Exploring Anomalies in Pacific Northwest Special Education Trends

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Abstract

Over the last 20 years, there have been drastic changes within public school districts in regards to special education classifications. By examining and comparing special education data spanning over 15 years in Vancouver, British Columbia and Oregon, policy changes can be visualized in student population data. Descriptive statistics are used to analyze trends seen both across special education categories, school years, and districts. Districts are classified as urban or rural and comparative analysis tracks trends observed. Special attention is given to any population or categorization changes occurring past the 2016 Supreme Court of Canada decision to revert BC classroom composition. Data visualization allows for large datasets, such as these, to be compacted into thorough plots where longitudinal trends can be observed and analyzed.

Keywords: Vancouver, British Columbia, Oregon, Special Education, SpEd

Word count: 0<n<1,000,000

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Introduction

Educational policy can impact practice by reorganizing educational delivery and reconceptualizing the meaning and impact of education on society (Ball, 1998). Educational policy exists as a mechanism to drive changes in school buildings that result in socially important outcomes (e.g., increasing literacy acquisition through improved instruction, reducing instances of bullying through prevention programs). However, the relationship between policy and practice in Western formal systems of education is often unclear, misdirected, or atheoretical (Cohen et al., 2009). Leveraging the power of policy as a change agent for the delivery and conceptualization of education stands to benefit a significant proportion of students (Swanson, 2007).

When policy is enacted, the intended outcomes are often not realized for months, years, or decades (Gu et al., 2018). For example, changing school district policy on professional development to align with research-informed practices may be constructed to increase student academic achievement; though, there is insufficient evidence pointing to how long professionalized intervention with teachers will take to increase student academic scores (Luke & McArdle, 2009). Longitudinal data helps to understand the impact of policy change because of the year-over-year comparisons that illustrate differences, inflection points, or anomalies of interest (Michelmore & Dynarski, 2017).

The above correlogram isolates a single school district - Greater Victoria - as a representation of the trends observed within the whole data set. This series of plots gives a snapshot introduction for the data trends to be observed.

Current Study

Our project primarily examines two datasets detailing head counts of students with exceptionalities eligible for special education services aged 6-21. The datasets offer insights to the categorization for special education eligibility in public schools within British Columbia (BC) and Oregon (OR). The head counts from BC are collected from 2002/2003 to the most recent data from 2019/2020. The OR head counts are drawn from an annual dataset spanning 2002 through 2020. Levels of categorization include school-, district-, and provincial-level head counts for BC. The OR data set includes state-wide head counts that are not aggregated by school or district.

We intend to explore several questions regarding longitudinal trends where educational policy may have impacted special education practice. First, we will use descriptive statistics to describe trends in disability prevalence over time. The initial analyses will inform a discussion on developmental trajectories by illustrating shifts in prevalence growth from static to linearly increasing based on age of diagnosis for the Oregon data, which can serve as a springboard to make inferences about BC data (e.g., common age of onset for diagnosis per category and diagnostic patterns over time). In studying the differences and similarities between OR and BC datasets, we will also engage in a discussion on diagnostic terminology across regions with respect to the definitions as detailed by the Diagnostic and Statistical Manual of Mental Disorders (DSM; American Psychological Association, 2013), in part as a response to a challenge set by differing terminology between BC and OR categorization (i.e., the United States federal guidelines for exceptionality designation are similar but not identical to exceptionality designation guidelines in BC).

Second, we hope to closely analyze any changes, or lack thereof, within the BC data following Canadian Supreme Court rulings between the British Columbia Teachers Federation and the province of BC (See Lambert, 2017). Canadian Supreme Court rulings

have significant implications on educational policy in the provinces and, in 2016, resulted in a limit to the number of students with disability designations in classrooms resulting in an expansion of the number of specialist teachers' that school districts are required to hire. The driving theory of change is that decreasing student-to-teacher ratios and capping the number of students with exceptionalities in each classroom causes student designation practices to change. Theoretically, school district administrators made decisions based on current staffing levels, student designations, diagnostic capacity and malleability, as well as external pressures to adjust practice according to legal mandates.

Finally, we will explore differences between urban and rural school districts in BC. Districts are categorized by population size and proximity to metropolitan areas, as recorded and defined by the Statistics Canada census from 2016. School district level data is useful for examining longitudinal trends for individual administrative units (e.g., superintendent's office and director(s) of inclusive education); however, this level of data analysis cannot speak to province-wide trends in the culture of superordinate legal directives which impact swift policy changes. Given this, we will run analyses on both exemplar districts to highlight localized policy impacts on practice and amalgamated districts (e.g., school districts defined as rural by Statistics Canada) to investigate cultural shifts in the policy-to-practice association.

Problem Statement and RQs

In comparison to the United States, Canadian education policy receives little attention and scholarly interest (Walker & Bergmann, 2013). While Canadian K-12 academic achievement outcomes are generally higher than a national-level comparison with the US, there are ongoing policy issues to address when provincial ministries of education are crafting legislation and procedures to impact a top-tier system of education. Significant events, such as the 2016 Canadian supreme court ruling that directly impacted British Columbia classrooms, have downstream effects on instructional interactions; yet a

retroactive policy lens is rarely applied after such events occur. The current study seeks to address the knowledge gap of downstream instructional interact effects after a significant event in BC educational policy.

With respect to the 2016 Supreme Court of Canada decision to revert BC classroom composition, size, and ratios for specialist teachers:

1. Do student prevalence rates of disability or disorder decrease after the supreme court ruling of 2016 against existing trends?

2. Are there different patterns for disability or disorder designation for rural versus urban school districts after the supreme court ruling in 2016?

Methods

Datasets were extracted from publicly available sources. Specifically, the BC Ministry of Education, Oregon Department of Education, and Statistics Canada are the data sources for the current study. Note that the primary jurisdiction of interest is BC, and OR is selected as a reasonable basis of comparison (i.e., similar geography, population, and population growth rate). Further, BC has distinct educational policy from OR as Canadian education is administered entirely by provincial ministries of education and special education law is remarkably different between BC and OR. Together, these datasets help achieve three objectives for acquiring data appropriate to the research questions: *Headcount data at multiple levels (e.g., district and state or province) for students with exceptionalities, disaggregated by category of exceptionality, year, and location.* Population data to fit school district locations to a geographical classification (e.g., urban, suburban, rural) as specified in national documentation (e.g., urban centers have a minimum of 10,000 inhabitants based on census data), and calculate prevalence rates. *Data from multiple jurisdictions where educational policies do not align chronologically. For example,

special education law in the United States is disjointed from BC special education law and policy changes are not the same, nor are they implemented simultaneously.

The nature of the current study is intentionally exploratory within a systematic approach of viewing data, testing a priori hypotheses against descriptive statistics, calculating effect sizes if appropriate, and, finally, exploring notable anomalies in prevalence trends that were not hypothesized a posteriori. As a first step, the authors took the approach of examining provincial-level data in BC. Then, trends in BC data were compared against trends in OR data to see if similar rates of students were designated with exceptionalities across jurisdictions. When anomalies were suspected in the BC trends of exceptionality prevalence, then effect size tests were conducted in line with the research questions. Finally, any anomalies that were suspected a posteriori were tested with effect size calculations and discussed in the final section of our current study.

The three datasets were used for analysis in R (cite R) for reproducibility and data visualization. All code for analysis and data representation is publicly available for reproducibility (https://github.com/JoeSwinehart/datascienceproject). There are several caveats for data use and cleaning in the current analysis. First, the BC and OR datasets were not a completely parallel comparison, because the OR data set includes a broader age range of students (ages 3 - 21) as compared to the BC data set (ages 5 - 19). The Oregon data set was pared down to include a similar age range to BC data; however, it is worth noting that differences in age range may represent different approaches to diagnostic categorization (e.g., intellectual disability in BC can be diagnosed at age 5; whereas the Oregon data follows IDEA where it is more likely young children will be categorized as developmentally delayed). Second, data masking necessitates a decision-point for analysis. Specifically, the BC Ministry of Education data masks all cells with headcounts below 10 students, therefore our analyses left out these cases when computing effect sizes for provincial-level data. Data masking was most prominently an issue when examining school district-level data in BC, as smaller school districts often masked low-incidence

exceptionality data. When appropriate, masked data is assigned a conservative estimate of (n = 9) such that enough data units were included in effect size comparisons. Third, Canadian census data from 2016 is the basis of classification for district geographical location (e.g., urban, suburban, rural, exurban). Due to the geographical distribution of population in BC, only two categories are used for the current analyses: urban and rural. Fourth, due to low population numbers with independent schools in BC, the current study will only examine public school data for the years 2002 - 2019.

Analysis Plan

The majority of the analyses for the current study are descriptive in nature. The descriptive analysis includes a table or visual representation of prevalence rates or headcounts of students with exceptionalities over time. As the current study is examining anomalies in trend data, trends that break the longitudinal trendline (e.g., sudden drop in prevalence after a decade of linear increase in prevalence) may be examined further. That is, effect sizes between two groups (e.g., group one is three years before a policy change, and group two is three years after a policy change) may be examined to detect the magnitude of differences between groups if they are hypothesized to represent a change in practice stemming from policy implementation. More specifically on the calculation of effect sizes, the Hedge's g statistic will be used because of the robustness against unequal group sizes.

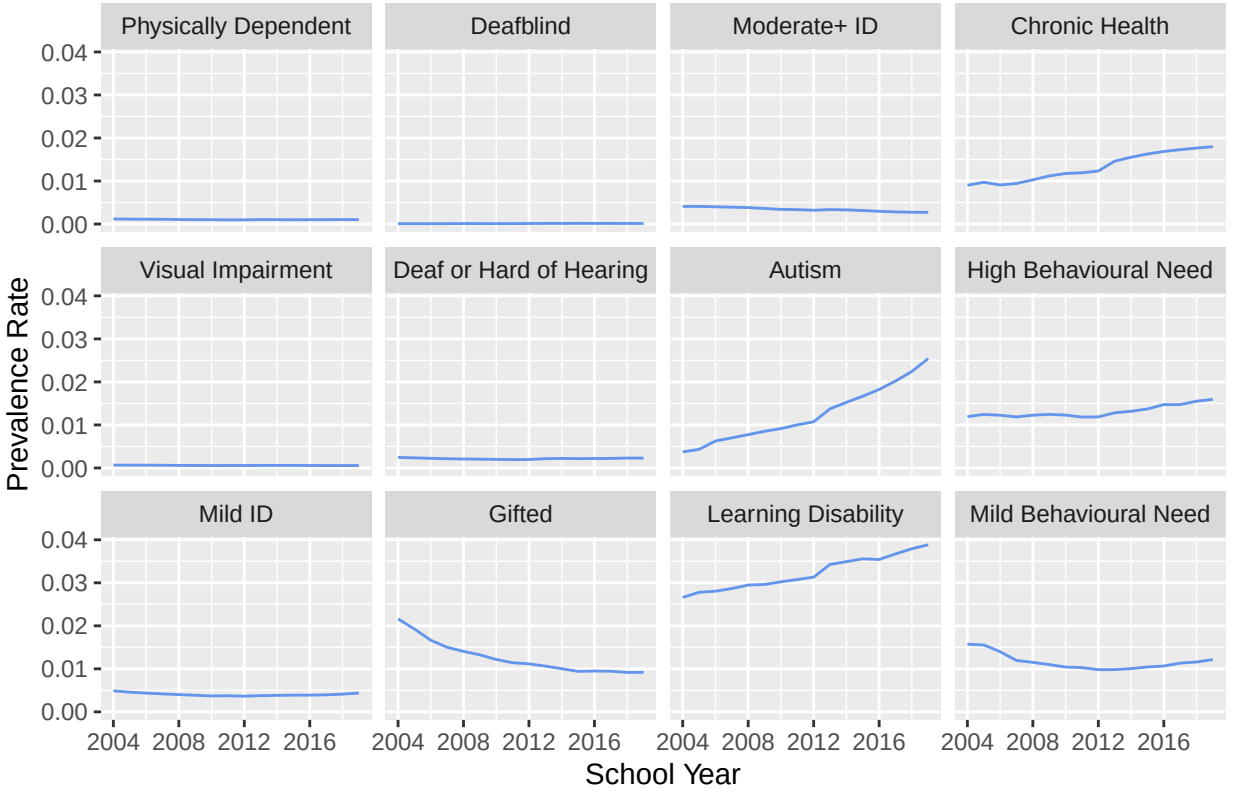
$$Hedges' g = \frac{M_1 + M_2}{SD_{pooled}}$$

Results

To answer the first research question, we examine the provincial-level prevalence data by exceptionality to view trendlines over 15 years. It is apparent that 2016 is not a point of inflection for any of the twelve designations listed. Low-incidence exceptionalities remain

consistent, and high-incidence exceptionalities are linearly (e.g., Learning Disabilities) or exponentially (e.g., Autism) increasing, and some high-incidence exceptionalities are linearly decreasing (e.g., Gifted). Due to the fact that there are no significant points of inflection observed on any of the 12 trendlines in figure 1, no further investigation (e.g., calculating effect size) was warranted.

Fig. 1 BC Provincial Prevalence of Students with Exceptionalities by Categ




```
## # A tibble: 198 x 18
##    year  disability    x6    x7    x8    x9   x10   x11   x12   x13   x14   x15
##    <chr> <chr>      <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
##  1 2002~ INTELLECT~   135   172   220   261   279   303   370   364   388   378
##  2 2002~ HEARING I~    46    66    69    67    79    78    69    70    53    72
##  3 2002~ SPEECH OR~  2502  2466  2443  2205  1894  1282   874   677   493   340
##  4 2002~ VISUAL IM~    18    27    25    16    12    26    19    24    31    19
##  5 2002~ EMOTIONAL~    81   178   241   292   347   433   504   487   549   548
```

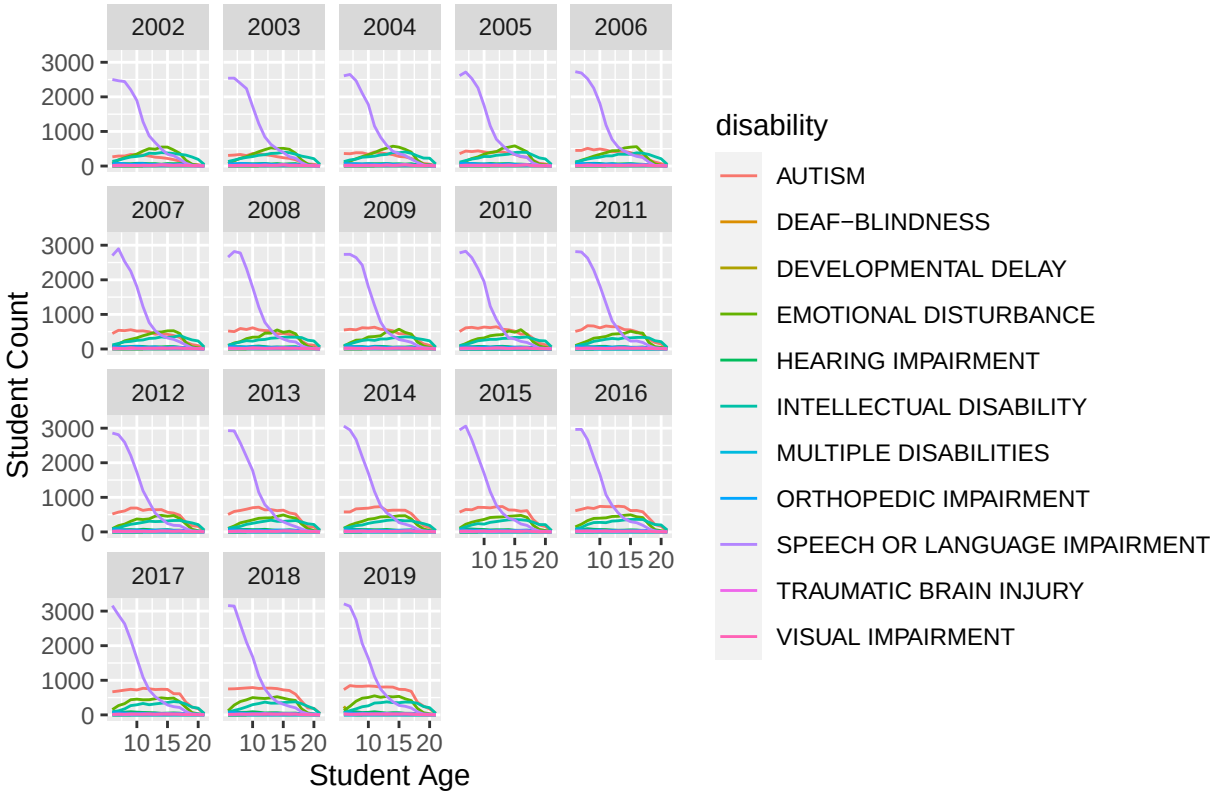
```
##  6 2002~ ORTHOPEDI~    65    77    64    49    64    71    50    48    44    43
##  7 2002~ DEAF-BLIN~     0     2     0     0     1     0     2     0     4     2
##  8 2002~ MULTIPLE ~     0     0     0     0     0     0     0     0     0     0
##  9 2002~ AUTISM       267   289   290   334   325   316   290   256   243   219
## 10 2002~ TRAUMATIC~     6    11    17    23    22    19    21    23    36    36
## # ... with 188 more rows, and 6 more variables: x16 <dbl>, x17 <dbl>,
## #   x18 <dbl>, x19 <dbl>, x20 <dbl>, x21 <dbl>

## # A tibble: 198 x 3
## # Groups:   year [18]
##     year disability                    total
##    <dbl> <chr>                         <dbl>
##  1  2002 AUTISM                         3339
##  2  2002 DEAF-BLINDNESS                   17
##  3  2002 DEVELOPMENTAL DELAY               0
##  4  2002 EMOTIONAL DISTURBANCE          4736
##  5  2002 HEARING IMPAIRMENT              873
##  6  2002 INTELLECTUAL DISABILITY        4387
##  7  2002 MULTIPLE DISABILITIES             0
##  8  2002 ORTHOPEDIC IMPAIRMENT           754
##  9  2002 SPEECH OR LANGUAGE IMPAIRMENT 15784
## 10  2002 TRAUMATIC BRAIN INJURY          306
## # ... with 188 more rows
```

This is roughly in line with Oregon's designation data, showing that there were no state-wide anomalies after the year 2016. Similar to the BC data, we see a steady increase in students identified under the autism diagnosis, while most categories remained relatively stable over all of the years surveyed. The recent growth in Developmental Delays and

Emotional Disturbance would be worth watching in future years, but we can reasonably predict that more rigid categories like Deaf-Blindness and Traumatic Brain Injury will remain stable in the years to come.

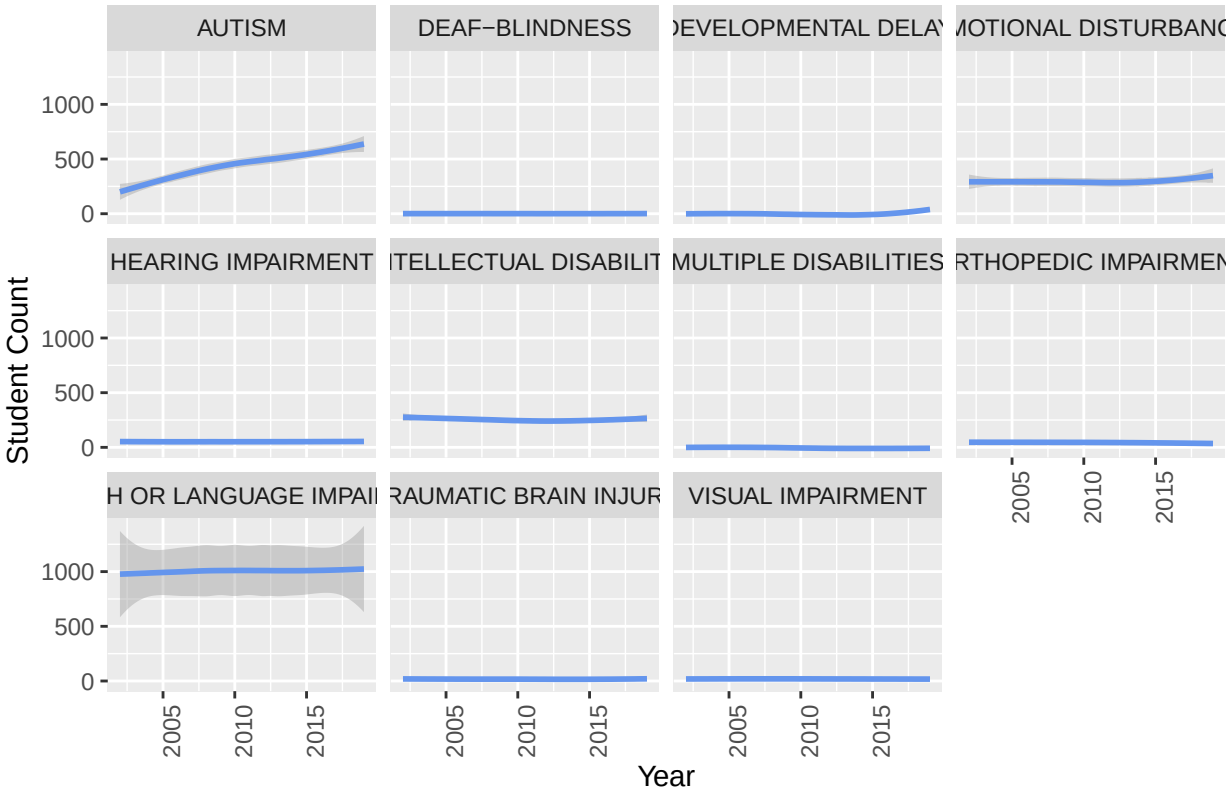
Fig. 2 Disability Prevalence By Age



Looking at Oregon disability prevalence by age gives us some idea of what happens to these categories over time, and also invites some questions. Most visually striking is the drop-off of students identified as having a Speech or Language Impairment, which makes sense, as it is addressed early in school and highly correctable. By middle school, most students have been exited from the speech program. At a striking contrast would be things that cannot be corrected, such as Deaf-Blindness or Traumatic Brain Injury. As expected, these numbers are extremely static over time. More thought-provoking would be the numbers for Emotional Disturbance. These tend to grow fairly steadily during elementary and middle school, but around age 16 the numbers actually start to decrease. One might wonder if this drop is due to these students no longer being part of the school system, as

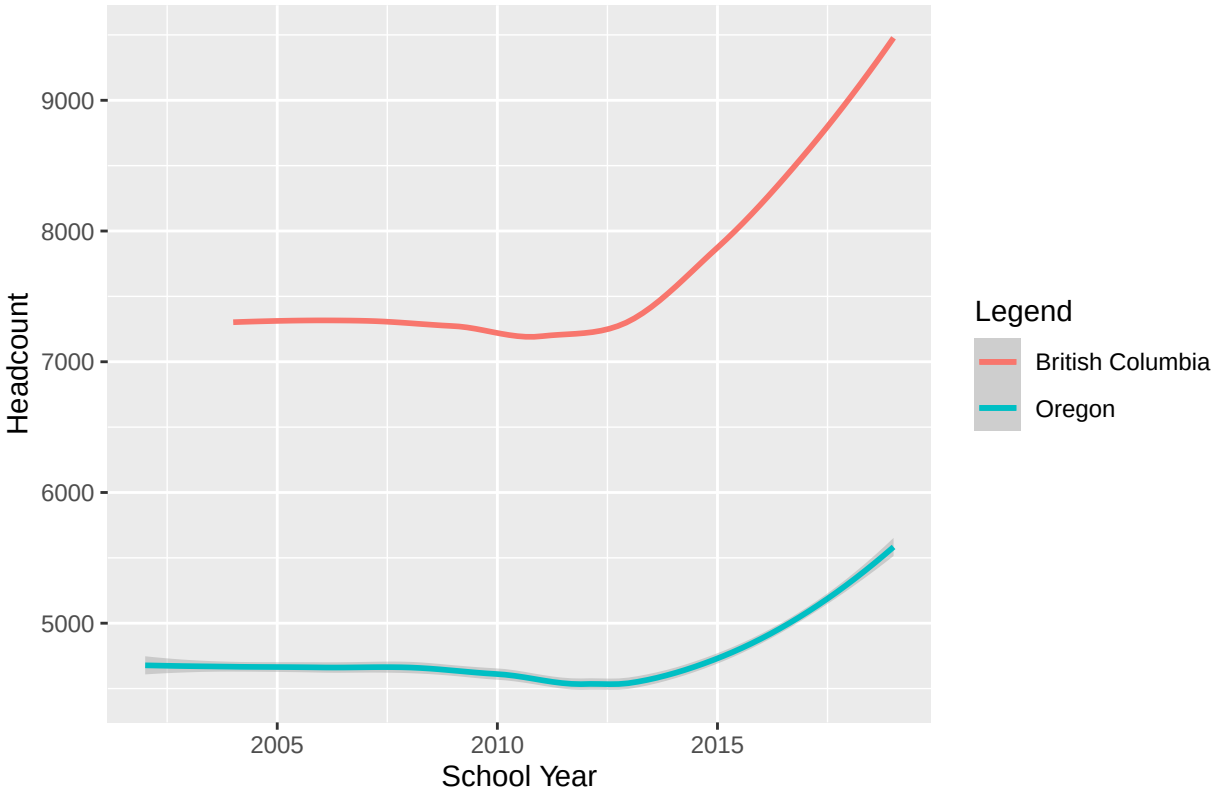
they may be far more likely to drop out and/or enter a different system as adjudicated youth. It certainly would be worth an additional look in the future.

Fig. 3 Oregon Headcount of Students with Exceptionalities by Category



Even for diagnostically malleable categories, such as students classified in Oregon has having an “emotional disturbance,” or in BC students requiring a “high behavioural need”, Oregon and BC had highly similar trends.

Fig. 4 BC and Oregon Headcount of Students with Chronic Health Conditi



Taken together, we see that at the provincial- and state-levels, there is consistency in identification of students with exceptionalities. It is clear that a notable inflection point in 2016 for the BC data would have represented a significant change from practice when comparing student identification practices in Oregon; however, there is no apparent inflection point in the BC data.

To examine potential differences within BC, the authors chose to divide school districts by urban or rural designation according to Statistics Canada guidelines on characterizing living populations.

The district classification data was scaled down to include only public schools, while excluding private institutions. The school districts of Southeast Kootenay, Rocky Mountain, Kootenay Lake, Arrow Lakes, Revelstoke, Kootenay-Columbia, Cariboo-Chilcotin, Sea to Sky, Central Coast, Haida Gwaii, Boundary, Bulkley Valley,

Nicola-Simikameen, Peace River South, Peace River North, Gulf Islands, Qualicum, Comox Valley, Campbell River, Gold Trail, Fraser-Cascade, Coast Mountains, Vancouver Island West, Vancouver Island North, Stikine, Nechako Lakes, Nisga'a, and Conseil scolaire francophone were excluded from the data set due to the lack of sufficient population information. The urban vs. rural classifications were made based on the district's population on the 2016 census. If the population was above 100,000 individuals, it is classified as urban. If the population was below 99,999 individuals, then it is classified as rural.

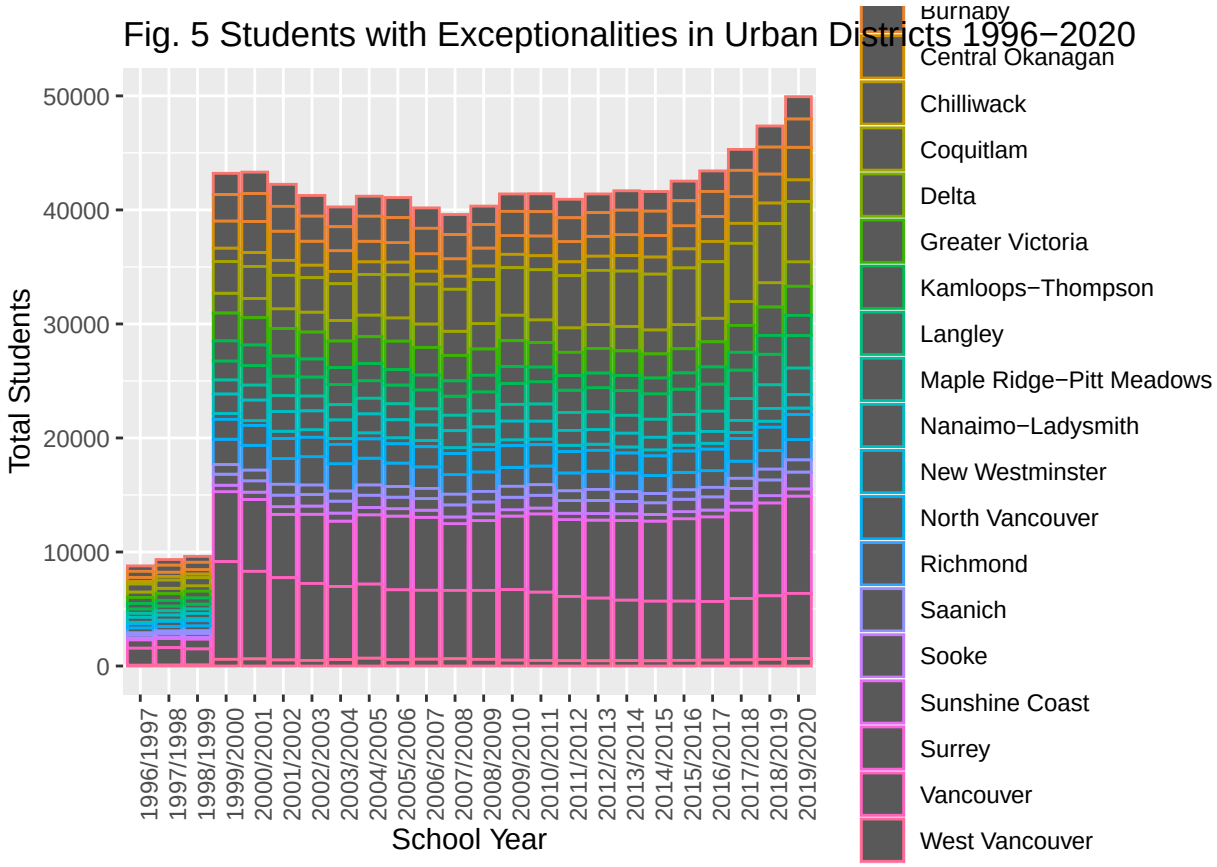
Disaggregating districts by urban and rural classification allowed for analysis across geographic designation and within case-study districts for further understanding of policy effects on regions with differing resources and large differences in student population sizes. The table below details our classification of districts, according to the 2016 census. Classification and population is shown in comparison to the number of students receiving special education services for the 2016/2017 school year in that school district.

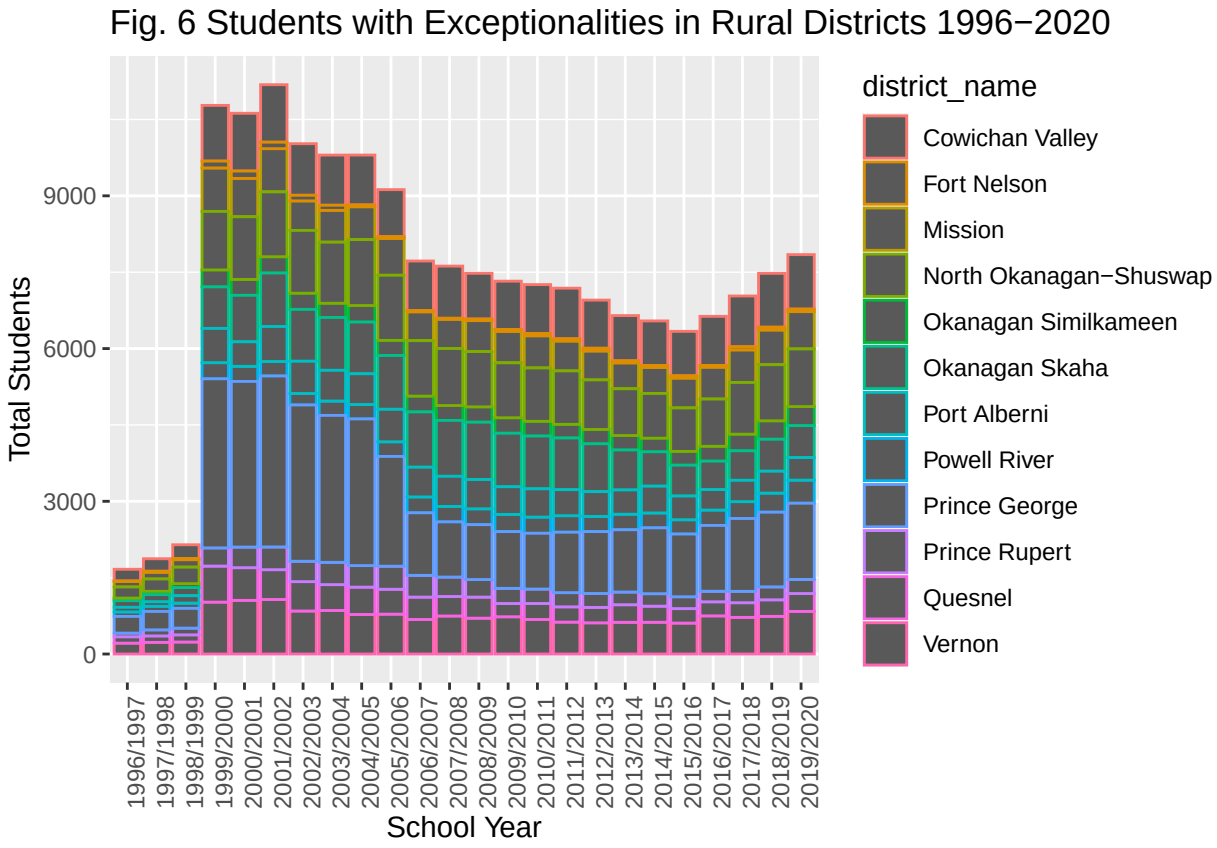
A closer look at the districts in Figure 5 details how overall urban areas appear more stable over time compared to urban areas, as in figure 6, which appear to have clustering trends. Between 1999 and 2004/2005 the number of students with exceptionalities appear fairly stable. Rural districts then suffer a noticeable drop between 2004/2005 and 2005/2006, specifically in the district of Prince George. The years following present a steady decline through 2016, which then begins a steady upward trajectory. Both urban and rural areas alike exhibit a similar dramatic rise between 1998/1999 and 1999/2000, which we attribute to data reporting changes, but may be worth a closer look.

There are two major outcomes of interest observed with the data sets when disaggregated by rural and urban school districts. First, the trends of rural student exceptionality designations followed urban trends closely. The vast majority of urban school districts did not differ in their post-2016 prevalence rates for exceptionality

designations (ps > 0.05). However, for diagnostically malleable categories (e.g., Moderate Behavioural designation) in rural school districts, 2016 was an inflection point for an increase in prevalence rates. When comparing prevalence rates between 2013-2016 (pre-2016 group) and 2017-2019 (post-2016 group) cohorts of rural students, the prevalence rate increased for the following student designation categories: High Behavioural Interventions (t(239) = -2.113, p = 0.036, g = 0.261, CI[-0.504, -0.019]), Learning Disability (t(262) = -1.984, p = 0.483, g = 0.230, CI[-0.453, -0.007]), and Chronic Health (t(255) = -2.068, p = 0.040, g = 0.247, CI[-0.479, -0.015]). Note that the exceptionality category Mild Behavioural Intervention did not result with the same small, detectable effect size (Hedges' g > 0.2, and g < 0.5), but did show an increasing trend post-2016 (t(195) = -0.879, p = 0.380, g = 0.120, CI[-0.383, 0.144]).

Fig. 5 Students with Exceptionalities in Urban Districts 1996−2020





Taken side by side, a simple visualization detailing student exceptionality designation presents the overall similarities between urban and rural areas, as in figures 7 and 8 below. Of note, the “Gifted” designation suffers a severe drop around 2005/2006 for urban and rural areas alike, though the change is more pronounced within rural districts.

Fig. 7 Total Students by Exceptionality − Rural

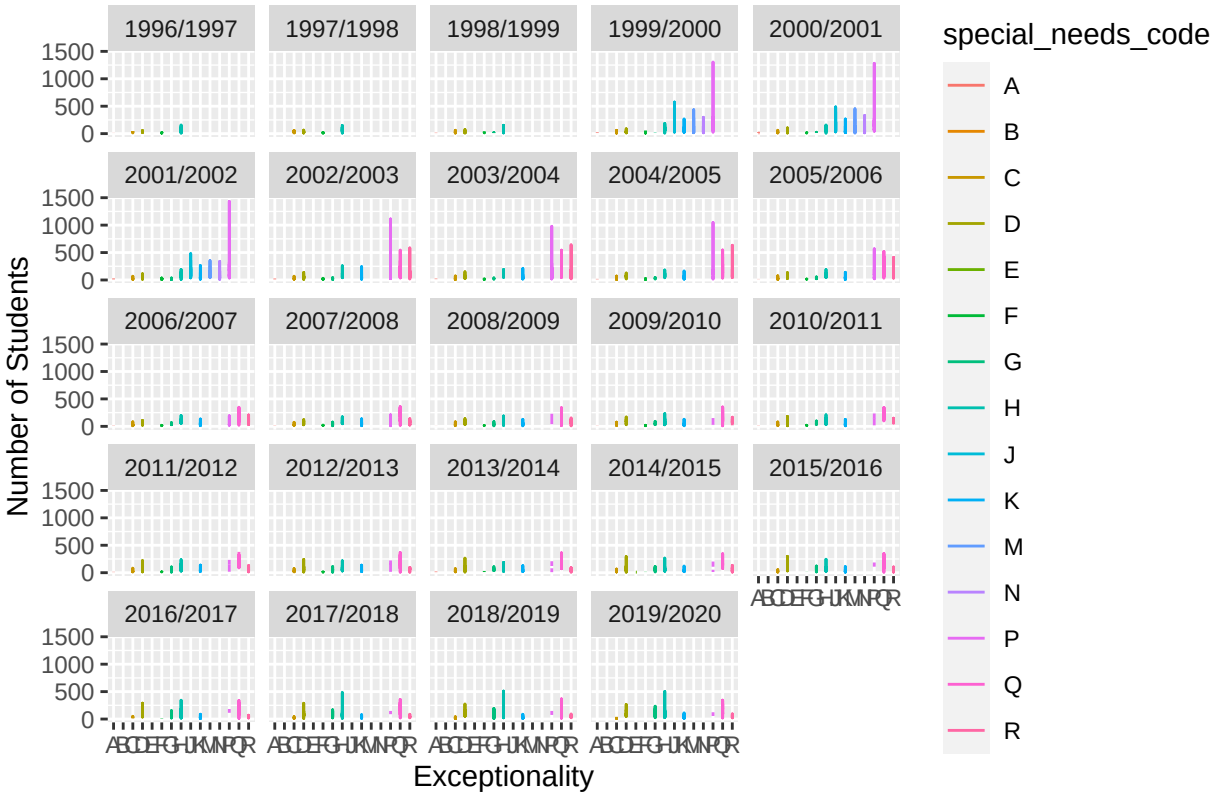
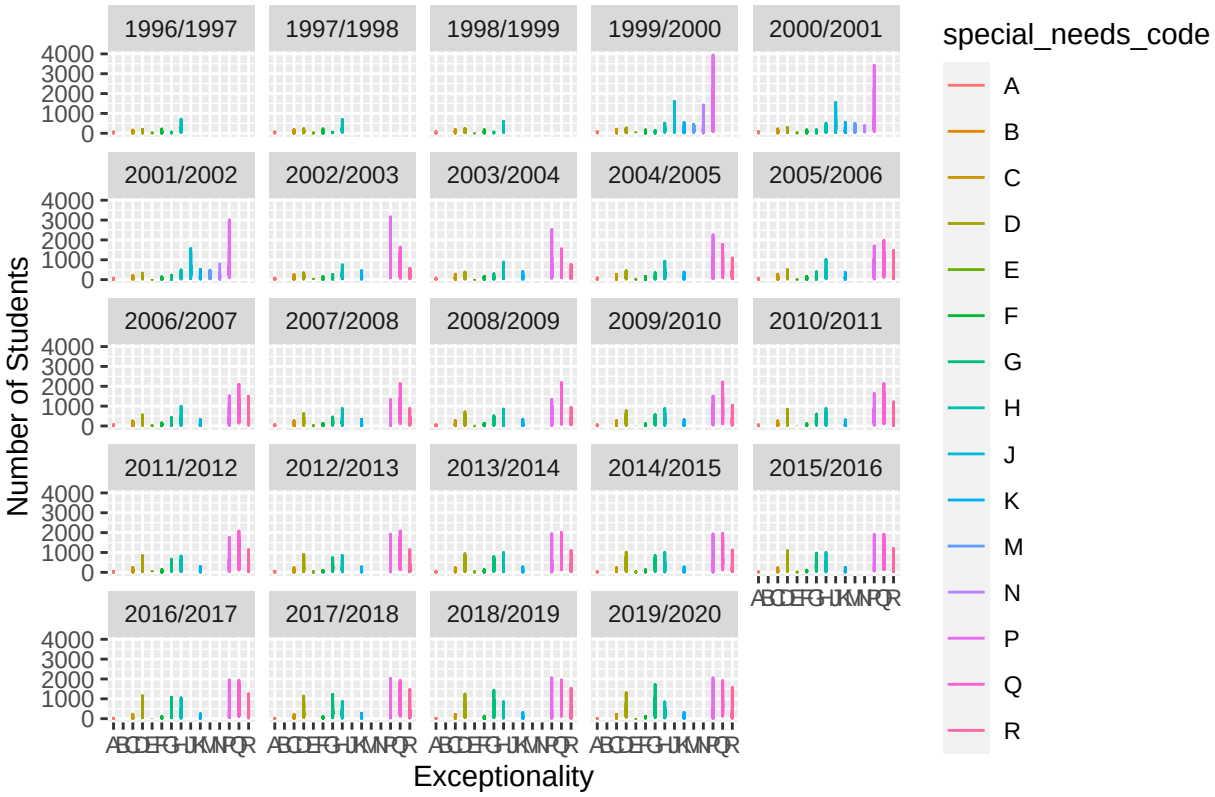
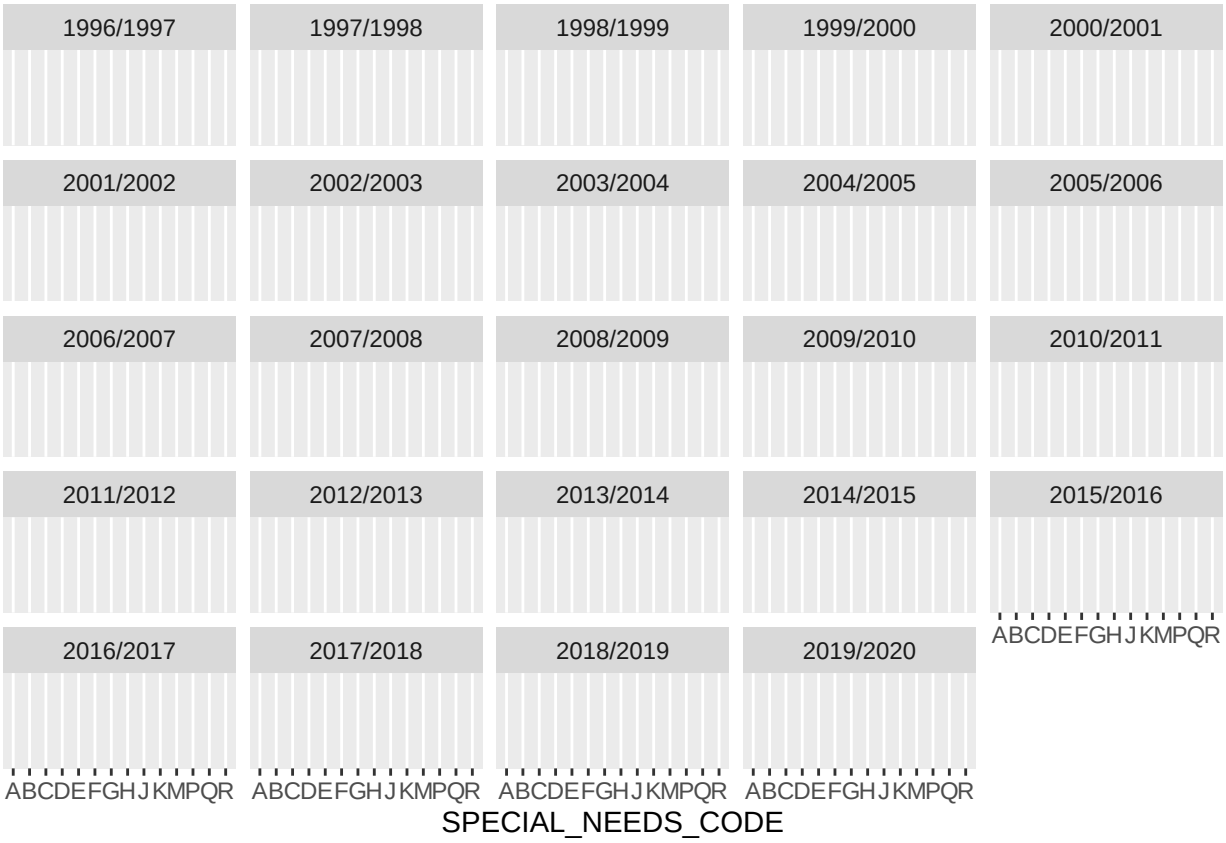


Fig. 8 Total Students by Exceptionality



The significant drop presents a second major outcome of interest, from which a posteriori visual analysis served as a basis for understanding notable trends. For example, multiple rural school districts reported a head count of more than 1,000 gifted students in 2004, and then by 2008 the districts reported fewer than 10 gifted students. This magnitude of declining gifted student designations is significant and specific to rural school districts in BC. Of particular note is the district of Prince George, where gifted students appear to have accounted for the majority of overall students with exceptionalities until 2006.




```
## geom_col: width = NULL, na.rm = FALSE
## stat_identity: na.rm = FALSE
## position_stack
```

Discussion

Regarding the first research question, it is apparent that the 2016 Supreme Court decision did not impact any of the 12 designation categories as hypothesized. The trendlines for each of the exceptionality categories remained consistent post-2016 in BC and this mapped on to Oregon trends in exceptionality designation reasonably closely. This finding suggests that the resources and practices around supporting students with exceptionalities did not differ significantly from a provincial policy determination.

Data on the second research question on rural versus urban school district response to the 2016 Supreme Court ruling suggests that the authors correctly hypothesized that

there are differences for rural versus urban districts. Urban school districts largely followed provincial-level trends, and rural school districts had small effect sizes of increased prevalence for the post-2016 cohort of students. That is, when looking at all rural school districts and comparing two groups, four years preceding 2017 and three years 2017 through 2019, there is a significant increase in prevalence for designations in which clinicians have diagnostic flexibility (e.g., behavioural designations, temporary health conditions). This finding suggests that clinicians and administrators in rural school districts responded to the 2016 Supreme Court ruling by changing exceptionality designation practices that align with an increase in prevalence.

The rapid decrease in students identified as gifted in rural districts between the years of 2004 and 2007 cannot be explained by one sole factor in this exploratory analysis. With respect to the speculative nature of this assertion, the authors assume that educational policy at the provincial level impacts educational practice across school districts. In 2006, the British Columbia Ministry of Education released Special education services: A manual of policies, procedures and guidelines, which explicitly states the acceleration programming that should be afforded to students with exceptional academic talent (Kanevsky & Clelland, 2016). In fact, this 2006 version of the manual was a revision of the original 1995 manual, and this initial version included scant guidance on service provision to gifted students. This 2016 shift in policy links to a higher degree of resources afforded to gifted students through "independent, guided education" (p. 52). Given the additional resources needed to properly implement gifted educational services, rural school districts may have de-designated students and sought other ways to provide instruction that meets the needs of their students. For example, Lo et al. (2019) suggest that the British Columbia Ministry of Education's recent curriculum update makes amends for the traditional test-and-place gifted student support model by giving educators the tools and inclusive framework to offer a rich, meaningful education to all students with exceptionalities.

References

Table 1

District Classification by Population According to 2016 Census

District Number	District Name	Population	Classification	Number of Students
022	Vernon	61,334	Rural	16,768
023	Central Okanagan	194,882	Urban	43,609
028	Quesnel	23,146	Rural	9,036
033	Chilliwack	101,512	Urban	28,997
034	Abbotsford	180,518	Urban	38,369
035	Langley	2,463,431	Urban	43,043
036	Surrey	2,463,431	Urban	143,222
037	Delta	2,463,431	Urban	43,897
038	Richmond	2,463,431	Urban	40,221
039	Vancouver	2,463,431	Urban	132,584
040	New Westminster	2,463,431	Urban	11,714
041	Burnaby	2,463,431	Urban	47,952
042	Maple Ridge-Pitt Meadows	2,463,431	Urban	33,633
043	Coquitlam	2,463,431	Urban	88,291
044	North Vancouver	2,463,431	Urban	39,657
045	West Vancouver	2,463,431	Urban	11,732
046	Sunshine Coast	2,463,431	Urban	13,283
047	Powell River	16,783	Rural	6,816
052	Prince Rupert	12,687	Rural	7,222
053	Okanagan Similkameen	43,432	Rural	6,596
057	Prince George	86,622	Rural	39,443
061	Greater Victoria	367,770	Urban	50,051
062	Sooke	367,770	Urban	24,126
063	Saanich	367,770	Urban	19,533
067	Okanagan Skaha	43,432	Rural	19,156
068	Nanaimo-Ladysmith	104,936	Urban	30,870