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Intersectional Program Evaluation: Considering Race, Class, Sex, and Language in Gifted Program Effectiveness

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Abstract: Gifted education is an effective intervention for high-ability students who need more academic challenges. However, the relationship between program effectiveness and demographic categories has been scantly evaluated. Research focused on the effectiveness of gifted education infrequently considers the intersections of ability, race, sex, socioeconomic status, and language. To fill this gap, I used an ex post facto quasi-experimental design to conduct a cross-sectional evaluation of gifted service models at the intersections of cultural identity groups in Ohio. Findings underscore the relationship between the type of gifted service model and achievement on standardized math test scores varying across demographic groups.

Keywords: gifted and talented education; program evaluation; intersectionality; achievement; equity; best match

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1. Introduction

Gifted and talented education (GATE) programs in the United States have largely remained segregated well after Brown v. Board of Education [1]. There is a wealth of research on the underrepresentation of minoritized groups in GATE, as researchers in the field continue to raise the alarm on inequitable access issues related to the assessment and identification of students from minoritized groups [2–7]. Representation is not only an outcome of access; representation is also an impetus for persistence. For minoritized students identified as gifted, research indicates issues related to retaining these students in GATE [8]. Many studies evaluate the general effectiveness of various models of gifted service provision in the United States [9–11]. However, much of the extant research on the effectiveness of GATE does not take an intersectional approach to evaluate service models at the intersections of ability, race, socioeconomic status, and English learner status.

The underrepresentation of minoritized students in gifted programs is often mirrored in GATE research, as research on this topic is largely based on samples from racially homogenous populations. The broader implication is that policies about gifted education are shaped by research in which students from minoritized groups, whose needs may differ from their peers, are not represented. This study aims to make a case for intersectional [12] program evaluation and research. Data from the state of Ohio, a state that mandates gifted identification, mirror the nationwide trend; students with economic disadvantages and students who are Black or Hispanic are underrepresented in gifted programs. White and Asian students are overrepresented in identification for gifted programs. In Ohio's statewide review of five years of gifted data, there were no conditions in terms of district urbanicity, poverty level, or population size in which Black students had proportional representation in identification [13]. Though Ohio has a policy that requires screening, assessing, and identifying gifted students, the state does not require districts to provide services related to gifted identification [14]. Ohio also does not have a formal process for evaluating and promoting effective gifted programs and interventions. Program evaluation is essential to ensuring support and services are appropriately aligned to students' needs.

In this study, I reviewed four years of Ohio programming data to evaluate the relationship between types of gifted service models and the math achievement of gifted-identified students across demographic groups and document how the relationship between the types of gifted service models and achievement on standardized math test scores varies across demographic groups. The focus was to determine if some service model types were associated with higher mean math scores for students based on their cultural group membership than others. In line with consequential research on culturally responsive teaching and culturally responsive pedagogy [15], findings from this research could help move understanding closer to identifying if and which particular models of service are more responsive to students based on their group identities. Intersectionality is used in my analysis to frame how the evaluation of GATE program effectiveness is typically organized around meeting the needs of some students while making invisible the needs of others at the margins of race, SES, and ability.

2. Materials and Methods

2.1. Sample and Sources

This study was conducted in SY19-20 before the onset of COVID-19. Criterion sampling was used for this research. The Ohio Department of Education (ODE) provided student-level data for all Ohio elementary students in grades third through fifth who were reported as gifted identified between School Year (SY) 2015–16 and SY 2018–19. In Ohio, students may be identified as gifted using various state-approved instruments, including the Cognitive Abilities Test (CogAT), i-Ready Assessment, Measures of Academic Performance (MAP) Growth, Naglieri Nonverval Ability Test Third Edition (NNAT3), PSAT, SAT, ACT, The Iowa Assessments, Wechsler Intelligence Scale for Children Fifth Edition (WISC V), and others [16]. From this data, students who were identified as gifted in math and/or superior cognitive and receiving services, as indicated by one of ODE's approved service models, were included in this study. See Table 1 for descriptions for each service model. This study included 149,907 observations of student math scores from the Ohio State Tests. Of these students, 125,972 (84.03%) received gifted education, while 23,935 (15.97%) were not provided gifted education. Students that were provided gifted education had higher mean scores on the math portion of the Ohio State Tests (m = 774.81, s.d. = 31.45) than students who were not provided gifted education (m = 767.43, s.d. = 36.04). Students were provided services through service models such as post-secondary enrollment options, early entrance to kindergarten, self-contained classrooms, grade acceleration, innovative services, cluster grouping, pullout enrichment, art instruction by a trained art instructor, International Baccalaureate program, mixed models, subject acceleration, guidance services, advanced placement, educational options, honors classes, other services, and differentiation in the regular classroom. Regular classroom is used throughout this paper to be consistent with ODE's program language and refers to the general classroom or where a student's learning takes place absent gifted programming. Descriptions for each service model are in Table 1.

Table 1. Descriptions for each service model.

Service Models	Based on the Ohio Department of Education Descriptions
Cluster grouping	Several gifted students are deliberately placed in one class and provided services.
Pullout enrichment	Students are regularly assigned (but less than 100% of time) to a resource room for gifted students instead of their regular classroom. The instruction is differentiated and delivered by a GIS who is not the teacher of record.
Self-contained gifted classroom	Courses that are primarily designed for gifted students and the instructor is credentialed in gifted education.
Subject acceleration	A gifted student is placed in a classroom with other students who are at a higher grade level than would normally be expected. Report this code for a student in the year one or more courses in the specific subject sequence are skipped.

Table 1. *Cont.*

Service Models	Based on the Ohio Department of Education Descriptions
Differentiation in the regular classroom	Services are provided in the regular classroom, and gifted students are not specifically grouped in the class (in contrast to Cluster Grouping).
Honors classes	Specific subject area classes which are differentiated from a regular (same) subject area class in terms of breadth, depth, and complexity.
Other services	Use of this service model should be rare and is likely to generate a request from the ODE for additional information from the district to document the nature of the "other service".
Educational options	Educational options provide experiences for individual students who need services not available in the regular school setting. They may include independent study, mentoring, and distance learning.
Grade Acceleration	A gifted student is moved to a higher grade level than would normally be expected for the current year, such as a double promotion at the end of the prior year or a midyear promotion during the current year.
Innovative services	An innovative service is a service not already described in the Gifted Operating Standards that offers a sustained and challenging experience, based on evidence or research suggesting the service is effective or is a promising practice, to meet the unique needs and interests of the district's students who are gifted.
Guidance	Services received from a guidance counselor and/or a guidance program specifically designed to meet the social and emotional needs of gifted children, including making academic and career choices.
Advanced placement	College-level courses with corresponding examinations in multiple subject areas (e.g., mathematics, art, and history). Credit for college may be obtained if a student takes in an AP examination sponsored by the College Entrance Examination Board and given in the spring of each school year.
International Baccalaureate	Services through an International Baccalaureate course.
Post-secondary enrollment options/CCP	Students may enroll in college-level courses and receive college credit and credit toward graduation from high school at the same time.
Art instruction by a trained art instructor	Services through a trained arts instructor trained in the arts areas of dance, visual arts, drama/theater, ormusic.
Early kindergarten	Students are admitted to kindergarten or first grade before they have reached the district's usual cut-off age and date for kindergarten or first grade.

2.2. Outcome Variable

Academic achievement. The ODE requires the administration of standardized assessments for students in grades three to twelve annually in the spring across Ohio [17]. The procedures for administering standardized assessments include ensuring the assessment is proctored by staff who have completed a test administrator (TA) certification course. The standardized assessments include a math exam for Grades 3–8. The standardized assessments for Grades 9 through 12 and advanced students in lower grade levels include algebra and geometry or integrated math 1 and 2. Students have between 150–180 min for math exams. Based on the number of questions students answered correctly on the assessment, raw scores are converted to scaled scores, the proportion of the overall questions students answered correctly, to allow for a consistent comparison of results. Scaled score range on the assessment is as follows: Grade 3, 587–818 (m = 719.56, s.d. = 47.92, Grade 4, 605–835 (m = 728.85, s.d. = 49.05), and Grade 5, 624–804 (m = 711.09, s.d. = 39.20) [17].

2.3. School-Level Variables

Service models. Gifted programs and services are delivered to gifted-identified students using service models. There are approximately eleven types of service model options listed in Chapter 3324.07 of the Ohio Revised Code (ORC): a differentiated curriculum; cluster grouping; mentorships; accelerated course work; the college credit plus program; advanced placement; honors classes; magnet schools; self-contained classrooms; independent study; and other options identified in rules adopted by the department of education [18] (p. 4). The regular classroom teacher or a gifted intervention specialist can deliver these service models. ORC requires boards of education to develop a plan for service of gifted students, including service models from the state-approved list [19]. In

this study, the categorical variables of service were recoded into a series of dichotomous dummy variables. The referent group in the dichotomous coding signifies the group of well-represented students that the underrepresented student groups were compared with.

Students who received gifted education through cluster grouping were coded as 1, and those who were not serviced through cluster grouping were coded as 0. Students who received gifted education through educational options were coded 1, and students who did not were coded 0. When grade acceleration was used to provide gifted programming, the coding was 1, and when services were provided through a different model, the coding was 0. Gifted programs that used guidance as a service model were coded as 1, and programs that did not use guidance as a service model were coded as 0. Students who received gifted education through Honors classes were coded as 1, and those who did not were coded as 0. When International Baccalaureate (IB) was used to provide gifted education, students were coded as 1, and students were coded as 0 when IB was not used. Students who received gifted education through innovative services were coded as 1, and those who did not were coded as 0. Students who received gifted education through post-secondary enrollment were coded as 1, and those who did not were coded as 0. Students who did not receive services were the referent group. When pullout services were used to provide gifted programming, the coding was 1, and when services were provided through a different model, the coding was 0. Gifted programs that used enrichment in the regular classroom as a service model were coded as 1, and programs that did not use enrichment in the regular classroom as a service model were coded as 0. Students who received gifted education through subject acceleration were coded as 1, and those who did not were coded as 0. When "other" services were used to provide gifted programming, the coding was 1, and when services were provided through a different model, the coding was 0. Students who received gifted education through self-contained classrooms were coded as 1, and those who did not were coded as 0. Some of the service models were originally coded separately if they were provided by a classroom teacher or a gifted intervention specialist. Those service models were combined for analysis in this study because of collinearity.

Cultural identity. Students identified as gifted are typically White, medium-to-high SES, male, have no disability status, and are not English learners [20]. These characteristics were used as the demographic variables representing student cultural identity and modeled as binary predictors. Economic disadvantagement represented a student's free or reduced-priced meal status and was a proxy for socioeconomic status for this study. In Ohio, schools with 40% or more students eligible for free or reduced-priced meal status, directly certified based on government assistance, homelessness or runaways, migrant, participating in Federal Head Start, or a confirmed foster child, are eligible for the Community Eligibility Provision [18]. The Community Eligibility Provision (CEP) allows schools to provide all students with school meals at no cost to the students [18]. When CEP was first made available, the ODE did not create new coding options to distinguish economically disadvantaged students in CEP schools from those not economically disadvantaged. However, the ODE has since made new codes to remedy this prior limitation [21]. In this study, economically disadvantaged students were coded as 1, and students who are not were the referent group. The disability status variable is a measure of the students who have a learning disability condition (SWD), which according to the ODE EMIS manual chapter 2.5 [21] (p. 5) can include multiple disabilities (other than deaf–blind), deaf–blindness, deafness (hearing impairment), visual impairments, speech and language impairments, orthopedic impairments, emotional disturbance (SBH), intellectual disabilities (formerly mental retardation, developmentally handicapped, or cognitive disabilities), specific learning disabilities, autism, traumatic brain injury (TBI), other health impaired (major), other health impaired (minor), and developmental delay. Students with a disability were coded as 1, and students without a disability were the referent group. English learner (EL) status is assigned to students for whom English is not the primary language and who have not yet achieved a score high enough on the Ohio English Language Proficiency Assessment (OELPA) to be coded as not EL. Students who were English language learners were coded as 1, and students who

were not EL were the referent group. Sex in this data was a binary variable represented as female (1), and male was the referent group. Black and Hispanic are included as the race variable. Black and Hispanic were included as a combined variable due to collinearity in the preliminary analysis of the data. If a student is Black or Hispanic, they were coded as 1, and all other race and ethnicity groups were coded as 0.

3. Research Design

This research used an ex post facto quasi-experimental design to conduct a cross-sectional evaluation of gifted service models at the intersections of ability, race, socioeconomic status, and English learner status. Given ethical and practical considerations concerning manipulating access to education-related services and instruction, ex post facto designs are commonly employed in education and social science research [22]. Using an ex post facto quasi-experimental design allowed this study to use data that have already been collected for the purposes of teaching, learning, and state assessment to test a hypothesis about the causal relationship between the independent variable, service model type, and the dependent variable, achievement on the math portion of the Ohio State Tests, even though the independent variable cannot be manipulated as it would be in a true experimental design.

4. Analytic Plan

The 15th version of Stata, a statistical software package, was used to model the mixed-effects multilevel regression needed to evaluate the relationship between types of gifted service models and the math achievement of gifted-identified students across demographic groups and document how the relationship between the types of gifted service models and achievement on standardized math test scores varies across demographic groups. In multilevel analysis, there should be a minimum of 20 level-two units [23], represented in this study by schools. For educational research, the smallest number of level-two units used should be 30, and the most frequently used number of level-two units is 50 [24]. Level-two units with sample sizes that are less than 50 may have standard error estimate bias at the group level [24]. This study met and exceeded the minimum threshold and most frequently used number of level-two units.

The effect size was calculated using the standardized group mean. The effect size was measured using Cohen's d, which is calculated by dividing the difference in the treatment group mean and the referent group mean by the overall population standard deviation [22]. The rule of thumb guidance suggested by Cohen is $d = 0.20$ is a small effect size, $d = 0.50$ is a medium effect size, and $d = 0.80$ is a large effect size [25]. This effect size is a measure of practical significance, which is how meaningful the result is in a practical or real-life context.

A regression analysis provides the best model for predicting the outcome variable: student math achievement scores. As the data contain individual student-level data that are nested within schools, a mixed-effects multilevel regression was used to control for school characteristics and account for lack of independence in error due to this clustering [23]. Dummy coding was used to create multiple dichotomous variables, because the predictor variable is categorical. This coding allowed for a more meaningful interpretation of differences between predictor variables on achievement scores than would have been possible if the predictor variables were coded as multiple-group categorical variables [22].

Appropriate measures were taken to screen the data for missing values, outliers, non-normal distribution, balance, and multicollinearity. These measures included using frequency distribution tables, descriptive statistics analysis, scatter plots, bar charts, and a plan for handling missing and extreme values [22]. Missing values were handled using casewise deletion. Casewise deletion removes all cases with missing or incomplete data, ensuring that the analysis is consistently based on the same cases [26]. Removing whole cases from the dataset could threaten the strength of the analysis if too many cases are removed [26], but the large sample size in this study made it robust enough to overcome this threat. The

data screening process also involved checking that assumptions for conducting regression analyses have been met. Regression analysis assumptions are that the relationship between the independent and dependent variable is linear, there is no multicollinearity between the independent variables, and that the variables have homoscedasticity, normally distributed residuals, and no extreme outliers [22].

Achievement regressed on service model as moderated by cultural identity. Multilevel regression analysis was to evaluate whether the characteristics of a student's cultural identity (i.e., sex, race/ethnicity, SWD, SES, and EL) have a moderating effect on each service model's impact on student math achievement.

Level 1. $Math_{ij} = \beta_j + \epsilon_{ij}$

Level 2. $\beta_j = \gamma_0 + \gamma_1 ServiceX_j + \gamma_2 IdentityX_j + \gamma_1 ServiceX_j \gamma_2 IdentityX_j + \zeta_j$

In this set of models, $Math_{ij}$ is the predicted mean score of a schools' Ohio State Test math achievement β_j. In Level 2, β_j is a school's mean math score as predicted by service model type. The second model also includes γ_1, the intercept coefficient for the service model, γ_2, the intercept coefficient for cultural identity, the interaction effect of the two factors, and ζ_j, the school-level deviation from the overall mean. $IdentityX$ represents a series of dummy variables that represent different cultural identities. A sex dummy variable was scored 1 for students who are female. A race variable was scored 1 for students who are Black and/Hispanic. The variable SWD was scored 1 for students with disabilities. The variable SES was scored 1 for students who are from low-income households. The variable LEP was scored 1 for students who are English learners. The interaction between each service model and cultural identity is represented as $\gamma_1 ServiceX_j \gamma_2 IdentityX_j$.

Cultural identity, service model type, and the interaction between cultural identity and service model type were included in the model. School was included as a level-two variable to control for unobserved school characteristics. These are the models that were used for the third question. The variables that represent cultural identity are heterogeneous, and within group differences likely exist for students with disabilities and the other groups represented in this study. Having a robust sample size and controlling for unobserved school factors helps improve the effectiveness of these variables while moving the research closer to answering the question of which service model(s) is the best match. Research from Vygotsky provides lasting insights from a social constructivist perspective into the learning and development of children, which informs readers of the crucial role social and cultural contexts play in child development [27]. Children from underserved cultural groups are often disadvantaged by familial and environmental circumstances and need culturally responsive educational opportunities [28]. Including cultural identity in the model is necessary for a more nuanced evaluation of service model effectiveness than the first model of the study.

5. Results

There were statistically significant differences in mean math scores for students from minoritized cultural groups who received gifted education when compared with gifted-identified students in the referent groups who were not provided gifted education. I controlled for unobserved characteristics of schools, cultural identity, and the interaction between service model type and cultural identity. Gifted-identified students in the referent groups had higher average math achievement than students who were female ($\gamma = -3.79$, $p < 0.00$, $d = 0.30$), English learners ($\gamma = -6.82$, $p < 0.00$, $d = 1.66$), Black and/or Hispanic ($\gamma = -15.23$, $p < 0.00$, $d = 0.54$), students with disabilities ($\gamma = -16.14$, $p < 0.00$, $d = 0.35$), or low-income students ($\gamma = -28.66$, $p < 0.00$, $d = 0.76$); see Table 2.

The main effects of each service model were also evaluated (Table 3). For the referent group gifted-identified students, early entrance to kindergarten ($\gamma = 11.86$, $p < 0.01$, $d = 3.68$) was associated with the highest average math achievement compared with students not provided gifted education. Grade acceleration ($\gamma = 5.99$, $p < 0.00$, $d = 0.54$), self-contained

classrooms ($\gamma = 3.91$, $p < 0.00$, $d = 0.28$), guidance services ($\gamma = 3.57$, $p < 0.00$, $d = 0.99$), pullout enrichment ($\gamma = 2.18$, $p < 0.00$, $d = 0.32$), and cluster grouping ($\gamma = 1.12$, $p < 0.00$, $d = 0.31$) were also associated with math achievement scores that were higher than those of referent group gifted-identified students who were not provided gifted education. Other service models used with referent group gifted-identified students were associated with average math achievement that did not significantly differ from those of those who were not provided gifted education. These service models include the International Baccalaureate program, innovative services, post-secondary enrollment options, advanced placement, art instruction by a trained art instructor, and using more than one service model. The service model that was associated with the lowest average math achievement of the referent group gifted-identified students were honors classes ($\gamma = -6.05$, $p < 0.00$, $d = 0.33$). Educational options ($\gamma = -5.01$, $p < 0.00$, $d = 0.49$), differentiation in the regular classroom ($\gamma = -4.27$, $p < 0.00$, $d = 0.32$), subject acceleration ($\gamma = -2.02$, $p < 0.00$, $d = 0.31$), and other services ($\gamma = -1.99$, $p < 0.00$, $d = 0.48$) were also associated with average math scores that were significantly lower than average math scores of the referent group gifted-identified students who were not provided gifted education.

Table 2. Main Effects of Gifted Service Models on Student Math Achievement based on Mixed-Effect Multilevel Regression.

Predictor	Coef. (γ)	Std. Err.	Effect Size Key
			Large +
SEX	−3.79 ***	0.30	medium +
LEP	−6.82 ***	1.66	small +
RACE	−15.23 ***	0.54	no effect
SES	−16.14 ***	0.35	small −
SWD	−28.66 ***	0.76	medium −
			large −

Note: Referent group students in the dichotomous dummy coding are students who are not Black and/or Hispanic, students with medium to high SES, students identified as male, students without a disability, and students who are proficient in English. Effect size as indicated by green coloring with a + symbol represents positive effect sizes, while red coloring with a − symbol represents negative effect sizes. *** $p < 0.001$.

Table 3. Moderation Effects of Gifted Service Models on Student Math Achievement based on Mixed-Effect Multilevel Regression.

	Predictor	Coef. (γ)	Std. Err.	Effect Size Key
				Large +
typical gifted student	Early kindergarten	11.86 **	3.68	medium +
	Self-contained gifted classroom	3.91 ***	0.28	small +
	Grade acceleration	5.99 ***	0.54	no effect
	Cluster grouping	1.12 ***	0.31	small −
	Pullout enrichment	2.18 ***	0.32	medium −
	Subject acceleration	−2.02 ***	0.31	large −
	Guidance services	3.57 ***	0.99	
	Educational options	−5.01 ***	0.49	
	Honors classes	−6.05 ***	0.33	
	Other services	−1.99 ***	0.48	
	Differentiation in the regular classroom	−4.27 ***	0.32	

Note: Effect size as indicated by green coloring with a + symbol represents positive effect sizes, while red coloring with a − symbol represents negative effect sizes. *** $p < 0.001$, ** $p < 0.01$.

Additionally, the effect of service models on math achievement based on cultural identity (Table 4) was estimated. The estimated effect of the service models for each cultural identity indicated the size of the effect varied across cultural groups (i.e., gender, race, disability status, socioeconomic status, and language learner status). For female students, the effects of post-secondary enrollment options ($\gamma = 41.33$, $p < 0.00$, $d = 3.71$), honors classes

($\gamma = 4.05$, $p < 0.00$, $d = 0.52$), innovative services ($\gamma = 2.59$, $p < 0.05$, $d = 1.16$), educational options ($\gamma = 2.01$, $p < 0.05$, $d = 0.78$), and cluster grouping ($\gamma = 1.97$, $p < 0.00$, $d = 0.42$) were significantly higher than the effects for male students. The largest positive difference in service model effect for female students was a 37.54-point increase in mean math score associated with post-secondary enrollment options. The effects of subject acceleration ($\gamma = -1.49$, $p < 0.01$, $d = 0.48$), other services ($\gamma = -2.52$, $p < 0.01$, $d = 0.73$), guidance services ($\gamma = -5.23$, $p < 0.00$, $d = 1.25$), International Baccalaureate ($\gamma = -13.71$, $p < 0.00$, $d = 3.41$), and advanced placement ($\gamma = -18.90$, $p < 0.05$, $d = 8.65$) were lower for females than males. The largest negative difference in service model effect for female students was an 18.40-point decrease in mean math score associated with advanced placement. When considering grade acceleration, pullout enrichment, differentiation in the regular classroom, self-contained classrooms, art instruction by a trained art instructor, and early entrance to kindergarten, and when more than one service model was used to provide services, there was no significant effect on the math achievement of female students when compared to males.

Table 4. Estimated Effect of Gifted Service Models Based on Cultural Identity.

Predictor	Typical	Sex	Race	SWD	SES	LEP
Post-secondary enrollment options	−3.95	37.54	−82.37			
Early kindergarten	11.86 ***				−8.68	
Self-contained gifted classroom	3.91 ***		5.60	18.63	1.26	15.79
Grade acceleration	5.99 ***		13.39			
Innovative services	0.07	2.66	18.43			
Cluster grouping	1.12 ***	3.08	7.68	19.07	4.65	
Pullout enrichment	2.18 ***		−2.56	−2.56	−0.99	
Art instruction by a trained art instructor	2.51					
International baccalaureate	1.59	−12.12		27.95		
More than one service type	0.67			−8.08		
Subject acceleration	−2.02 ***	−3.51			−4.48	
Guidance services	3.57 ***	−1.66	18.18		−0.65	
Advanced placement	0.50	−18.40				
Educational options	−5.01 ***	−3.00		19.03		−83.32
Honors classes	−6.05 ***	−2.00	2.81	17.46	−0.10	
Other services	−1.99 ***	−4.51	2.47			
Differentiation in the regular classroom	−4.27 ***		−13.50	11.95		

Note: Blank cells indicate that the effect for females, Black and/or Hispanic students, students with disabilities, low-income students, and English learner students was not statistically significantly different than that for students in majority cultural groups ($p < 0.05$). *** $p < 0.001$.

For Black and/or Hispanic students, the effects of innovative services ($\gamma = 18.36$, $p < 0.00$, $d = 7.73$), guidance ($\gamma = 14.61$, $p < 0.01$, $d = 5.32$), honors classes ($\gamma = 8.86$, $p < 0.00$, $d = 2.46$), grade acceleration ($\gamma = 7.4$, $p < 0.05$, $d = 3.27$), cluster grouping ($\gamma = 6.56$, $p < 0.00$, $d = 0.82$), and self-contained classrooms ($\gamma = 1.69$, $p < 0.05$, $d = 0.81$) were significantly higher than the effects for White students. The largest positive difference in service model effect for Black and/or Hispanic students was an 18.43-point increase in math score associated with innovative services. The effects of pullout enrichment ($\gamma = -4.74$, $p < 0.00$, $d = 0.91$), differentiation in the regular classroom ($\gamma = -9.23$, $p < 0.00$, $d = 1.21$), and post-secondary enrollment options ($\gamma = -78.42$, $p < 0.05$, $d = 37.57$) were lower for Black and/or Hispanic students than White students. The largest negative difference in service model effect for Black and/or Hispanic students was an 82.37-point decrease in mean math score associated with post-secondary enrollment options. When considering educational options, International Baccalaureate, subject acceleration, and art instruction by a trained art instructor, and when more than one service model was used to provide services, there was no significant effect on the math achievement of Black and/or Hispanic students when compared to White students.

For students with a disability, the effects of the International Baccalaureate ($\gamma = 18.36$, $p < 0.00$, $d = 7.73$), educational options ($\gamma = 14.61$, $p < 0.01$, $d = 5.32$), honors classes ($\gamma = 8.86$, $p < 0.00$, $d = 2.46$), cluster grouping ($\gamma = 6.56$, $p < 0.00$, $d = 0.82$), differentiation in the regular

classroom ($\gamma = 7.4$, $p < 0.05$, $d = 3.27$), pullout enrichment ($\gamma = -4.74$, $p < 0.00$, $d = 0.91$), and self-contained classrooms ($\gamma = 1.69$, $p < 0.05$, $d = 0.81$) were significantly higher than the effects for students without a disability. The largest positive difference in service model effect for students with a disability was a 27.95-point increase in math score associated with International Baccalaureate. The effects of when more than one service model was used ($\gamma = -9.23$, $p < 0.00$, $d = 1.21$) were lower for students with a disability than students without a disability. The largest negative difference in service model effect for students with a disability was an 8.08-point decrease in mean math score associated with when more than one service model was used. When considering grade acceleration, guidance services, innovative services, other services, subject acceleration, and art instruction by a trained art instructor were used to provide services, there was no significant effect on the math achievement of students with a disability when compared to students without a disability.

For students from low-income families, the effects of honors classes ($\gamma = 5.95$, $p < 0.00$, $d = 0.92$) and cluster grouping ($\gamma = 3.53$, $p < 0.05$, $d = 0.49$) were significantly higher than the effects for students from middle-to-high income families. The largest positive difference in service model effect for students with a disability was a 4.65-point increase in math score associated with cluster grouping. The effects of subject acceleration ($\gamma = -2.46$, $p < 0.01$, $d = 0.73$), self-contained classrooms ($\gamma = -2.65$, $p < 0.00$, $d = 0.48$), pullout enrichment ($\gamma = -3.17$, $p < 0.00$, $d = 0.54$), and guidance services ($\gamma = -4.22$, $p < 0.01$, $d = 1.32$) were lower for students from low-income families than students from middle-to-high income families. The largest negative difference in service model effect for students with a disability was an 8.68-point decrease in mean math score associated with early entrance to kindergarten. When considering educational options, grade acceleration, International Baccalaureate, innovative services, other services, post-secondary enrollment options, differentiation in the regular classroom, and art instruction by a trained art instructor, and when more than one service model was used, there was no significant effect on the math achievement of students from low-income families when compared to students from middle-to-high income families.

For English learner students, the effects of self-contained classrooms ($\gamma = 11.88$, $p < 0.00$, $d = 2.91$) were significantly higher than the effects for students without a language learner status. The largest positive difference in service model effect for English learner students was a 15.79-point increase in math score associated with self-contained classrooms. The effects of educational options ($\gamma = -78.31$, $p < 0.05$, $d = 30.74$) were lower for English learner students than students without a language learner status. The largest negative difference in service model effect for English learner students was an 83.32-point decrease in mean math score associated with educational options. When considering cluster grouping, grade acceleration, guidance services, honors classes, other services, pullout services, differentiation in the regular classroom, and subject acceleration, and when more than one service model was used, there was no significant effect on the math achievement of English learner students when compared to students without a language learner status.

6. Discussion

As a theoretical frame, intersectionality sharpens the focus on the structural dimensions of GATE experienced by students at intersections of ability and race/ethnicity, language, socioeconomic status, and sex. Crenshaw (1989) defined intersectionality as the ways in which systems of oppression such as racism, sexism, and other forms of discrimination overlap to create a unique synthesized experience of burdens for Black women at the intersection of multiple identities. The number of intersecting identities a person can experience, according to Crenshaw [29], depends on the kind of discrimination, policies, and institutional structures that play a role in excluding some people and not others. The work of Hill-Collins [30] focuses on the overall power dynamics and social organization that allow intersectional oppressions to be born, developed, and thrive.

Access to appropriate GATE programs and advanced coursework is constrained at the intersections of ability and race/ethnicity, language, socioeconomic status, and sex. Experts

in the field note that Black students are the most underrepresented racial group in gifted education in the United States and that Black males are even more underrepresented than Black females (Ford and King, 2014). Francis and Darity Jr. [31] add the following:

> *Structural and historical forces, such as racialized tracking, that contribute to an initial condition of fewer black students in advanced courses can create an environment where black students are more likely to be isolated from other members of their racial group, relative to white students (p. 1).*

Patrick et al. [32] reviewed data from the "Civil Rights Data Collection" and the "Common Core of Data". They found that for every 100 Black or Hispanic students in elementary GATE programs in Ohio, 71 Black and 39 Hispanic students, respectively, would need to be added to achieve "fair representation." GATE programs that are not well aligned with students' needs can have unintended negative consequences. The absence of educational opportunities that best match student needs could result in adverse academic outcomes, such as underachievement and dropping out [33,34], and adverse social and emotional outcomes, such as loneliness, isolation, anxiety, and depression [35,36]. Though the issue of access to GATE programs is central for children from minoritized groups, the isolation these students experience in educational environments due to their culture and cultural experiences not being represented in classes, curriculum, and instructional practices indicates a lack of appropriate or effective educational experience. The following is a discussion of findings by identity group.

Poverty level is an important factor in the effect of gifted education. Economically disadvantaged students were 24% of the students in this study. The main effect of being economically disadvantaged was associated with a mean math score of 16.4 points lower for these students than those not economically disadvantaged. This finding was consistent with what scholars describe as an opportunity [37] and academic [38] gap attributed to low income and less access to resources. Galindo and Sonnenschein [38] and Plucker et al. [39] recommended early access to enriched learning environments as a solution for economically disadvantaged students. However, the results indicate that the effects of early entrance to kindergarten were associated with the lowest average mean math achievement of students from low-income families. As students from low-income backgrounds who attend a high-poverty school are even less likely to be identified for gifted programming than students from a low-income background that do not attend a high-poverty school [4], these results could reflect the double disadvantage of being from a low-income family and attending a high-poverty school. Given variations in programming and settings, early entrance to kindergarten does not guarantee students will experience an enriched learning environment. Alternatively, these results could reinforce the importance of enriched learning environments for children during prekindergarten ages and continuing through the elementary grade levels [40]. Plucker et al. [39] also recommended grade acceleration and concurrent enrollment in middle and high schools. In this study, students from low-income families who were provided gifted education through grade and subject acceleration had mean math scores that were not significantly different than students from middle- to high-income families. In Ohio, not every district permits early entrance to kindergarten, and the requirements are that whole-grade screening only must be done twice in a K–12 school career. One of those screenings must happen while a student is in grades K–2 and then once more during grades 3–5 [16]. Educator bias in not recommending economically disadvantaged students [41] and district policies that wait to whole-grade screen in second or later grade levels may cause delays in identification for and access to gifted education. These delays are critical when gifted education's early intervention is needed to offset what Hair et al. [40] and Clark [28] describe as the deleterious effects of poor learning environments.

Service models like enrichment are described in past literature as offering benefits related to developing a talent pool of gifted potential and increasing identification opportunities [42,43]. The effect of self-contained classrooms was associated with a positive difference in the mean math scores of economically disadvantaged students when com-

pared with economically disadvantaged students who did not receive gifted education. The effect of cluster grouping was associated with the highest mean math scores for students from low-income households. The effects of clustering grouping were also positive for referent group gifted identified students, female students, Black and/or Hispanic students, and students with disabilities. These findings mostly supported the findings of Brulles et al. [10] that cluster-grouped gifted students from all cultural backgrounds had more significant achievement gains than students who were not cluster grouped. The positive effect of cluster-grouping challenges old conceptions from Feldhusen and Kolloff [44] and Renzulli [45] that these models lack a theoretical base and are not definitive enough in identity to justify their use. Grouping students by ability may make it easier to provide differentiated instruction. Additionally, clustering students may allow students to be with their peers.

Black and/or Hispanic students were 8.03% of the students in this study. The main effect of being a Black or Hispanic student was associated with a mean math score of 15.23 points lower than that of White students. Being part of the community and representation is important to recruiting, retaining, and instructing Black and/or Hispanic students [1,31]. The effect of cluster grouping was associated with a 7.68-point increase in mean math scores for Black and/or Hispanic students. Given the academic achievement outcomes of this study, this finding supports the finding of Delcourt et al. [46] that students in within-class programs, such as cluster grouping, had higher self-perception of scholastic competence than students in separate-class programs, such as self-contained classrooms. Despite the positive effect of these services models for Black and/or Hispanic students, two additional service models were associated with higher mean math scores for these students.

Of the Black and/or Hispanic students who were provided gifted education, those whose services were provided through innovative services and guidance services had the highest average math achievement. Innovative services were associated with the largest effect, an 18.43-point increase, and guidance services were associated with the second largest effect, an 18.18-point increase in average math achievement for Black and/or Hispanic students. These findings make sense in that Black and/or Hispanic students face stereotype threat [47,48] and are more susceptible to big-fish-little-pond effects [49]. According to research from project M2 (Mentoring Young Mathematicians), a research project focused on incorporating advanced math in kindergarten curriculum, higher math scores in elementary students were observed when acceleration was paired with mentoring [50]. Race was not a variable in this M2 study. Grade acceleration was also among the service models that were not associated with statistically significant differences in math scores for Black and/or Hispanic students. Pairing math intervention with mentoring or guidance is an innovative service. In Table 3, guidance services did not appear to be associated with positive increases in math achievement. However, by including sociocultural factors in the model, the positive effect of this service model was illuminated. The effect of additional service models became visible for students with disabilities.

Students with disabilities represented only 2.75% of the students in this study. The largest gap in mean math achievement was between students with a disability and those who do not have a disability. The main effect of being a student with a disability was associated with a mean math score of 28.66 points lower than that of students who did not have a disability. According to existing research, service models like differentiation, acceleration, and AP, which focus on strength-based talent development, are recommended for twice-exceptional students [51,52]. This study included talent development models such as differentiation and enrichment through pullout services. Both these service models were associated with higher mean math scores for students with a disability compared with the mean math score of students who did not have a disability. Enrichment through pullout was associated with a 14.93-point increase, and differentiation was associated with a 16.22-point increase in mean math scores relative to students who did not have a disability.

The effect of educational options was associated with a large increase in mean math scores for students with disabilities when compared with students who did not have a

disability. Students with disabilities who were provided services through educational options had a mean math score that was 24.04 points higher when compared with students who did not have a disability. Educational options as a service model are not specifically mentioned in the literature, but given their statistical and large practical significance in this study, this is an interesting new finding that should be further explored in future research.

Ableism in schools can result in students with disabilities being excluded from gifted services due to the greater focus on services related to their disability and are overlooked for gifted identification and appropriately challenging academic coursework [53–55]. This is supported by the findings in this study that when students with a disability are identified as gifted and provided gifted education, the effect of honors classes and International Baccalaureate programming was associated with higher mean math scores than students who did not have a disability. The effect of International Baccalaureate programming was associated with a 27.95-point increase in average math achievement for students with a disability. Though it is unclear specifically what services are provided through educational options, this service model was also associated with a 24.04-point increase in mean math scores compared with the mean math score of students who do not have a disability.

Cluster grouping and self-contained classrooms were also associated with improvements in the mean math scores of students with disabilities. The difference in scores for students with disabilities who were provided services through grouping models was practically and statistically significant compared with students without disabilities. In the research literature, gifted self-contained classrooms often assume that gifted children generally have the same needs and provide full-time programming for these needs [56]. Given the fact that students with a disability have needs that vary based on both their area of giftedness and type of disability, gifted self-contained classrooms may provide more benefit than no gifted services, because these models address the strengths of these students but do not provide as much benefit as educational options, honors classes, and enrichment through pullout services because learning challenges are not addressed well enough.

In this study, among the students with a disability identified as gifted, only 8.03% were Black and/or Hispanic, and of those, only 5.13% were provided gifted education. In comparison, 14.21% of gifted students with a disability who were White received gifted education. The current literature informs readers that Black and/or Hispanic students are not only less likely to be identified as gifted but are often educated in places of "disciplinary exclusion" and "academic exclusion" [55,57,58]. Black and/or Hispanic gifted students with a disability cannot access enrichment, honors classes, and other forms of gifted education from places Annamma [57] describes as special education rooms, credit recovery, GED classes, and spaces of incarceration. This important finding should be more deeply explored in future research. Whereas students were very underrepresented by race and disability status, the balance shifted with sex.

Just under 42% of the students in this study's sample were coded as female. The main effect of a student being female was associated with a 3.79-point decrease in mean math score and was not practically significant. The lack of practical difference in math scores between female and male students is not surprising, given the literature that indicates no difference in the math abilities in female and male learners [59]. Additionally, in this study, female students are almost as represented in gifted math programming as male students, but at the elementary level, participation may be less reflective of self-selected courses than in middle or high school.

Service types recommended for use with female students, and included in this study, were counseling or mentoring (guidance), enrichment, and authentic learning experiences (educational options, innovative services, or "other" services). The effect of the post-secondary enrollment option was the only service model that was associated with a large increase in average math achievement for female students. It is not clear why post-secondary enrollment options had this effect. Considering the optimal match compromise described by Robinson and Robinson [60] for these students, it is possible that being matched with peers of similar intellectual maturity and achievement in college courses is

more important than matching based on age and average intelligence. Innovative services and cluster grouping were also associated with positive changes in the mean math scores of female students, but the effect was smaller than in post-secondary enrollment options. Unlike all other cultural identity groups, self-contained classrooms were not associated with a significant change in mean math scores.

Overall, the results for sex as a variable might be explained by the existing literature that advances the understanding of gender as a nonbinary social construct. The lack of practically significant difference for most service models could be attributed to the murky pool of literature attempting to categorize gender definitively, when this construct seems to vary by individual and by a perception of what is typical [61]. Even findings that suggest a difference in math scores, such as the increase associated with post-secondary enrollment options, have to be viewed with skepticism, as the student's ability to "do gender" or how closely their feelings of masculinity and femininity match their biological sex could also be an influence [62,63]. The fact that males are highly represented in physics, engineering, and architecture [28] is still true, as is the fact that females are less likely to pursue STEM subjects [64].

The main effect of being a student learning English is associated with a mean math score of 6.82 points lower than the mean math score of students who were not English learners (EL). The gap in mean math achievement between students who are ELs and those who are not ELs is relatively small. However, EL students were the most underrepresented cultural group in this study. Less than 1% of the students were EL students. This observation is not surprising, given EL students are underrepresented in gifted education and are less likely to be recognized for their academic strengths [65,66].

The past literature indicates that Hispanic EL students who are not native to the United States are often strong in math [67]. The specific ethnicities of the EL students in this study are unknown. Still, when identified as gifted and provided gifted education in self-contained classrooms, the effect was associated with a 15.79-point increase in mean math scores. The only other service model associated with both a statistical and large practical significant difference in the mean math score of EL students, when compared with students who are not ELs, is educational options. The large difference of −83.32 in mean math scores compared with students who are not English learners is noteworthy. It is difficult to make meaning of this finding without a clear description of what those educational options included. If these services were based on a differentiated learning experience that combined language acquisition with instruction that was tailored to the student's math skills [68], the expected outcome would be a higher mean math score. However, if the intervention followed a deficit thinking model and focused mostly on language acquisition, as is often the case [65,66], then these results are unexpected. Given the low representation of EL students in this study, the findings for this group of students should be considered with caution.

7. Conclusions

Cultural identity moderates service model effectiveness. This study is significant because the findings demonstrate a need for culturally responsive intersectional research approaches, service provision, and program evaluation. These findings could improve opportunities for underrepresented and underserved students to access their best match for support and services. This study reaffirms that the typical student identified as gifted in the United States is White, from a middle- to high-income family, does not have a disability, and is not an English language learner. However, in this study, there was an equitable balance between the sexes. Research in gifted education that does not explicitly include sociocultural factors may have findings that reproduce biases toward majority cultural group gifted-identified students. Given the variation of effects of service models in this study, the needs of students between cultural identity groups are not necessarily the same. There are no one-size-fits-all solutions to programming, not even within cultural groups. Best-match programming considers and addresses each students intersecting identities.

Researchers and educators who engage in intersectional research and evaluation bolster their abilities to promote equity in education for students in their spheres of influence.

8. Limitations

This study provided a detailed analysis of the effects of service models as associated with the differences in math achievement for gifted-identified elementary students in Ohio. Like any study, there were limitations. In general, more research is needed to fill the gaps in the literature. This research clearly indicates that there are between-group differences. Also important to recognize is that students from a shared cultural group do not have monolithic experiences. Gifted education services that work for some students in a cultural group may not work for all students in the same cultural group.

Much detail is unknown about the application of some service models. For example, English learner students who were provided services through educational options had mean math scores that were 78 points lower than students who were not English learners. Conversely, educational options were associated with increased mean math scores for students with disabilities. Table 1, based on the Ohio Department of Education's descriptions of service models, lists potential educational options; however, it is not clear which of these approaches were taken with students in the district(s) that reported using this service method.

Additionally, there are many teaching styles, forms of curriculum, and service model types, and any combination of these factors could produce different results. Data related to the type of curriculum each district or school used were not included in this research and is an important consideration. For example, differentiation involving content modification might produce different results than differentiation involving process, product, or learning environment modification. Multilevel modeling was used to account for the data being nested; however, the classroom was not included as a specific level. Therefore, differences associated with teacher-level variables were not controlled for. Type of instruction is a different piece of the puzzle that if asked, answered, and combined with this research could move understanding even closer to identifying culturally responsive practices for minoritized and underserved gifted students of color. Each part of the puzzle is important, and no one study will provide all the answers; this study is just one piece. Future studies can help address some of these limitations.

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