievement tests, but perhaps not limited to such outcomes.

With that expectation, this study leverages student achievement and demographic data to assess the association between gifted and talented programs and students' academic performance in Arkansas. Particularly, using regression analysis and controlling for student characteristics and across district practices, we investigate the association of gifted services with academic performance on math and literacy tests for gifted identified students who scored above the 95th percentile for math or literacy relative to a similar ability group that did not gain access (gifted non-identified) to services from third to eighth grade. We conducted the analysis for five independent cohorts to assess robustness and replication. In the following sections, we first present relevant literature, methodology, data, and sample selection. We then discuss our findings and provide policy suggestions from this study.

Review of Relevant Literature

Studies Assessing the Effectiveness of Gifted and Talented Programs on Student Outcomes

One of the first significant studies on gifted and talented (G/T) programs' potential effectiveness was as early as 1932 when Unzicker conducted a comparison between 22 accelerated students and 22 top students in the regular classroom. Numerous additional studies conducted across the ensuing years have produced different results, both negative (e.g., Bui et al., 2014), positive (e.g., Aljughaiman & Ayoub, 2012; Assouline et al., 2015, Booij et al. 2017; Cohodes, 2020; Kim, 2016), and negligible or null (e.g., Adelson et al., 2012; Golle et al., 2017; Redding & Grissom, 2021; Smith et al., 2017), though in the gifted education research field there is a general consensus that programming is important to help students learn something new each day and develop their talents to the fullest (Assouline et al., 2015; Subotnik et al., 2011; Wai et al., 2010), and these studies examined a wide array of outcomes so it is unclear whether the programming was intended to impact the exact outcomes studied (e.g., Lakin, in press; Makel & Wai, 2016).

A rich literature that spans multiple subfields and methodological approaches comes with a wide array of "identification strategies" in addressing the relationship between G/T programs and students' outcomes. Traditionally, researchers have conducted pre-post analyses (Aljughaiman & Ayoub, 2012, Gubbels et al., 2014; Jen et al., 2017). In recent years, researchers have ventured into using new methods including analysis of covariance (Smith et al., 2017) and econometrics and causal inference (Booij et al., 2017; Bui et al., 2014; Cohodes, 2020; Golle et al., 2017; Hann, 2018). Such differences in approaches can be reconciled by recognizing that a plurality of methods may be useful to understand the ways in which G/T programs may make a difference for students in practice (Wai & Benbow, in press).

There is also increasing traction in longitudinal studies in gifted and talented identification and education. Some of the most well-known longitudinal studies into gifted and talented education is Study of Mathematically Precocious Youth (SMPY) and Project Talent (Bernstein et al., 2019; Bernstein et al., 2020; Brown et al., 2021; Clynes, 2016; Lakin & Wai, 2020; Lubinski & Benbow, 2021; Wai et al., 2005). However, these studies focused on out-of-level achievement assessments among highly gifted populations.

Researchers have looked at meta-analysis as one promising approach. Kim (2016) examined research on enrichment programs serving gifted students from 1985 and 2014 and found a positive association of the programs with both students' academic achievement and socioemotional development. Kim found that the largest effect size for academic achievement was observed for more educationally intensive programs like summer residential programs. A combination of summer and academic year programs generated the largest effect size for socioemotional development. This finding on social-emotional outcomes also resonates with conclusions by other researchers (Cross et al., 2015; Jung & Gross, 2015).

Henfield et al. (2017) conducted another meta-analysis to explore gifted education programs' intervention effect on gifted minority student academic achievement, finding a positive overall intervention effect. They also uncovered heterogeneous effects regarding types of programs. The effect size for programming was significantly larger for high school students compared to that for primary school students.

Steenbergen-Hu and colleagues (2016) conducted two second-order meta-analyses that synthesized a century of research on the effects of ability grouping and acceleration on K-12 students' academic achievement. They found that for grouping and acceleration there was "positive, near moderate, and statistically significant impact on accelerated students' academic achievement" (p. 890). Associations between educational programming or stimulation and longitudinal low base rate achievement have also been found among extraordinarily gifted and talented students tracked well into adulthood (e.g., Park et al., 2013; Wai et al., 2010).

In short, gifted programs do seem to help academic or other achievements, or at the very least are consistently linked with improved talent development. This conclusion is important because academic achievements are linked to performance in critical knowledge and skill domains (Lohman, 2005a). Such domain mastery in the symbol systems underlying the development of mathematical and verbal abilities, in turn, indicate students' current developed talents which highly correlate with both short-term and long-term outcomes on many aspects (Bernstein et al., 2019; Deary et al., 2008; Gubbels et al., 2014; Lubinski et al., 2014; Terman & Oden, 1959; Wai, 2013). Additionally, many researchers have used academic achievement as outcomes of gifted and talented education (e.g., Redding & Grissom, 2021; Olszewski-Kubilius et al., 2017).

Gifted and Talented in Arkansas

In 2019-2020, more than 473,000 students were enrolled in public schools in Arkansas; 8% of them were identified as gifted and talented (Office for Education Policy, n.d). The Arkansas Department of Education states that Arkansas mandates all public schools to have a program for gifted and talented students. The state provides guidelines and encourages local schools to use the state guidelines but ultimately it is the local school district that has the power to select and design their gifted programs. In each school district, parents are encouraged to contact the gifted and talented coordinator to refer their child for service. Selection criteria and services, therefore, are district-dependent with guidance from the state.

Arkansas' G/T identification process follows the tradition that looks at giftedness and talents as multifaceted and should be accommodated with appropriate educational services (Renzulli, 1978). The Arkansas Department of Education defines gifted and talented students as those with "high potential or ability whose learning characteristics and educational needs require qualitatively differentiated educational experiences and/or services." Particularly, the identification of giftedness and talent "will be evidenced through an interaction of above average intellectual ability, task commitment and /or motivation, and creative ability" (Division of Elementary and Secondary Education, n.d).

The identification process has several stages and can occur at any grade level from kindergarten to 12th grade. However, almost all school districts (96%) in Arkansas identify the majority of G/T students by the fourth grade (Tran et al., 2020; Tran et al., forthcoming). Under current practice, students must first be nominated for consideration as qualifying for G/T. This nomination can come from various sources, including teachers, parents, or counselors. Next, data must be collected on the nominated students using, per state requirement, at least two objective and two subjective measures with at least one of the objective measures being a creativity assessment. A committee consisting of at least five professional educators chaired by a trained specialist in gifted education then decide to place the student in appropriate programs based on the collected information. This committee can be per campus within the districts and/or at the district level with representatives from each campus (Arkansas Department of Education, 2009). There is, however, no consistently applied standard across the state to identify a student as G/T. Districts have the autonomy to determine whether they will honor the gifted identification of a student from another district. Additionally, a district's gifted program must have an annual evaluation through a state program approval report (Arkansas Department of Education, 2009).

In terms of servicing students that are identified, districts must meet the minimum requirements of services. From Kindergarten through 2nd grade, districts generally provide weekly whole-group enrichment classes. Between 3rd and 12th grade, once students are identified as in need of the gifted and talented program, they are required to receive a minimum of 150 minutes of services per week. Those services vary widely across the state, but especially in the secondary setting, ranging from a G/T seminar or honors courses to advanced placement, such as

AP/Pre-AP/Concurrent classes. However, there is no consistency or uniform way in how districts meet the needs of G/T students as local decisions lead to the implementation of services. Regarding the program's G/T teachers, they have to pass the Gifted Education Praxis Examination and meet licensing standards for an add-on endorsement/licensure in gifted education (Arkansas Department of Education, 2009). Once a student is identified as G/T, unless they changed school district, they will keep the label with them throughout their school years.

Current Study

There have been studies focused on training for G/T teachers and early interventions in Arkansas (Robinson et al., 2018; Robinson et al., 2014; Robinson et al., 2009). However, research on the effectiveness of gifted services to increase students' academic performance over time in Arkansas is limited. This study is an attempt to partly address that gap by evaluating the association of gifted services across the state of Arkansas with academic performance on mathematics and literacy achievement tests. This study makes the following contributions. First, it will be among the limited research studies on the effects of gifted education across the state of Arkansas for high aptitude students. Second, the study will also add to the literature on efficacy of G/T programming or services. In this paper, the term G/T means gifted and talented identification. G/T students means students who were identified and received gifted services. Non-G/T students means students who were not identified nor received gifted services, though does not mean they are not gifted or high achieving and worthy of additional support. We should make clear at the outset that although the identification process or the programming goals of G/T in Arkansas may not be math and literacy achievement focused, using such test scores as outcomes is at least a good first step to understanding whether the programs may be useful in developing these core aptitudes for schooling (Lohman, 2005a).

Method

Data

Anonymized student-level data including demographics and math and literacy achievement were provided through the Arkansas Department of Education. Data at the district level are publicly available at the Office for Education Policy at the University of Arkansas' website (http://www.officeforeducationpolicy.org/). As mentioned earlier, even though G/T identification and programs in Arkansas may not have been designed necessarily to specifically boost literacy and mathematics scores, it would make sense, as a first step, to examine whether such programming might be associated with such achievement. Additionally, because much program evaluation research not limited to gifted education focuses on test scores changes or performance, this approach is useful to apply to gifted education to examine comparability of program evaluation. Therefore, we leveraged the data that we had access to with the aim of using literacy and mathematics achievement performance as a first step in evaluating G/T programming in Arkansas, while fully acknowledging that some impacts of such programming may not be detectable on such tests.

We used a top 5% cutoff on these math and literacy tests not because this is a clear-cut score for who is truly gifted or not-gifted, but simply because this is a reasonable cut score for students who are highly achieving academically and may very likely be ready for advanced educational programming. We assumed that those students who scored in the top 5% of state standardized tests were high achievers and have high academic aptitudes (e.g., Lakin & Wai, 2020; Wai et al., 2012). The Acceleration Institute at Iowa State University (n.d) also recommends using the 95th percentile threshold to define "who has mastered the classroom curriculum and needs an intervention that provides more advanced work in a specific subject."

Though other more inclusive cutoffs such as at the 90th percentile could have been used, in this study, we selected students who scored at or beyond the 95th percentile in state standardized tests in math and literacy separately to ensure that we follow the definition and guidance provided by the Acceleration Institute.

We created our populations through multiple steps. First, using students' third grade standardized state assessment scores, we isolated students that scored in the top 5% in the state in math and, separately, literacy. We started at third grade because it is the first year with state assessments available. Second, we used unique student IDs to match the third graders from 2009 to 2013 with their fourth, fifth, sixth, seventh, and eighth grade standardized math and literacy achievement in the subsequent years, following individual students as they progressed in their education. Finally, we limited our sample to high achieving students who were consistently enrolled in progressive grades in Arkansas schools from third through eighth grade. We matched the students with their fourth-grade demographic characteristics (see Figure 1). We used fourth grade demographics because almost all school districts (96%) in Arkansas identify the majority of G/T students by the fourth grade.

<Table 1 insert here>

There were some significant changes in the testing structure in Arkansas that may challenge the interpretations of our study (see Table 1). In 2013-14, all students in grades 3-8 were required to complete their grade-specific math Benchmark assessment, even if they were enrolled in advanced courses such as algebra or geometry (Division of Elementary and Secondary Education, 2011). In 2014-15, Arkansas switched to the PARCC (Partnership for Assessment of Readiness for College and Careers) assessment (Division of Elementary and Secondary Education, 2015). Middle-school students who were enrolled in Algebra I or

Geometry took those course-aligned assessments *instead of* the grade-specific math assessments. In that specific school year, only 83% of eighth graders participated in the grade-level PARCC math assessments (Arkansas Department of Education, 2015). Because of this change in testing, we did not include the sample tested in eighth grade because it is not likely representative of G/T students in Cohort 2 (See Table 2).

However, in 2015-16, the state switched to using the ACT-Aspire tests, and all students in grades 3-10 again took grade-specific assessments regardless of course enrollment (Division of Elementary and Secondary Education, 2020). This disruption in testing mechanism may have impacted student's performance overall. In fact, as mentioned above, during this PARCC test period, academically better students had the opportunity to take Algebra or Geometry. Figures 2 and 3 suggest a dip in academic performance corresponding with the year of the PARCC tests. Similar patterns were present in the other four cohorts for the year in which PARCC was administered (see the Supplement link: https://doi.org/10.6084/m9.figshare.19087055.v1). As listed on the website of the Arkansas' Division of Elementary & Secondary Education, from Spring 2007 to Spring 2014, Arkansas administered the Arkansas Augmented Benchmark Exams in Literacy and Math to students in grades 3-10. In the Spring of 2015, 3-10 graders took the PARCC English Language Arts exams, and 3-8 graders took math exams, end-of-course Algebra 1, and Geometry. Starting Spring 2016, Arkansas administered the ACT Aspire assessments in English, reading, writing, math and science to students in grades 3-10 (visit https://dese.ade.arkansas.gov/Offices/learning-services/augmented-benchmark-and-iowa). Because the state changed the standardized tests, we standardized all test scores in all subjects to account for differences in scales.

Analytic Strategy

We leverage the benefit of having longitudinal data and the nesting nature of our data. In particular, to model of nesting nature, we employ mixed effect models. Mixed effect models allow for "the simultaneous investigation of the relationship within a given hierarchical level, as well as the relationship across levels" (Woltman et al., 2012). In our study, we take into account two levels of nesting: individual students and school districts. The lower-level units are individual students, the higher-level units are school districts. In Arkansas, it is common that G/T placement is done at the district level. The simple regression form for individual student i in school district j is:

$$achievement_{ij} = \beta_{0j} + \beta_{1j} gifted_{ij} + \beta_{2j} X'_{ij} + \beta_{3j} D'_{ij} + r_{ij} \quad (1)$$

where:

$achievement_{ij}$= standardized state assessments for student i in school district j,

$gifted_{ij}$ = an indicator of G/T status taken from 4th grade of student i in school district j,

X'_{ij} = a matrix of student-level characteristics, including free and reduced lunch price (FRL) status, race, gender, special ed status, and limited English proficiency status of student i in school district j,

D'_{ij} = matrix of district-level characteristics, including district FRL percentage, district enrollment, district rural indicator, and region indicator,

β_{0j} = average achievement for student i in school district j,

β_{1j} = regression coefficient associated with $gifted_{ij}$ for the jth district,

β_{2j} = regression coefficient matrix associated with student-level characteristics for student i in school district j,

β_{3j} = regression coefficient matrix associated with district-level characteristics for student i in school district j,

r_{ij} = random error associated with student i in school district j.

Arkansas is in large part a rural state where income inequality is positively correlated with economic growth and metropolitan status (Shelnutt & Yao, 2005). Such fast growing economic hubs in Arkansas including the Northwest region and Little Rock-North Little Rock region may attract the most diverse populations financially, culturally, and linguistically from within but also from outside the state. Such populations then may impact the overall picture of gifted education in the rest of the state. Therefore, we included an interaction term for gifted status and rural indicator as defined in the U.S. Census and regional indicator as provided by the Office for Education Policy at the University of Arkansas as follows

$$achievement_{ij} = \beta_{0j} + \beta_{1j}gifted_{ij} + \beta_{2j}gifted * rural + \beta_{3j}gifted * region + \beta_{4j}X'_{ij} + \beta_{5j}D'_{ij} + r_{ij} \ (2)$$

Results

Descriptive Statistics

Tables 2 and 3 report the proportion of G/T students identified in fourth grade and who remained enrolled in Arkansas public schools through the course of examinations from the third to eighth grades. We do not observe significant changes in the proportion of gifted students across cohorts and grades, which in our view suggests there were no systematic changes in the student samples throughout the cohorts examined. We conducted descriptive analyses for each of our cohorts to study if student characteristics, including gender, lower socioeconomic status, limited English proficiency status, special education status, ethnicity status, and third grade achievement, might have changed from the third compared to eighth grade. Tables 4 and 5 report demographic breakdowns of the students scoring in the top 5% in math and literacy (RLA/ELA). Across all cohorts, more than half of the top performers were identified as G/T. White students were the largest G/T identified ethnic group. There were slightly more female students in our samples compared to males.

We observed that more than 40% of students who scored in top 5% in math or literacy in 3rd grade were not identified as G/T by 4th grade. This finding is somewhat expected as there is a misalignment between the system that Arkansas uses to select students into G/T services and our analytical strategy. This percent is consistent across all five cohorts in math and literacy achievements.

<Tables 2- 3 insert here>

In addition, we selected on the top 5% of achievement in math or literacy with the assumption that students within the top 5% of students statewide were comparable in their developed ability at the time of selection. We are aware of potential ceiling effects or headroom issues on measures for talented students, in that such students cannot distinguish themselves from other high-ability students because of the lack of headroom on the measure to capture the full range of individual differences (Lubinski & Benbow, 2000; Warne, 2012). The ceiling effect may also depend on how difficult the tests are. However, we did not observe concerning ceiling effects in our analytical samples, at least for the purposes of our study which focused on the top 5% as a whole (Figure 1). Figures 2 and 3 present mean standardized scores for math and literacy for Cohort 5. Across grades, students with G/T status consistently had higher average scores compared to non-G/T students and all students. This pattern replicated across five independent cohorts (see the Supplements for similar graphs: https://doi.org/10.6084/m9.figshare.19087043).

We also observed a dip in Cohort 2 mean achievement in both math and literacy. This dip reflects the change in testing. Therefore, results for Cohort 2 may not be representative nor relevant in this study.

<Figures 1-3 insert here>

Mixed-Effects Model Analyses

<Table 4 insert here>

<Table 5 insert here>

Tables 6 and 7 report mixed effect models regression coefficients of the relationship between G/T status and student academic achievement measured by standardized state tests, for students in the top 5% on their third-grade state assessments in mathematics and/or literacy, controlling for student and district characteristics.

We consistently found that as these high-achieving students progressed from third grade to eighth grade across five cohorts, students identified as gifted scored higher on standardized state assessments in both math than their peers that were not identified as gifted. For Cohort 1, for example, students in the top 5% on their third-grade math assessment identified as gifted scored 0.11 standard deviation (SD) higher on state standardized math assessment than the students in the top 5% not identified as gifted. For Cohort 5, the latest cohort for which data are available, the findings were similar. G/T students scored 0.10 SD statistically higher than non-G/T students in state math standardized assessments as they progressed through the grades.

In reading, we also observed a significant positive association between G/T status and state standardized reading scores for recent cohorts (Cohort 4 and 5). For Cohort 5, the latest cohort for which data are available, G/T students scored 0.05 SD statistically higher than non-G/T students in state reading standardized assessments as they progressed through the grades.

For Cohort 5, the coefficient for G/T was 0.03 SD. We did not find a positive correlation between G/T status and reading achievement for older cohorts (Cohorts 1-3).

In Model 2, we included interaction terms for rurality and regions. We found strong evidence that receiving G/T services was positively correlated with students' academic performance measured by state standardized test scores. The coefficients for G/T status were slightly bigger in Model 2 compared to Model 1 and similarly consistently positive when looking at math assessments. When studying literacy achievement, we found a similar pattern. The coefficients for G/T status were slightly bigger in Model 2 than Model 1. Significantly, Cohort 3's coefficient for G/T is now statistically significant. However, we did not find consistent nor obvious evidence to conclude that there was a differential effects of G/T status on achievements based on rurality and regions. We have provided full result tables via FigShare (https://doi.org/10.6084/m9.figshare.19087052.v3).

Discussion

As noted from the beginning of our paper, Arkansas provides a definition of gifted and talented as students with high potential or ability, who likely need qualitatively differential services. The process of identification relies on three components: intellectual ability, task commitment and/or motivation, and creative ability. This model, we argue, largely follows Renzulli's (1978) theory of giftedness and talents, where he defines giftedness and talents as multifaceted and should be accommodated with appropriate educational services. This study, therefore, looked at academic achievement as a demonstration of one facet of giftedness and talents: developed math and literacy achievement. We note that this approach does not address the creativity aspect of the Renzulli model and thus the associations we pick up may not necessarily capture those aspects of identification and programming. That is also the reason we observed that more than 40% of students in our top 5% populations were not identified as G/T across five cohorts. Regardless, academic growth and program evaluation typically is of broad interest to education scholars and policymakers on literacy and math achievement tests (e.g., Redding and Grissom, 2021; Wai & Allen, 2019), and so we leveraged the sample we had access to in order to start our G/T evaluation using these outcome metrics.

G/T Programming Evaluation Broadly and G/T Programming Evaluation in Arkansas Specifically

Evaluations of G/T programs in Arkansas are rare. Limited studies have looked at training for teachers and early interventions (Robinson et al., 2014; Robinson et al., 2018). An evaluation of early intervention for first grade students from low-income households through an engineering curriculum suggests positive gains on both out-of-level science content and engineering knowledge (Robinson et al., 2018). Our study looked at a different group of students and a different question, and is the first to evaluate the actual G/T designation effects on students with high academic attitude from the third to eighth grade.

Particularly, we investigated the relationship between G/T status and student academic performance after accounting for various selection bias factors, including prior developed ability or achievement and other factors. We defined a cohort as top performers from their third grade, separately for math and literacy, and longitudinally followed them as they progressed in their grades. We first found that there were no systematic changes of the proportion of students identified as G/T in each cohort as the students progressed. Second, by following same cohort of top performers from their third to eighth grade, separately for math and literacy, we found a consistent positive correlation between G/T status and student academic performance. Our findings resonate with the majority of research on the association of gifted education with student achievement and academic performance (e.g., Aljughaiman & Ayoub, 2012; Assouline et al., 2015; Booij et al. 2017; Cohodes, 2020; Kim, 2016). We found positive correlations between gifted status and academic achievement measured by standardized state assessments in math and literacy among the top 5% of students even when controlling for student characteristics and district differences.

Overall, we found greater gains in math compared to literacy across all cohort analyses. This pattern of academic gains is similar to the national trend in math and literacy achievement (Hasen et al., 2018). We suspect that greater gains in math are a function of many factors including school and non-school aspects. At the school level, it could be that the teaching of math is consistently associated with more universally agreed upon principles whereas the teaching of literacy may be more dependent upon the local context. The focus on teaching literacy may also vary from one school to another, from one grade to another (Callahan et al., 2015), which may not be reflected in the general state assessment tests as pooled across years in this study. In addition, at the non-school level, literacy instruction outside of the class context may be more a function of socioeconomic background, which remains an important variable in academic achievement. For example, wealthier parents may have the opportunities to help their children with reading compared to parents from disadvantaged backgrounds. Finally, the overemphasis on STEM may shift the attention from literacy at all levels, which further exacerbates the amount of attention placed on the teaching of literacy.

We also investigated the relationship between G/T status and student academic performance for rural students and regional students in Arkansas. Regarding geographic patterns, we did not find consistent differences in the G/T coefficients for the top 5% state-wide students and the top 5% rural students nor students from different regions. This finding is supported by a study conducted by Gentry and colleagues (2019) where they looked at laws, access, equity and missingness in gifted education across the U.S. Gentry et al. (2019) found that Arkansas, Mississippi, and New Hampshire were the only three states out of 47 states that had equitable representation indices across all locales and school types. They defined representation indices as the ratios between percent of a group that is identified as G/T and the percent of that group in the general population. This finding may help illustrate how G/T education is in Arkansas is less systematic than in other states.

A common assumption is that rural schools are facing challenges with their gifted population, both in terms of identification and services (Howley et al., 2009; Howley et al., 2013; Lawrence, 2020), noting that these challenges are also similar to the general discussion of rural education (McShane & Smarick, 2020). Our findings challenge this assumption for Arkansas. Even though Arkansas is a relatively rural state, it is among the fewer states that have been doing better in gifted identification and services (Gentry et al., 2018). At least for those students in rural areas who are G/T identified, whatever programming that is provided appears to be positively associated with their academic performance up through the 8^{th} grade, in a way quite similar to students in larger locales with arguably greater resources and opportunities.

Policy Recommendations

As we investigated, nearly 40% of students in top 5% in either math or literacy were not identified as G/T in their third grade (Tables 2-5). Looking more finely, our descriptive finding resonates with what Tran et al. (forthcoming) which found that almost 30% of students who scored in the top 5% in *both* math and literacy in third grade were not identified as G/T by 4^{th} grade in Arkansas. As mentioned in the result section, given the current G/T identification scheme in Arkansas, this finding is not surprising. However, Arkansas' defines gifted and talented children and youth as “those of high potential or ability whose learning characteristics and educational needs require qualitatively differentiated educational experiences and/or services” (Arkansas Department of Education, 2009). It is also undisputed that those academically ready students who were not identified were denied of the service that could potentially be beneficial to them. There should be, therefore, careful consideration of selection process in order to increase academic equity in Arkansas. In particular, educational policy should address this concern of mismatch in service and academic aptitude to enhance student learning outcomes (Callahan et al., 2015). Testing and screenings regularly provide a helpful solution to accurately identify and support students. In addition, personalized learning is another avenue that could potentially bring about positive results for students. For gifted students, personalized learning could be acceleration or other forms of out-of-level services.

Having said that, we consistently found a positive correlation between the G/T status and academic performance. Among the two groups who may have the same starting point, we were able to determine that those who were identified as G/T performed better in math and reading. This finding is encouraging given the political pressure on gifted and talented education (Gallagher, 2015). Gifted services, therefore, should be maintained and even expand to help students in need.

Limitations and Future Directions

Even though the purpose of this study was not to parse out causal effects of gifted education in Arkansas given our research design and tools, with the demonstrated consistency of findings across many cohorts (with some exceptions from Cohort 2 when the state changed its testing policy and older cohorts for literacy), we can broadly conclude that gifted services have a positive association with students’ academic achievement in math and literacy and performance over time. The black box of gifted education is not yet fully explained, particularly in this study. The treatment of gifted education may range from curriculum, peer effects, to teachers' ability to identify the right students who are most likely to benefit from gifted services provided (Lakin, in press), and the motivational or labeling effect of being identified as gifted, in addition to the basic set of individual differences characteristics or aptitudes that selected students may bring (Lubinski, 2020; Snow, 1990). While we cannot identify what aspects of gifted education in Arkansas casually contribute, individually or in combination, to increased student achievement, our findings are valuable because they contribute, in part, to the research literature on rural gifted education (Lawrence, 2009), and also provide a window into what happens from the third through eighth grade to high achieving students across Arkansas who are and are not identified as G/T.

In addition, creating and examining instruments for measuring a wide range of outcomes in gifted education is challenging (Callahan et al., 2020). Academic achievement measured by state standardized tests is limited in some respects. Especially in this paper where testing is not the only criteria in selecting students into service in Arkansas, we fully acknowledge that the findings are only relevant to high aptitude students in specific areas. However, this is a limitation in our study as well as in many other studies of talented students (e.g., Makel and Wai, 2016; Park et al., 2007). It is possible tools used to evaluate rural gifted education might be different, but one thing this study shows is that gifted education, even though it varies quite considerably in its implementation across the state (rural areas probably do not do the same thing as say Bentonville, Fayetteville, or northwest Arkansas), we still identify positive associations – which shows that tests as outcome measures can be used effectively in rural gifted evaluations. Thus, more studies like ours should be done using such tools, especially when tests have been shown to be one objective and fair method to pick up low income and disadvantaged talent broadly as part of universal screening in identification (Card & Giuliano, 2016; Grissom & Redding, 2016).

We are fortunate to have access to a state-wide administrative database over the span of many years. However, using administrative data also has limitations and methodological concerns (Hodge, 2020). As mentioned earlier, there is no consensus about how to identify gifted and talented students at the national level and at the state level. In Arkansas, the state encourages local schools to use the state guidelines but ultimately it is the local school district that has the power to select and design their gifted programs. Additionally, even though we have the population in our study, we created samples of top 5% and followed them from 3rd grade through 8th grade. Our coefficients, therefore, could be seen as closer to population parameters than sample statistics. We are fully aware that there could be errors in administrative data. For example, for the entire year 2016, we did not have gifted identifier in the dataset. There are cases of duplicated student identification numbers in our data. Additionally, we are also sympathetic with *CritQuant* movement and acknowledge that these numbers are not perfect (Garcia et al., 2018; Gillborn et al., 2018; Sablan, 2019).

Much research has been conducted on the potential positive academic, achievement, or other benefits of acceleration for gifted students (Assouline et al., 2015; Plucker & Callahan, 2020). Perhaps more fine-grained analyses of more rural areas of Arkansas can be explored to disentangle the context in which gifted programming is and is not beneficial for students, which may lead to possible improvement of the G/T identification and programming process across the state as well as informing gifted education more broadly. In addition, perhaps outcome measures, such as those that may be used to tap creativity, might be linked to such data to examine the role that the current identification and G/T programming practice in Arkansas is aligning its identification to services provided (Lakin, in press) and also capturing creative outcomes that may have been missed in this analysis. Nevertheless, the fact that we found a consistently positive correlation between G/T identification for math achievement across five cohorts and in the most recent two cohorts for literacy achievement begs the question of what if the compared group (those in top 5% but not labeled as G/T) received the same services. With the consistent finding, we expect such students may benefit from the services, which relates to the recent push for local norm approach in G/T identification.

Conclusion

It should be noted that there have been many gifted students who are largely invisible in the public school system (Makel et al., 2016; Lakin & Wai, 2020). The fact is that there is limited consistency in gifted education policy at the federal, state, and local school district levels (NAGC, 2020). In many cases, gifted students do not get sufficient attention from policymakers, perhaps because of their extraordinariness and the tension between equity and excellence in education (Benbow & Stanley, 1996; Gallagher, 2015; Wai & Worrell, 2020). However, gifted students are important intellectual engines of societal development (Lubinski & Benbow, 2020). Rural gifted students, particularly, can help innovate and develop rural areas, should they choose to remain in their communities.

We started this paper asking about the correlation between gifted designation and student academic performance. The short answer from our study is yes, in Arkansas, there is a positive correlation between receiving G/T status and academic achievement. Even though this study does not provide causal inferences, it highlights a consistent positive association between gifted services and student academic achievement for those students that perform in the top 5% on third grade state assessments of literacy and math. This is in contrast to other studies that have found little to no impacts (e.g., Adelson et al., 2012; El-Abd, et al., 2019; Henfield et al., 2017; Redding and Grissom, 2021; Smith et al., 2017).

We did not look into the black box of gifted and talented services, nor can we specifically address the possible labelling effect, or other factors related to selection bias. Yet, it seems like the current G/T process in Arkansas is working, as supported by findings from Gentry et al. (2019) and this paper. School districts at the minimum should keep their G/T practices to help high potential and ability students until any causal mechanism is detected. Though this process is working, this does not rule out improvements or expansions to the identification or programming processes that might be useful, especially when thinking about using math and literacy measures as selection tools to expand programming to reach more disadvantaged and underrepresented minority students and not just as evaluation tools (e.g., Tran et al., 2020). Additionally, the success of Arkansas, in a sense, may illuminate useful strategies that may also be useful in other rural states and regions, both nationally and internationally.

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Figures

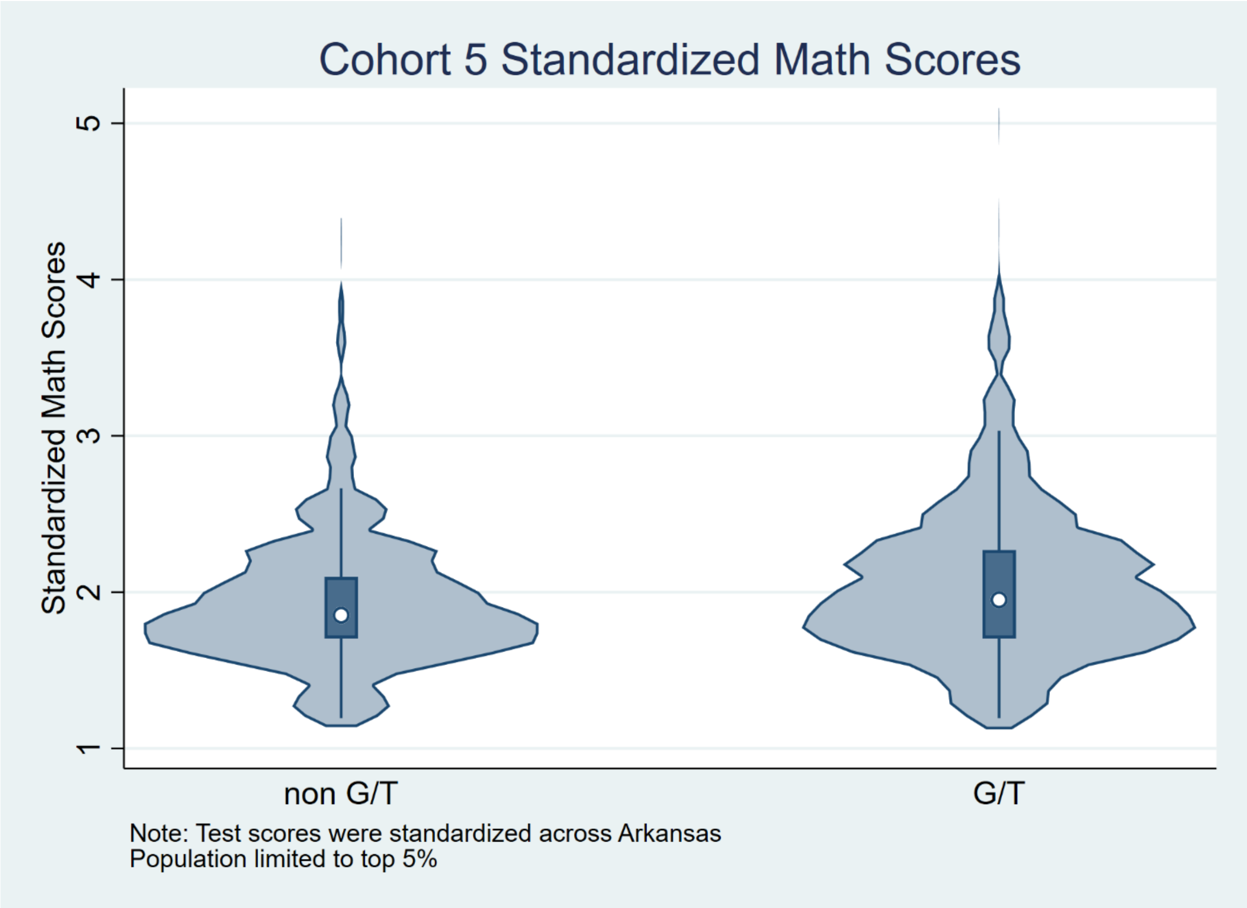

Figure 2. Distribution of standardized third grade math achievement for Cohort 5.

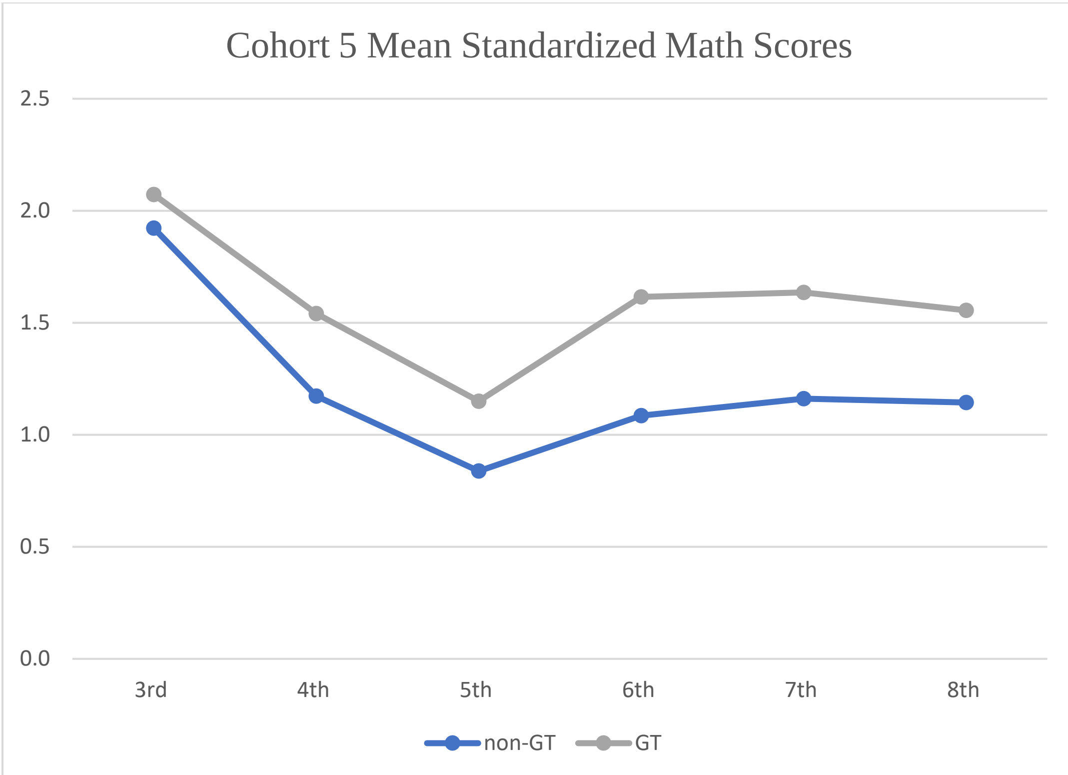

Figure 3. *Mean standardized math scores for Cohort 5, by grade. N=1,688.*

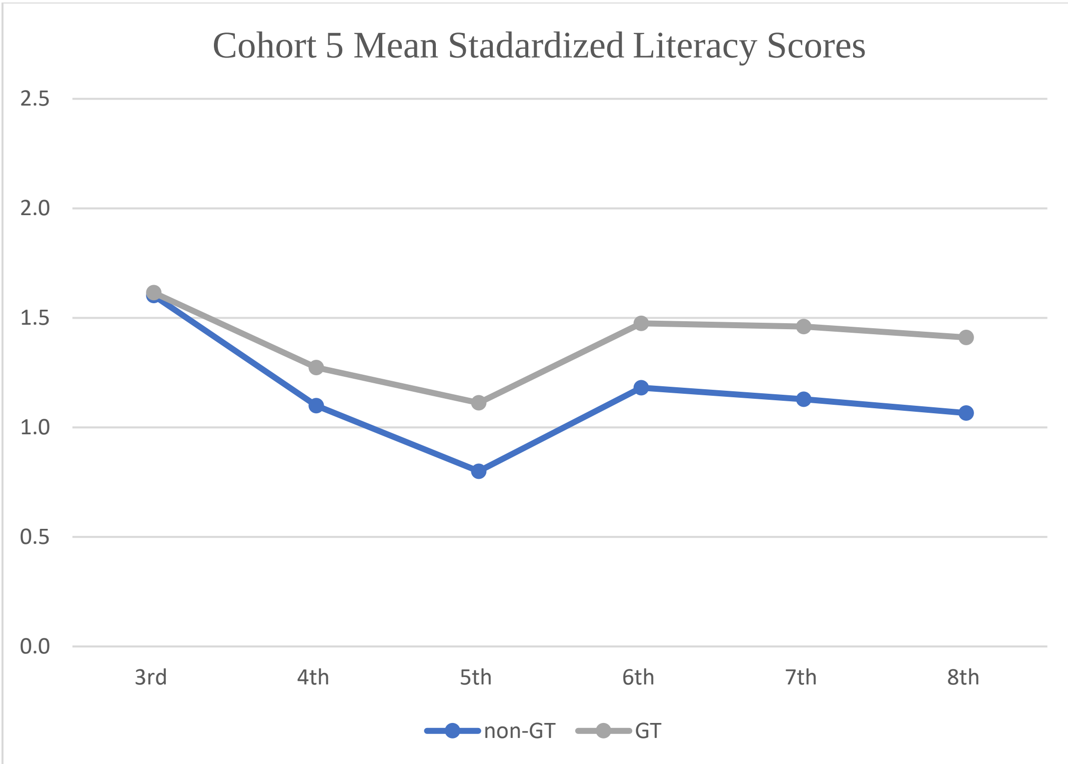

Figure 4. *Mean standardized literacy scores for Cohort 5, by grade N=1,615.*

Tables

Table 1

Cohort grade by academic year

Year	**2008-2009**	**09-10**	**10-11**	**11-12**	**12-13**	**13-14**	**14-15**	**15-16**	**16-17**	**17-18**
Ct. 1	Gr. 3	Gr. 4	Gr. 5	Gr. 6	Gr. 7	Gr. 8				
Ct. 2		Gr. 3	Gr. 4	Gr. 5	Gr. 6	Gr. 7	Gr. 8			
Ct. 3			Gr. 3	Gr. 4	Gr. 5	Gr. 6	Gr. 7	Gr. 8		
Ct. 4				Gr. 3	Gr. 4	Gr. 5	Gr. 6	Gr. 7	Gr. 8	
Ct. 5					Gr. 3	Gr. 4	Gr. 5	Gr. 6	Gr. 7	Gr. 8
	Benchmark Tests						PARCC	ACT Aspire Tests		

Table 2

Proportion of G/T students in the 3rd-8th grade samples, by cohort in math achievement

Math	3rd Grade	4th Grade	5th Grade	6th Grade	7th Grade	8th Grade
Cohort 1	51.9%	51.7%	52.1%	51.9%	51.2%	52.3%
N	2,030	1,992	1,888	1,827	1,639	1,596
Cohort 2	52.2%	52.1%	51.9%	51.6%	51.8%	40.0%
N	1,992	1,880	1,813	1,730	1,660	692
Cohort 3	56.8%	57.0%	57.1%	57.1%	57.1%	57.1%
N	2,013	1,985	1,881	1,779	1,678	1,635
Cohort 4	54.4%	54.5%	54.3%	53.9%	54.0%	54.2%
N	1,897	1,850	1,782	1,672	1,628	1,578
Cohort 5	56.0%	56.4%	56.1%	55.9%	55.8%	55.8%
N	1,990	1,939	1,859	1,767	1,724	1,688

Table 3

Proportion of G/T students in the 3rd-8th grade samples, by cohort in literacy achievement

Literacy	3rd Grade	4th Grade	5th Grade	6th Grade	7th Grade	8th Grade
Cohort 1	57.3%	57.3%	57.3%	57.3%	57.0%	57.2%
N	1,818	1,778	1,686	1,612	1,524	1,461
Cohort 2	54.5%	54.7%	54.5%	54.7%	54.6%	54.9%
N	1,742	1,693	1,640	1,544	1,495	1,460
Cohort 3	54.4%	54.3%	54.3%	54.1%	54.4%	54.5%
N	1,843	1,820	1,736	1,659	1,602	1,558
Cohort 4	52.8%	53.1%	53.4%	53.0%	52.8%	53.0%
N	1,935	1,877	1,800	1,712	1,658	1,612
Cohort 5	56.0%	56.4%	56.3%	56.2%	56.1%	56.3%
N	1,916	1,875	1,799	1,718	1,667	1,615

Table 4

Mixed-effects estimates of the relationship between gifted status and student math achievement measured by the standardized state assessment

Variables	Cohort 5		Cohort 4		Cohort 3		Cohort 2		Cohort 1	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Gifted status	.101***	.103***	.142***	.181***	.083***	.096***	.097***	.023	.111***	.090***
	(.013)	(.019)	(.014)	(.021)	(.015)	(.029)	(.025)	(.053)	(.015)	(.026)
Gifted*rural		.001		-.036		.001		.030		.017
		(.029)		(.023)		(.032)		(.052)		(.026)
Gifted*NEA		-.013		-.044		-.020		.099		-.023
		(.035)		(.040)		(.038)		(.061)		(.038)
Gifted*CA		.015		-.022		-.005		.059		.057*
		(.032)		(.035)		(.038)		(.067)		(.033)
Gifted*SEA		-.004		-.055		-.070		.024		.022
		(.081)		(.041)		(.046)		(.076)		(.061)
Gifted*SWA		-.102		-.035		-.077		.123		-.098
		(0.066)		(.067)		(.064)		(.116)		(.073)
Student characteristics controls	X	X	X	X	X	X	X	X	X	X
District level characteristics controls	X	X	X	X	X	X	X	X	X	X
Constant	1.950	1.934	1.896	1.880	1.841	1.835	1.787	1.818	2.083	2.094
	(.033)	(.033)	(.028)	(.030)	(.031)	(.034)	(.071)	(.072)	(.050)	(.047)
Observations	5,822	5,822	5,372	5,372	5,756	5,756	1,907	1,907	3,564	3,564
Number of groups	210	210	200	200	204	204	170	170	202	202

Robust standard errors in parentheses
*** p<.01, ** p<.05, * p<.1
All constants are significant at p<.01
Note: The omitted group for ethnicity is White; the omitted group for region is Northwest Arkansas. NEA: Northeast Arkansas, CA: Central Arkansas; SEA: Southeast Arkansas; SWA: Southwest Arkansas

Table 5

Mixed-effects estimates of the relationship between gifted status and student literacy achievement measured by the standardized state assessment

Variables	Cohort 5		Cohort 4		Cohort 3		Cohort 2		Cohort 1	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Gifted status	.052***	.053***	.029***	.037**	0.008	.036**	-.021	-.015	.008	-.001
	(.009)	(.016)	(.009)	(.016)	(0.008)	(.015)	(.014)	(.029)	(.006)	(.010)
Gifted##rural		.002		-.008		-.020		.000		.022
		(.017)		(.015)		(.015)		(.036)		(.013)
Gifted##NEA		-.017		-.032		-.024		.007		.015
		(.021)		(.021)		(.023)		(.033)		(.015)
Gifted##CA		.004		.032*		-.041**		-.043		-.015
		(.023)		(.018)		(.016)		(.048)		(.016)
Gifted##SEA		.020		-.054*		-.014		-.069		-.042*
		(.030)		(.032)		(.022)		(.058)		(.024)
Gifted##SWA		-.028		-.101		.009		.052		-.053**
		(.035)		(.090)		(.031)		(.045)		(.022)
Student characteristics controls	X	X	X	X	X	X	X	X	X	X
District level characteristics controls	X	X	X	X	X	X	X	X	X	X
Constant	1.633	1.633	1.527	1.528	1.512	1.494	1.446	1.443	1.313	1.317
	(.019)	(.023)	(.014)	(.014)	(.013)	(.013)	(.037)	(.042)	(.014)	(.015)
Observations	6,039	6,039	5,374	5,374	5,610	5,610	1,768	1,768	3,749	3,749
Number of groups	206	206	205	205	205	205	166	166	206	206

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1. All constants are significant at p<.01.

Note: The omitted group for ethnicity is White; the omitted group for region is Northwest Arkansas. NEA: Northeast Arkansas, CA: Central Arkansas; SEA: Southeast Arkansas; SWA: Southwest Arkansas

Chapter 3: Local Norms and Gifted and Talented Identification in Arkansas: Can It Help Improve Student Diversity?

Co-authored with Sarah McKenzie and Jonathan Wai

Abstract

In the past decades, the gifted and talented (G/T) community has wrestled with an important question about improving equity: How can we best use research to increase student diversity in G/T education? There are many suggestions for answering this question but using local norms, where students are selected based on comparisons with others from a similar school context using traditional measures, has attracted much attention. In some districts, using local norms and universal screening has greatly improved student diversity, whereas, in other districts, the findings have been unclear. Thus it seems useful to study local contexts. In this study, we leveraged Arkansas' administrative data to answer a similar question: "Would using district/school assessment norms improve student diversity in G/T identification in Arkansas?" We found no consistent evidence that using district/school norms would improve racial and programmatic diversity (i.e., special education students, students with limited English proficiency, and students from low-come and minority backgrounds). However, we still urge school districts to consider employing local norms in identifying G/T students. It would limit human errors in identification and increase the alignment between students' academic aptitude and G/T services, especially for students of racial and demographic groups that the current system has identified successfully.

Keywords: gifted and talented identification, local norms, Arkansas, high academic aptitude, gifted education policy

Introduction

Students' representation in gifted and talented (G/T) education has long been studied. One common concern is the underrepresentation of minority students (Callahan, 2005; Plucker & Peters, 2016; Yaluma & Tyner, 2021). Such students of color, students with limited English proficiency, and students from low-income families (Grissom & Redding, 2016; Gubbins et al., 2020; Harris et al., 2009). Improving the representation of such groups becomes relevant to the sustainable development of society as these are the people who may have the best understanding of the needs of their communities. The drive for social justice, therefore, justifies improving the diversity in G/T identification and education both for the personal flourishing of these students but also for the benefit for society.

Card and Giuliano (2016) conducted a quasi-experimental study suggesting that universal screening may increase diversity in G/T identification. Universal screening means "data are collected on all students at one or more grade levels" (Gubbins et al., 2020, p. 341). Many researchers have advocated for using local norms in concert with universal screening (Peters et al., 2019; Peters et al., 2021; Peters & Engerrand, 2016). Local norms mean emphasizing the local context of school districts or school buildings (Lohman, 2005; Lohman & Gambrell, 2012; Peters et al., 2019, 2021).

In Arkansas, regarding identification, Tran et al. (2022) found that students from low-income families are 50% less likely to be identified as G/T by 4th grade even if they scored in the top 5% statewide on both math and English Language Arts (ELA) state assessment tests in 3rd grade compared to their counterparts from affluent families. In this study, therefore, leveraging administrative data in Arkansas, we examined whether using local norms in tandem with universal screening would improve the identification rates of underrepresented students compared to the current identification practices. In the next sections, we first present relevant literature, methods, results, discussion, and a conclusion including policy implications.

Relevant Literature

Local Norms

Local norms is an approach to identify G/T students emphasizing the local context of school districts or school buildings (Peters et al., 2019; Peters et al., 2021). In this approach, students are ranked and selected for G/T services at the local level based on their composite achievement scores (Peters et al., 2021). Technical and practical details on how to use local norms in selecting G/T students can be found in McBee and Peters (2019) or visit https://osf.io/2pqmj/. in some cases, the local norm approach has been found to substantially increase rates of gifted identification for traditionally underrepresented students compared to using national norms (Lohman, 2005; Lohman & Gambrell, 2012; Peters et al., 2019, p. 15; Peters & Gentry, 2012).

G/T Identification and Education in Arkansas

All Arkansas public schools are required to provide G/T services (Arkansas Department of Education, 2009). Arkansas' Department of Education's rules define G/T students in the following way:

> Gifted and talented children and youth are those of high potential or ability whose learning characteristics and educational needs require qualitatively differentiated educational experiences and/or services. Possession of these talents and gifts, or the potential for their development, will be evidenced through an interaction of above-average intellectual ability, task commitment and /or motivation, and creative ability (Arkansas Department of Education, 2009).

The G/T identification process unfolds through many steps and can occur at any level from kindergarten to 12th grade. Under the current practice, students must first be nominated for consideration as qualifying for G/T. This nomination can come from various sources, including teachers, parents, or counselors. Following a nomination, data must be collected on the student including, per state requirement, at least two objective and two subjective measures with at least one of the objective measures being a creativity assessment. A committee consisting of at least five professional educators chaired by a trained specialist in gifted education then decide whether to place the student in G/T programs based on the collected information. This committee can be per campus within the districts and/or at the district level with representatives from each campus (Arkansas Department of Education, 2009).

The state provides guidelines and encourages their use, but ultimately it is the local school district that determines the G/T identification process. There is no consistently applied standard across the state to identify a student as G/T. In addition, districts have the autonomy to determine whether they will honor the gifted identification of a student that transfers from another district in the state. Selection criteria, therefore, are district-dependent with guidance from the state. Districts also determine the design and delivery of G/T services for identified students. G/T services vary widely across the state, but especially in the secondary setting, ranging from a G/T seminar or honors courses to advanced placement, such as AP/Pre-AP/Concurrent classes. However, there is no uniform way in how districts meet the needs of G/T students as local decisions lead to the implementation of services.

A district's gifted program must have an annual evaluation through a state program approval report (Arkansas Department of Education, 2009). G/T teachers must pass the Gifted Education Praxis Examination and meet licensing standards for an add-on endorsement/licensure in gifted education (Arkansas Department of Education, 2009). Once a student is identified as G/T, unless they change school districts, or ask to exit the program, the student retains the G/T label throughout their school years.

Few studies have examined G/T education and identification in Arkansas. Limited research has studied the effectiveness of G/T teacher training programs and early STEM interventions (Robinson et al., 2018; Robinson et al., 2014; Robinson et al., 2009). Regarding identification, Tran et al. (2022) was among the first to study the question of G/T identification in Arkansas. Tran et al. (2022) found that students from low-income families are less likely to be identified as G/T by 4th grade even if they scored in the top 5% statewide on both math and English Language Arts (ELA) state assessment tests in 3rd grade by 50%. Regarding the correlation between G/T status and academic achievement, Tran et al. (2021) found that G/T status had a positive correlation with academic growth and achievement among high aptitude students. Thus, local norms might be considered a novel way to expand identification to more students ready for advanced programming who might benefit from it.

There are two main findings from the limited studies about G/T identification and education in Arkansas. First, there is a concern about the underrepresentation of low-income students with high academic aptitude. Second, given the positive correlation between G/T status and academic achievement among high aptitude students, how can we extend the identification to serve a greater number of deserving students? It is against this background that we decided to investigate if using a local norms approach would help identify more racially diverse students and students from low-income backgrounds including those with limited English proficiency and special education needs.

Method

Data

We leveraged access to the state of Arkansas' education administrative data between the 2009 and 2019 fiscal years. The dataset contains anonymized student-level data for both students' demographic and programmatic characteristics, i.e., special education students, students with limited English proficiency, and students from low-come and minority backgrounds, as well as scores on state assessments. We rely on the 3rd grade and 4th grade data of all students in Arkansas as 3rd grade is the first statewide assessment and the majority of G/T students are identified by the 4th grade. In particular, for the 3rd grade, we use both demographic and achievement data to study top-ranked students. For the 4th grade, we use demographic data to study those students who were identified as G/T. Demographic and programmatic characteristics include free-and-reduced-price lunch (FRL) status, special education (SPED) status, limited English proficiency (LEP) status, race and ethnicity, and gender. Table 1 shows the descriptive summary for 3rd grade students and Table 2 shows the descriptive summary for all 4th grade G/T students in the consecutive year.

<Table 1 is here>

<Table 2 is here>

Table 1 shows that a majority of Arkansas 3rd grade students (approximately two-thirds) are from low-income families. About 10% of all students are students with special needs. About 6-9% of all students have limited English proficiency. Approximately 60% of 3rd grade students are White, about 20% of students are Black, and the Hispanic student population increased over the years, to approximately 14% in the 2018-19 school year. Slightly under 50% of 3rd grade students are female.

Table 2 reports the demographics of all G/T students identified in 4th grade of the following year. The proportion of low-income students has increased over the years. In the 2008-09 academic year, slightly under 50% of all G/T students are from low-income families. SPED and LEP students consistently account for a small proportion of all G/T identified students. White students are the majority of identified students, which, at 68%, is higher than the proportion of the general student population that is White in Arkansas (60%). Conversely, Black and Hispanic students are identified at a lower rate than their proportions of the student population. Female G/T students are identified at a higher rate than the rate in the general student population (53% compared to males at 47%).

Analytical Strategy

With access to the state's administrative data, we have the privilege of studying the entire population of Arkansas public school students. Our findings are thus close to population parameters for the time period studied. We, therefore, chose to conduct a descriptive statistical analysis using this dataset rather than inferential statistics. The goal of the descriptive approach is to describe the population of students within a school district using the current G/T identification schemes compared to the population that would be identified by using the local norm approach (see Figure 1). To achieve this goal, we completed three steps.

First, we examined the demographic and programmatic characteristics of 4th grade G/T identified students in each year and school district. We chose 4th grade because between 3rd and 4th grade, the total number of G/T jumped by 149% and by 4th grade approximately 87% of all G/T students were identified on average across Arkansas (see Appendix Table 1). This step generates the demographics of G/T students under the current identification scheme as well as the number of G/T identified 4th grade students each school district has. We used this number to represent available G/T seats at the district and school levels. As recommended in the local norms approach by Peters et al. (2021), we have two options: using a cut-score/percentile or using the number of available G/T seats. There is no available cut-score or determined percentile to screen G/T students in Arkansas. We, therefore, use the number of identified G/T students in 4th grade as a proxy for available G/T seats.

We created a composite score for each student using the previous year's 3rd grade achievement on statewide math and ELA exams. We then ranked students within each school district by the composite score. Using the number of 4th grade G/T students in each district as a proxy for the number of available seats, we identified "local norms G/T" students, selecting students from the ranked list until the available G/T seats were filled. We examined the demographic and programmatic characteristics of the students that would have been selected using local norms.

Finally, we compared the status quo identified and local norms identified students to determine if there was any difference regarding students' socioeconomic status, English proficiency status, special education status, race, or gender. We conducted this descriptive analysis for nine cohorts of 3rd and 4th grade students at the district level. In Arkansas, 78% of school districts have only one school serving 4th grade students. For the 10 largest school districts, we conducted an additional analysis using local school norms.

We use the term "cohort" to represent different years of comparison. A "cohort" is defined as the combination of top-ranked students in 3rd grade and G/T students in 4th grade in the following year. For example, Cohort 1 includes top-ranked students in 3rd grade in 2008-09 and G/T students in 4th grade in 2009-10 (see Table 3). We conducted both cross-sectional and pooled analyses in the study. In cross-sectional analysis, we examine the differences for each

Cohort. In the pooled analysis, we calculated the average demographic and programmatic changes for all nine cohorts.

We also investigated the potential change in gifted identification rates for various groups using school norms at the 10 largest school districts in Arkansas, namely Little Rock, Fort Smith, Springdale, Rogers, Pulaski County Special, Bentonville, Conway, Cabot, North Little Rock, and Fayetteville. Within the 10 largest school districts, there were significant differences among schools regarding student demographic and programmatic characteristics (see Table 3 in the Appendix for details). Therefore, we used school norms for these school districts to capture the changes in identification rates that district norms may not be able to achieve.

<Table 3 here>

<Figure 1 here>

Results

In Table 4, we reported school district counts for each cohort, whether the change by using local norms was negative, null, or positive. Table 5 shows the mean comparison of student demographic characteristics using the district norms approach and the current system. Positive changes indicate positive effects of using a district norm approach to increase G/T student diversity and vice versa. We found that, across nine cohorts, there was *no consistent evidence* that using a district norm approach would increase the racial or programmatic diversity of students identified as G/T except for the proportion of female students. Using district norms would increase the number of female students in identified students in six of the nine examined cohorts. This pattern is not, however, present for most of the recent cohorts (Cohorts 6-8). Female students, on the other hand, are over-represented in G/T education, as shown in Table 2. Looking at cohort specifics, we found that in Cohort 4 using the district norm approach would decrease student diversity in terms of race, socioeconomic background, and educational needs. In the most recent cohort, Cohort 9, we found that using district norms would increase the G/T rate of students with special needs, students with limited English proficiency, and female students.

We conducted a pooled analysis for all cohorts. As shown in Table 6, using district norms, on average, across nine cohorts, decreased the proportion of identified SPED students by one percent, and increased the proportion of female students by 4.5 percent. For other demographic and programmatic characteristics, we did observe statistically significant differences between students identified using local norms and students identified using the current selection mechanism.

We also investigated ten school districts in Arkansas with the largest student enrollment using the school norm approach. The largest 10 school districts include Little Rock, Fort Smith, Springdale, Rogers, Pulaski County Special, Bentonville, Conway, Cabot, North Little Rock, and Fayetteville. With this selection of the largest ten districts, we ensured that we studied the most diversified districts in terms of student demographics. At the school level, we are also able to account for the fact that school buildings may be different from one another even though they are in the same district. Using school norms, therefore, may amplify the benefits of local norms that is not captured at the district level. In Table 7, we reported school counts in the 10 largest school districts: whether there was a negative, null, or positive change, in G/T student demographic and programmatic characteristics using school norms (see Supplement A for full statistical results). We did not find consistent patterns that using school norms would improve student racial or programmatic diversity among G/T students.

Changes in the G/T identification rates for student demographic and programmatic characteristics between local norms and the status quo in the Little Rock school district are presented in Figure 2. Positive changes reflect increased identification rates using the school norm approach. We see that there was no consistently significant change in student demographics. Using school norms typically indeed reduced the proportion of low-income students with G/T identification; however, this result was not consistently statistically significant (see Supplement B for a full list of demographic characteristics and Table 3 in the Appendix for a full comparison of school demographic and change in G/T identification rates for individual schools in Little Rock for Cohort 9).

<Tables 4-7 here>

<Figure 2 here>

Discussion

Using local district norms and local school norms in identifying G/T students with the goal of increasing the G/T identification rates of underrepresented student groups would not be particularly successful in Arkansas. We did not find consistent patterns of change in student demographics across Arkansas nor in the 10 largest school districts, except for some pattern in the proportion of female students, which may mean many more females are indeed ready for more advanced programming, noting that female students are already over-identified. This finding may seem to undermine the argument for using local norms in G/T identification (Lohman & Gambrell, 2012; Peters et al., 2019; Peters & Gentry, 2012), at least in Arkansas. Local norms have enjoyed some hype in the last decade as the remedy for improving student diversity in G/T. Our research, however, shows that the success of using local norms to increase demographic and programmatic diversity profoundly depends on the local context. In Arkansas, for example, school segregation may limit the effect of local norms. No matter which method school districts use to select G/T students, if there is no diversity within the school district, the same demographic and programmatic students will be identified.

In addition, while it might be true that local norms may not change the current diversity, using local norms may in conjunction with universal screening help limit human bias in selecting students into G/T services. The current G/T identification system in Arkansas starts with a nomination. Researchers have found that nomination may have a negative impact on student diversity in G/T education (McBee et al., 2016). Using local norms will help to reduce human error in selecting students.

Although we did not find that using local norms would increase diversity in G/T education in Arkansas, the local norms approach allows identifying students with high academic aptitude who deserve G/T service as defined by the Arkansas Department of Education. Therefore, on the positive side, leveraging district norms in Arkansas will help increase the alignment of student aptitude and G/T services. This alignment coupled with the positive correlation between G/T status and academic achievement (Tran et al., 2021) may lead to bigger impacts of G/T education in Arkansas to be more effective in supporting student learning. The key is to identify the students who will most benefit from G/T services and provide them with timely and appropriate education and training.

Limitations and Future Research

We limited our analysis to 4th grade because by 4th grade, on average, 87% of all G/T students were identified in Arkansas. However, we also acknowledge that the remaining 13% may create a difference if students mainly come from underrepresented groups. However, the highest numbers of G/T students across Arkansas are mainly in 5th grade, then 7th and 6th grade.

After that, the numbers decline (see Appendix Table 1). Future steps should look into this peak and decline trend and identify who enters and leaves the G/T services.

We are also limited by looking at math and ELA scores only to create composite scores and rankings for students. Other tests are being used to identify students in some school districts, such as the Cognitive Abilities Test or Measures of Academic Progress tests. Including other measures in creating the opposite scores may allow more insights into the use and benefits of local norms in the context of local school districts in Arkansas.

Conclusion

Using local norms may vary based on context, and thus, a state by state or a local analysis may be important to conduct to understand whether the strategy could be useful. This shows that theoretical approaches that seem to work broadly really need to be examined in specific contexts. Our study highlights this point, at least in the case of Arkansas. Better research needs to be conducted to solve problems on the ground.

In our study, we examined if using a local norm approach would improve the G/T identification rate of students, particularly programmatic groups, i.e., special education students, students with limited English proficiency, and students from low-come and minority backgrounds. We did not find consistent evidence to support that using local norms would succeed in doing so. However, we believe that using district and school norms will allow for the identification of students with high academic appropriateness who are ready for G/T services. By identifying a broader range of students with academic aptitude ready for advanced programming in comparison to their local peers, we would improve the alignment between service and students, which will ultimately benefit students. We, therefore, urge school districts in Arkansas to consider this approach in identifying their G/T students as one possible tool in addition to others in seeking to improve the identification and service of talented students across the state.

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Figures

Figure 1

Comparing AR current identification strategy and a local norms approach

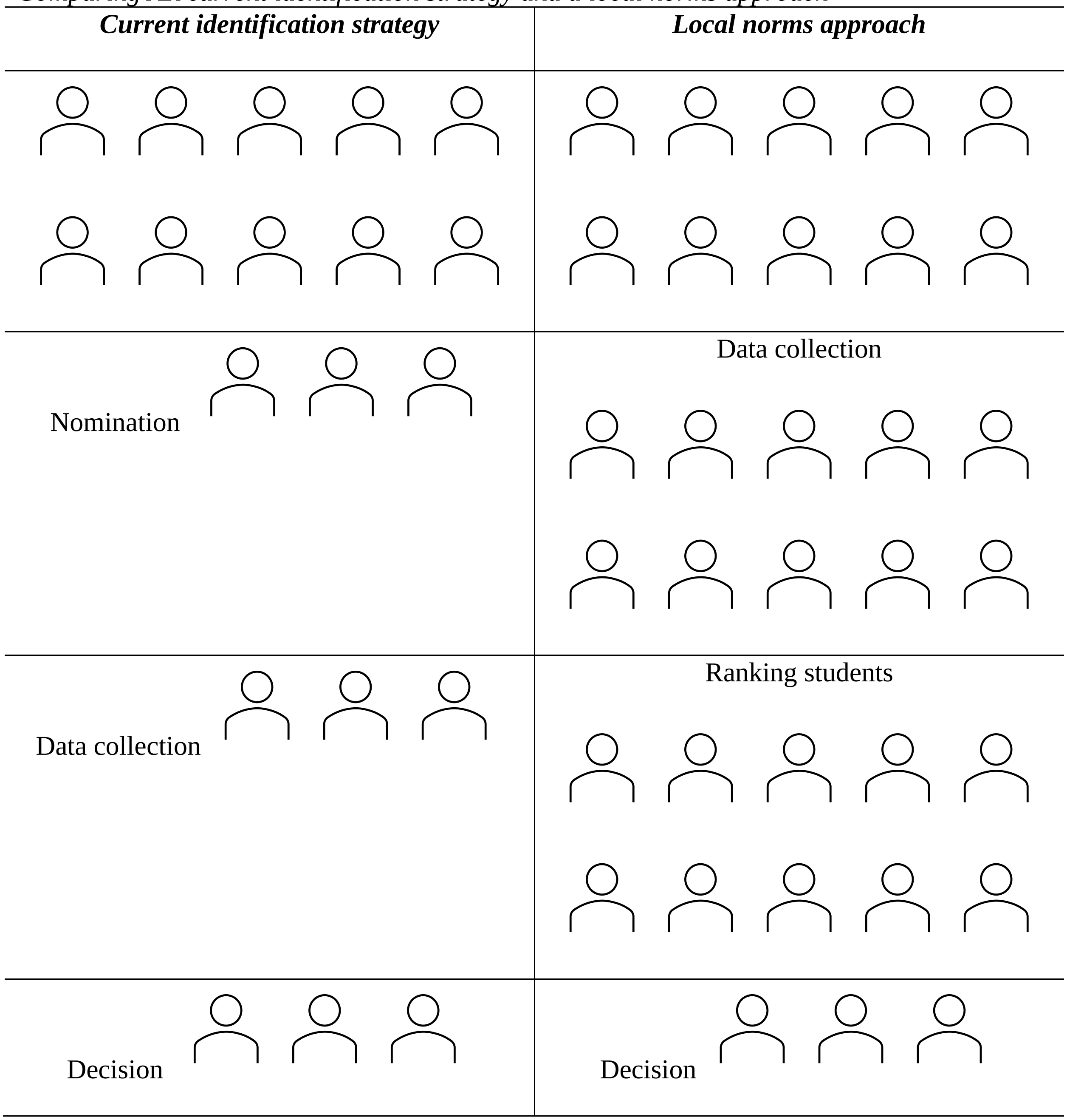
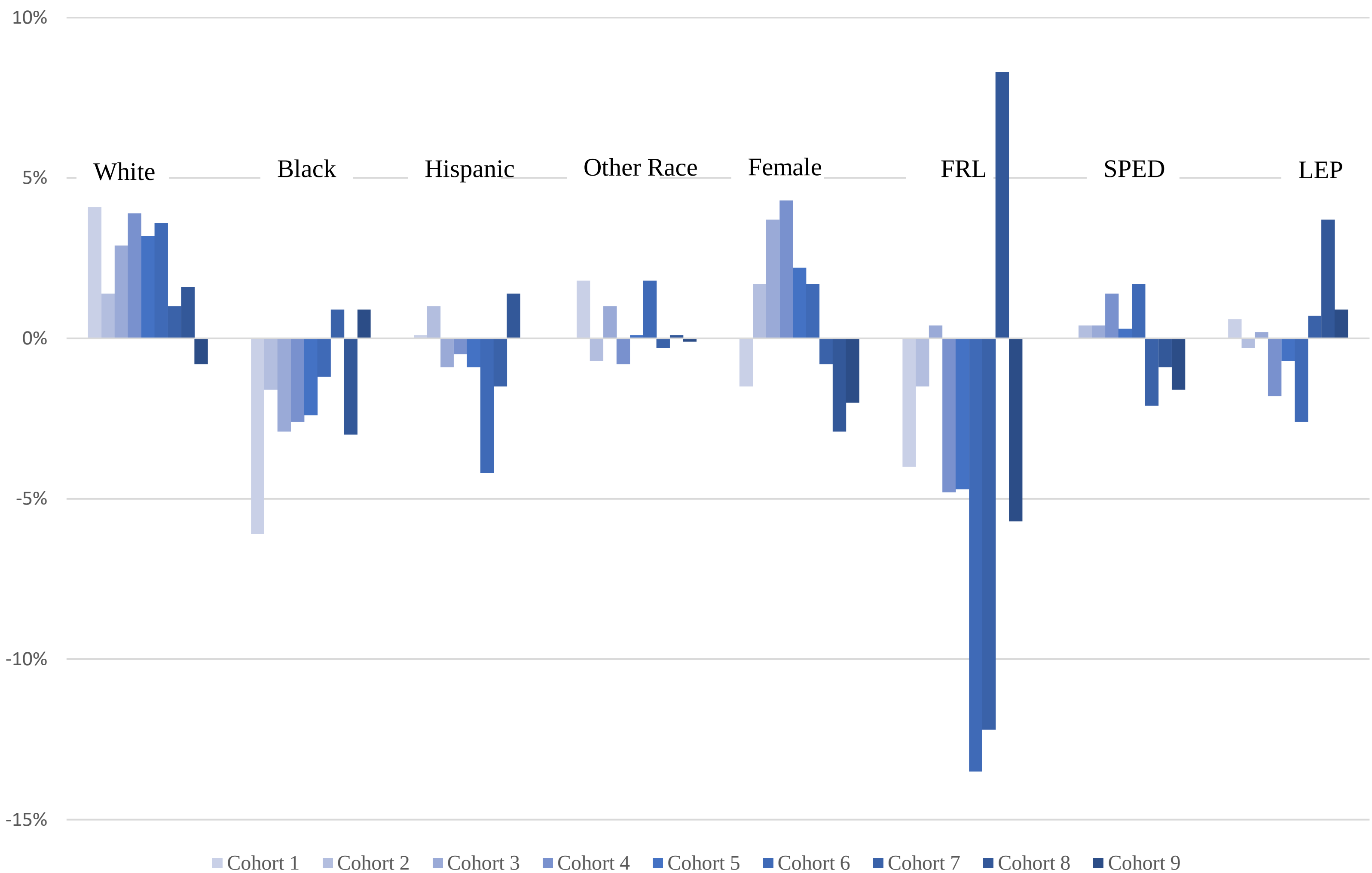


Figure 2

Change in G/T ID rates for Little Rock School District (School Norms - current identification ratecurrent identification rate), by student demographics and Cohorts



Tables

Table 1

Summary statistics of all third-grade students' demographics (limited to students with both math and ELA records), percent

	FRL	SPED	LEP	White	Black	% Hispanic	Other race	Female	N
2008-09	62.2	10.0	7.5	66.3	22.1	9.3	2.4	49.3	35,130
2009-10	64.5	10.6	7.8	64.9	21.6	9.8	3.6	48.7	35,992
2010-11	65.0	10.7	8.4	64.2	21.0	10.8	4.0	49.1	35,440
2011-12	65.5	11.0	8.8	63.7	20.3	11.4	4.6	48.5	35,537
2012-13	64.8	11.2	8.6	63.6	20.1	11.1	5.2	49.3	35,069
2013-14	64.9	11.5	8.8	62.8	20.2	11.9	5.0	48.9	34,603
2015-16	67.5	9.0	6.1	60.7	20.4	13.4	5.5	49.3	37,594
2016-17	68.3	9.3	6.3	60.0	21.0	13.2	5.8	49.2	37,684
2017-18	67.3	10.3	7.1	59.9	20.2	14.0	5.9	48.5	37,027

Table 2

Summary statistics of all fourth-grade G/T students' demographics

	% FRL	% SPED	% LEP	% White	% Black	% Hispanic	% Other race	% Female	N
2009-10	38.4	1.6	2.7	74.1	16.9	5.0	4.0	55.4	4,220
2010-11	40.1	1.9	3.2	74.0	16.3	5.3	4.3	53.7	4,164
2011-12	41.3	1.8	3.9	71.5	17.5	6.4	4.7	52.9	4,413
2012-13	42.0	1.8	4.1	71.5	16.6	7.0	4.9	53.3	4,494
2013-14	41.3	2.0	3.7	69.9	17.4	7.1	5.6	53.8	4,610
2015-16	42.0	1.8	3.5	71.5	16.4	6.8	5.3	53.2	4,325
2016-17	46.5	1.7	4.1	68.8	16.8	5.6	5.9	54.2	4,252
2017-18	46.2	1.8	3.0	66.2	17.0	9.6	7.2	53.2	4,186
2018-19	49.2	2.4	1.9	67.9	14.9	9.7	7.5	53.0	4,116

Table 3

Cohort definition

	Cohort 1	**Cohort 2**	**Cohort 3**	**Cohort 4**	**Cohort 5**	**Cohort 6**	**Cohort 7**	**Cohort 8**	**Cohort 9**
3rd grade	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2015-16	2016-17	2017-18
4th grade	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2016-17	2017-18	2018-19

Table 4
District counts for change (local norms – current identification rate) in Arkansas, percent

Cohort	1		2		3		4		5		6		7		8		9	
Changes	–	+	–	+	–	+	–	+	–	+	–	+	–	+	–	+	–	+
FRL	29.6	36.3	15.0	44.1	26.0	45.8	79.1	15.1	21.0	49.6	28.5	39.8	26.0	41.6	25.1	40.5	23.1	33.9
SPED	8.4	12.8	7.5	15.4	5.7	17.6	93.8	5.3	10.7	14.7	9.0	16.7	15.1	2.3	17.2	1.4	21.7	1.4
LEP	7.1	5.8	5.7	5.3	6.2	6.2	48.4	4.4	7.1	7.1	9.5	8.6	7.8	9.1	6.0	7.9	2.7	13.1
White	17.3	31.9	22.0	26.0	19.8	20.7	22.2	72.0	27.7	21.4	25.8	24.9	24.7	25.1	23.7	29.3	20.8	27.1
Black	17.7	13.3	16.7	12.8	12.8	12.8	58.7	6.7	14.7	14.7	16.3	10.9	16.4	14.2	15.8	11.6	9.5	12.7
Hispanic	15.9	13.3	11.5	14.5	11.0	16.3	60.4	16.4	13.8	12.9	14.5	19.0	13.7	16.4	18.1	14.0	19.5	15.8
Other race	17.7	7.1	12.8	8.4	15.9	6.6	47.1	28.4	9.4	17.9	11.8	15.8	12.8	15.5	12.1	18.6	20.4	9.5
Female	24.8	45.1	22.5	47.6	25.1	44.5	20.4	78.2	21.4	53.6	24.4	47.1	35.2	34.7	27.0	41.4	75.1	40.7
Total districts	226		227		227		225		224		221		219		215		221	

Note: "–" indicates a negative change, "+" indicates a positive change. All negative changes are grey shaded.

Table 5

t-tests for mean comparisons on student demographics (mean difference = local norms – current identification rate) at the district level

Cohort	FRL	SPED	LEP	White	Black	Hispanic	Other race	Female	N
1	.013	-.002	.000	.030	-.014	-.003	-.013**	.039**	226
	(.027)	(.005)	(.004)	(.020)	(.018)	(.007)	(.006)	(.017)	
2	.029	.008	.002	.003	-.002	.005	-.006	.051***	227
	(.026)	(.009)	(.004)	(.021)	(.020)	(.007)	(.006)	(.019)	
3	.047*	.013**	.001	.003	-.001	.004	-.006	.042**	227
	(.026)	(.007)	(.004)	(.021)	(.019)	(.007)	(.005)	(.018)	
4	-.168***	-.106***	-.025***	.080***	-.063***	-.026***	.009	.120***	225
	(.020)	(.008)	(.007)	(.022)	(.021)	(.009)	(.006)	(.014)	
5	.066***	.009	.003	-.006	-.006	.004	.008	.076***	224
	(.024)	(.009)	(.006)	(.020)	(.017)	(.008)	(.006)	(.017)	
6	.015	.007	-.003	.006	-.007	-.000	.002	.030	221
	(.026)	(.004)	(.005)	(.021)	(.019)	(.008)	(.007)	(.019)	
7	.029	-.011	.001	-.011	-.001	.011	.001	-.013	219
	(.029)	(.007)	(.005)	(.024)	(.022)	(.010)	(.006)	(.020)	
8	.023	.012*	.003	-.005	.004	-.005	.006	.024	215
	(.030)	(.007)	(.005)	(.025)	(.021)	(.011)	(.008)	(.019)	
9	.008	0.014**	.013***	.018	-.002	-.007	-.009	.034*	221
	(.031)	(.007)	(.004)	(.025)	(.022)	(.010)	(.007)	(.019)	

Standard errors in parentheses

*** p<.01, ** p<.05, *p<.1

Table 6

t-tests for mean comparisons on student demographics (mean difference = local norms – current identification rate) using district norms, pooled analysis

Demographics	FRL	SPED	LEP	White	Black	Hispanic	Other race	Female
Mean difference	.007	-.012***	.001	.030	-.010	-.002	-.001	.045***
	(.009)	(.003)	(.002)	(.020)	(.007)	(.003)	(.002)	(.006)

Standard errors in parentheses

*** p<.01, ** p<.05, *p<.1

Table 7

School counts for change (local norms – current identification rate) – Largest 10 school districts, percent

Cohort	**1**		**2**		**3**		**4**		**5**		**6**		**7**		**8**		**9**	
Changes	–	+	–	+	–	+	–	+	–	+	–	+	–	+	–	+	–	+
FRL	28.8	32.2	31.7	28.3	32.4	33.1	37.6	22.1	32.5	39.1	34.5	36.5	31.2	34.1	18.6	44.3	42.4	38.1
SPED	7.5	12.3	8.3	15.2	9.5	14.2	10.1	15.4	15.2	9.3	8.1	14.9	20.3	3.6	16.4	5.0	25.9	2.9
LEP	11.6	17.1	11.7	14.5	12.8	18.9	14.1	14.8	10.6	25.8	16.9	22.3	12.3	19.6	7.9	25.7	9.4	23.7
White	17.8	36.3	23.4	36.6	24.3	38.5	22.8	43.0	30.5	37.1	29.1	31.1	26.1	31.2	32.1	31.4	38.8	39.6
Black	30.1	15.1	27.6	10.3	27.7	10.1	28.2	11.4	29.1	13.9	22.3	12.8	25.4	17.4	22.1	15.0	24.5	29.5
Hispanic	19.9	15.1	14.5	22.1	16.2	20.9	22.8	24.2	21.2	29.8	22.3	26.4	24.6	28.3	19.3	33.6	34.5	35.3
Other race	12.3	11.0	17.2	15.9	21.6	16.2	18.8	16.1	16.6	22.5	16.9	21.6	18.8	19.6	20.7	20.7	29.5	26.6
Female	28.8	39.7	29.0	44.8	29.7	40.5	22.1	47.0	23.2	50.3	29.7	45.9	36.2	398.6	27.9	37.1	37.4	55.4
Total schools	146		145		148		149		151		148		138		140		139	

Note: "–" indicates a negative change, "+" indicates a positive change. All negative changes are grey shaded.

Appendix

Table 1

Number of G/T students by grade by year in 4th grade

Grade	2008	2009	2010	2011	2012	2013	2014	2015	2017	2018	2019
1	298	210	216	138	166	142	121	135	61	79	68
2	754	705	674	635	671	823	917	757	759	798	383
3	2,894	2,834	2,728	2,831	3,197	3,070	2,983	2,899	2,747	2,847	2,561
4	4,106	4,354	4,220	4,164	4,413	4,494	4,610	4,325	4,252	4,186	4,116
5	4,634	4,720	4,956	4,918	**5,055**	**4,905**	**5,133**	**5,089**	4,624	4,998	**4,802**
6	4,745	4,723	4,788	5,074	5,009	5,030	4,825	5,068	4,921	**4,807**	**5,005**
7	4,626	4,872	4,948	**5,001**	**5,171**	**5,051**	4,923	4,888	4,930	4,767	4,671
8	4,813	4,440	4,727	4,797	4,741	5,029	4,748	4,644	4,869	4,764	4,796
9	4,288	4,568	4,326	4,456	4,675	4,641	4,849	4,557	4,603	4,638	4,647
10	4,149	4,014	4,358	4,046	4,431	4,509	4,416	4,589	4,418	4,401	4,546
11	3,858	3,690	3,729	3,957	3,929	4,169	4,168	4,120	4,301	4,183	4,198
12	3,801	3,637	3,536	3,559	3,995	3,863	4,066	4,086	4,196	4,166	4,069

Note: Highest numbers of G/T are highlighted. Colors represent Cohorts. 5/10 Cohorts peaked in 5th grade, 2/10 peaked in 6th grade, and 3/10 peaked in 7th grade.

Table 2

District variations in student G/T identification rate and student racial characteristics

School District	Mean of Enrollment	Mean G/T	Average FRL	Average % White	Average % Black	Hispanic
Bentonville	625	3.8%	24.2%	70.9%	3.1%	11.0%
		[1.6%; 6.1%]	[8.6%; 44.6%]	[46.4%; 83.5%]	[1.0%; 7.5%]	[7.8%; 18.5%]
Cabot	422	4.5%	43.7%	86.6%	2.2%	5.6%
		[2.1%; 7.6%]	[27.2%; 62.3%]	[69.0%; 91.7%]	[0.6%; 6.1%]	[3.2%; 16.3%]
Conway	436	3.8%	57.1%	54.5%	28.3%	10.3%
		[2.2%; 6.2%	[30.5%; 75.0%]	[45.6%; 70.5%]	[15.7%; 42.8%]	[5.8%; 18.9%]
Fayetteville	482	6.7%	40.7%	67.3%	9.8%	11.4%
		[3.9%;9.0%]	[9.2%; 80.5%]	[47.5%;85.9%]	[1.4%; 20.3%]	[4.5%; 20.5%]
Fort Smith	410	3.6%	77.0%	40.6%	12.2%	33.5%
		[1.3%; 5.4%]	[42.8%; 97.1%]	[12.1%; 66.6%]	[2.9%; 24.1%]	[11.5%; 66.0%]
Little Rock	404	14.7%	73.0%	20.1%	58.7%	16.5%
		[4.5%; 39.7%]	[18.8%; 98.4%]	[0.9%; 74.5%]	[14.9%; 96.0%]	[2.2%, 45.7%]
North Little Rock	427	8.8%	75.3%	28.2%	58.9%	10.4%
		[5.4%; 15.3%]	[32.2%; 98.0%]	[3.8%; 68.7%]	[23.1%; 90.2%]	[3.2%; 25.7%]
Pulaski County Special	337	9.9%	53.6%	42.0%	40.0%	10.0%
		[4.4%; 14.6%]	[18.3%; 94.5%]	[7.1%; 67.3%]	[18.8%; 87.4%]	[2.4%; 37.0%]
Rogers	494	4.2%	60.5%	44.6%	1.6%	46.2%
		[2.7%; 8.0%]	[11.0%; 81.5%]	[17.9%; 80.3%]	[0.0%; 4.0%]	[9.8%; 78.2%]
Springdale	566	6.9%	74.7%	33.0%	2.4%	47.4%
		[2.7%; 10.1%]	[26.7%; 97.7%]	[6.4%; 79.8%]	[0.8%; 6.2%]	[10.4%; 73.7%]

Ranges are included in brackets.

Source: https://myschoolinfo.arkansas.gov/

Table 3

Student demographic and programmatic characteristics in 4th grade at the school level and change in G/T identification rate Cohort 9, Little Rock, percent

School	FRL	SPED	LEP	White	Black	Hispanic	Other	Female
Booker Arts Magnet Elem.	85.9	12.5	26.6	6.3	62.5	31.3	0.0	68.8
	(-18.3)	(-7.7)	(1.9)	(1.0)	(0.6)	(-1.6)	(0.0)	(13.5)
Bale Elem.	89.2	23.1	18.5	3.1	73.8	16.9	6.2	35.4
	(15.9)	(0.0)	(-5.3)	(0.8)	(12.90	(-6.1)	(-7.6)	(14.4)
Brady Elem.	96.4	26.8	7.1	3.6	85.7	7.1	3.6	41.1
	(-16.7)	(-16.7)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(16.7)
Mcdermott Elem.	87.0	15.2	10.9	4.3	78.3	8.7	8.7	45.7
	(-8.6)	(0.0)	(-20.0)	(14.3)	(-8.6)	(-20.0)	(14.3)	(-22.9)
Carver Magnet Elem.	77.1	18.8	10.4	4.2	68.8	22.9	4.2	41.7
	(-6.1)	(-2.4)	(0.0)	(-2.4)	(-10.9)	(8.1)	(5.3)	(-8.9)
Forest Park Elem.	20.0	14.3	1.4	70.0	21.4	7.1	1.4	45.7
	(-4.5)	(-9.4)	(0.0)	(-4.4)	(3.5)	(0.9)	(0.0)	(-12.3)
Gibbs Magnet Elem.	61.4	6.8	6.8	25.0	65.9	6.8	2.3	47.7
	(-8.9)	(-6.7)	(0.0)	(-11.1)	(6.7)	(4.4)	(0.0)	(0.0)
Western Hills Elem.	88.1	14.3	26.2	14.3	57.1	26.2	2.4	54.8
	(0.0)	(0.0)	(7.1)	(0.0)	(-7.1)	(7.1)	(0.0)	(0.0)
Jefferson Elem.	42.2	31.1	0.0	60.0	33.3	2.2	4.4	33.3
	(3.3)	(6.7)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(3.3)
Meadowcliff Elem.	95.5	18.2	20.5	6.8	68.2	25.0	0.0	40.9
	(-14.3)	(0.0)	(1.3)	(7.1)	(2.6)	(-9.7)	(0.0)	(13.6)
M.L. King Magnet Elem.	94.7	19.3	1.8	0.0	94.7	5.3	0.0	43.9
	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(9.5)
Pulaski Heights Elem.	65.9	13.6	0.0	27.3	61.4	4.5	6.8	52.3
	(27.9)	(0.0)	(0.0)	(-15.9)	(32.9)	(-8.5)	(-8.5)	(-17.5)
Romine Interdist. Elem.	97.8	21.7	23.9	0.0	76.1	23.9	0.0	37.0
	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(-10.0)
Stephens Elem.	87.7	31.5	1.4	4.1	93.2	1.4	1.4	43.8
	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(-9.1)

Table 3

Student demographic and programmatic characteristics in 4th grade at the school level and change in G/T identification rate Cohort 9, Little Rock, percent

School	FRL	SPED	LEP	White	Black	Hispanic	Other	Female
Washington Magnet Elem.	93.1	19.0	1.7	0.0	94.8	3.4	1.7	46.6
	(-17.5)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(4.8)
Williams Magnet Elem.	56.6	11.8	7.9	22.4	64.5	2.6	10.5	51.3
	(3.5)	(-6.3)	(12.7)	(0.8)	(0.3)	(7.7)	(-8.8)	(-4.5)
Terry Elem.	82.1	14.3	8.9	21.4	62.5	10.7	5.4	55.4
	(-6.3)	(0.0)	(6.3)	(-6.3)	(0.0)	(12.5)	(-6.3)	(6.3)
Fulbright Elem.	39.3	13.5	5.6	49.4	39.3	5.6	5.6	46.1
	(-2.4)	(-3.9)	(2.7)	(1.3)	(-6.5)	(2.5)	(2.7)	(-2.4)
Rockefeller Incentive Elem.	85.3	26.5	5.9	5.9	88.2	5.9	0.0	44.1
	(-17.8)	(0.0)	(6.7)	(6.7)	(-20.0)	(6.7)	(6.7)	(2.2)
Baseline Elem.	91.5	31.0	43.7	11.3	36.6	49.3	2.8	62.0
	(0.0)	(0.0)	(-10.0)	(-10.0)	(20.0)	(-10.0)	(0.0)	(10.0)
David O.Dodd Elem.	64.1	15.4	33.3	5.1	64.1	30.8	0.0	43.6
	(-1.5)	(0.0)	(-18.5)	(6.7)	(11.8)	(-18.5)	(0.0)	(-29.2)
Mabelvale Elem.	95.4	14.9	21.8	6.9	63.2	27.6	2.3	49.4
	(-6.7)	(0.0)	(6.7)	(0.0)	(-23.3)	(23.3)	(0.0)	(-13.3)
Otter Creek Elem.	75.4	18.0	29.5	6.6	62.3	31.1	0.0	41.0
	(-20.0)	(0.0)	(12.5)	(-11.3)	(2.5)	(8.8)	(0.0)	(-12.5)
Wakefield Elem.	97.5	7.5	37.5	2.5	55.0	41.3	1.3	48.8
	(-15.8)	(0.0)	(-7.9)	(0.0)	(17.9)	(-17.9)	(0.0)	(-2.6)
Don Roberts Elem.	26.8	15.2	8.5	50.6	25.0	4.9	19.5	50.0
	(-2.3)	(-1.3)	(10.8)	(1.5)	(-5.1)	(-1.3)	(5.0)	(4.0)
Forest Heights Stem Academy	46.4	8.7	11.6	27.5	49.3	11.6	11.6	44.9
	(9.7)	(3.6)	(-0.4)	(2.4)	(2.2)	(-0.3)	(-4.4)	(1.7)
Watson Elem.	86.8	10.5	28.9	0.0	69.7	30.3	0.0	39.5
	(-11.1)	(0.0)	(19.4)	(0.0)	(-16.7)	(16.7)	(0.0)	(-11.1)
Chicot Elem.	99.0	14.6	36.5	3.1	53.1	41.7	2.1	46.9
	(-41.7)	(0.0)	(0.0)	(-4.2)	(8.3)	(-4.2)	(0.0)	(0.0)

Note: Change in G/T student demographics and programmatic characteristics are in parentheses (change = local norms – current identification rate). Elem. = elementary school.

Overall Conclusion

I started my dissertation by discussing challenges in researching gifted and talented (G/T) education and identification. Such challenges include public support, definition and terminology, accountability, and methodology. I then used administrative data between 2009 and 2019 to answer three questions regarding G/T identification and education in Arkansas: (1) How can we improve gifted identification to capture academically advanced low-income and disadvantaged students? (2) Do gifted services benefit high aptitude students? (3) Can the local norms approach help with student demographic and programmatic diversity in G/T education?

In seeking to answer the first question, we predicted the likelihood of being identified as gifted and talented by 4^{th} grade in public schools in Arkansas for students with high academic aptitude in 3^{rd} grade. We found that poor high aptitude students were 50% less likely to be identified compared to their more affluent peers after controlling for individual and district differences. We recommended that school districts look at their current practices and consider universal screening to improve the representation of deserving students from low-income families.

Based on the foundation of the first question, we know that some high achieving students were identified as G/T, and some were not. Leveraging this fact, we followed the same group of students from 3^{rd} to 8^{th} grade to study the correlation between being identified as G/T and their academic achievement. Using mixed-effects analysis for longitudinal data, we found that high aptitude students identified as G/T by 4^{th} grade scored higher consistently in state math assessments across five examined cohorts than their high aptitude peers who were not identified as G/T by 4^{th} grade. A similar pattern was found in more recent cohorts for literacy. With such positive correlations between G/T identification and achievement, we urge districts to keep and expand G/T services to serve more deserving students and help them excel in their learning. However, future research should examine ways that a causal claim could be made regarding the effect of G/T services and investigate the black box of G/T services at the school and district levels.

Also inspired by findings from the first paper, we extended this approach and examined whether local norms would improve the discrepancy in the G/T identification rate of students from low-income and minority families as well as students with diverse educational needs, including students with limited English proficiency and students with special needs. Across nine cohorts, we did not find consistent evidence that using district norms could help improve demographic and programmatic diversity in G/T identification rates. We applied school norms for the ten largest school districts in Arkansas, hoping that because of the diversity in these districts, a school norm approach may help capture things that district norms may not be able to achieve. However, we did not find evidence that using local norms to identify G/T students could improve demographic and programmatic diversity in G/T identification either. However, using local norms may help reduce human errors in identifying students who might benefit from appropriate developmental placement in educational services they are ready for.

A critical limitation of the three studies is that they do not produce causal inferences. Even though we tried to account for observable characteristics at both student level and district level and the nested structure of our data, or when we even have access to the entire student population of Arkansas, we could not affirm that the findings are causal. However, having access to administrative data is a significant improvement from other studies in the G/T field, and provides an important starting point for more evaluation studies in the future.

Another limitation of our studies is that our selection of gifted and talented does not match the identification process provided by Arkansas. We limited our analysis to 3rd grade achievement and 4th grade achievement. However, we stayed faithful to the state's broad definition of gifted and talented students with high academic aptitude. We believe our definition of giftedness and readiness is not far off from reality in Arkansas. Future steps should include (1) incorporating more measures of giftedness that align with the state's definition and (2) examining the mobility of G/T students, among other topics.

In summary, there are three important takeaways from my research: first, some academically ready students from low-income families are being missed in the current gifted and talented education system. Second, gifted and talented services indeed seem to benefit students academically, particularly in math. And finally, using this local norm approach does not appear to successfully improve diversity in the G/T student pool. However, using the local norm approach will identify academically ready students, which ultimately improves service alignment and resource utilization. Finally, this series of studies is the first to look into G/T identification and services in Arkansas. It highlights that research is dependent on local context and can produce robust evidence to benefit students, especially those from underprivileged backgrounds.