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How the existence of special schools affects the placement of students with special needs in inclusive primary schools

Nikola Ebenbeck[1], *Jakob Rieser*[2], *Jana Jungjohann*[1] *and Markus Gebhardt*[1]
[1]*University of Regensburg, Germany;* [2]*Julius-Maximilians-Universitat Würzburg, Germany*

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Although inclusion is the declared goal, the transition from a system based on special schools to an inclusive school system has only been progressing very slowly in individual countries. In an evolving school system, the existing special schools keep struggling to justify their existence. This study investigates the regional distribution effects based on official school data and shows the influence of a pull effect on special schools as a distance effect of special schools affecting the placement of students. For this purpose, official school statistics including all students at special and regular schools in the years 2010, 2015 and 2020 (N = 11 280 040) are evaluated in a spatiotemporal comparison using Educational Data Mining. In a hierarchical regression model on school placement in inclusive schools, the distance between primary and special schools has the highest influence (β = 0.48) on the inclusion rate (i.e., the proportion of students with special needs who are educated in regular schools in relation to all students with disabilities), along with the size (β = –0.14) and the density of special schools in a district (β = –0.12). The effects differ according to the population density of the region and are stronger in large cities. When the proportion of students with and without SEN in regular schools is considered (support rate), the density of special schools has the greatest impact on school placement ($\hat{O}$ = 43.44). Self-preservation of schools, traditional funding systems and regional differences between urban and rural areas are discussed as possible reasons.

Introduction

Inclusive education has become a trend, empirical studies confirm its effectiveness (Hehir, Grindal, Freeman, et al., 2016; Lindsay, 2011), and the Convention on the Rights of Persons with Disabilities (CRPD; United Nations, 2006) guaranteeing a right to inclusive schooling was ratified in most countries. Still, inclusion within schools has been increasing only slowly on an international scale. Even though inclusion is least advanced in developing countries (Bines and Lei, 2011), some parts of Europe have also seen only little or slow change in the structures and funding of the inclusive school system (Buchner, Shevlin, Donocan, et al., 2020; Meijer and Watkins, 2019). This mainly affects countries with a high population density and urbanisation that have an established special school system (European Agency for Special Needs and Inclusive Education, 2022). The expansion of inclusion is more easily achieved in rural and sparsely populated areas where special schools were either never existed or only reachable at great expense and children with disabilities had to cover long distances (Ojok and Wormnæs, 2013).

Correspondingly, inclusive practice is less established in countries with an extensive (e.g., comprehensive and professionalised) special school system (Powell, 2011; Sansour and Bernhard, 2018; Buchner, 2021). Such countries tend to hold on to their school structures (Linertova, Gonzalez-Guadarrama, Serrano-Aguilar, et al., 2019). Special schools are under pressure to justify their existence against the background of the worldwide progress in establishing inclusive schooling and have to fear their being closed down if the number of students is too small. To ensure a sufficiently high number of enrolments, special schools compete with regular schools for students. This is especially true when the merging of special schools and regular schools into inclusive schools is only insufficiently or not at all standardised.

Germany is a country with an existing comprehensive and professionalised special school system that is slow to adapt to inclusive efforts (Gebhardt, Sälzer, Mang, et al., 2015a; DeVries, Voss, and Gebhardt, 2018). Basically, there are seven different segregated special school types for students with special needs. Each type of special school has its own focus, namely on learning, behaviour, vision, hearing and on motor skills, while the introduction of the focuses speech and language or intellectual development is envisaged. In addition, all German federal states have their own school systems. As a consequence, the progress of inclusion in the 16 German federal states is different. Although German students and parents are allowed to choose as regards the placement in inclusive or special schools, many students with special needs still attend separate special schools (Schurig, Weiß, Kiel, et al., 2020; Kölm and Gresch, 2021).

Using the example of Germany, this study investigates how the existence of special schools affects the placement of students with special needs in inclusive school settings. The influence of spatial-systemic factors, such as the distance between home and regular schools on the one hand and special schools on the other hand and the size and number of special schools in a certain region, is focused to show a pull effect of special schools. It is also investigated to which degree this pull effect (Helbig and Steinmetz, 2021) occurs in urban as opposed to rural areas. For this purpose, the data of the school statistics of the German federal state of Bavaria which has its own school administration and school system are evaluated.

Reasons for maintaining special school systems

School policy decisions are based on how they are or can be financed. Funding structures which are seen as key to successful inclusion have only rarely been changed and adapted to inclusive requirements in many European countries (Head and Pirrie, 2007; Meijer and Watkins, 2019). Often, the size of the school determines the resources it is provided with, and small schools have fewer funds and thus fewer opportunities to support all students (Bray, 1987; Slate and Jones, 2005; Kantrabutra and Tang, 2006). For example, in Bavaria, Germany, old funding rules still exist according to which larger schools are assigned more head teacher positions with higher salaries and fewer hours to teach (Bayerische Staatskanzlei, 2011; Bayerische Staatskanzlei, 2019). Heading a large school is therefore just as attractive to special education head teachers as it is to all other school principals.

In the traditional special school system, special teachers are employed as classroom teachers and have the opportunity to be promoted to, for example head teacher. In an inclusive school system, the role of special teachers often changes from a teaching role to an advisory or supportive role (Takala, Prttimaa, and Törmänen, 2009; Curran and Bodison, 2021; May, 2021). Speaking of Germany, there is also the structural problem that special teachers have a higher salary than regular teachers because of a longer university training, which is why a special teacher cannot take over the position of a regular teacher. Also, there are no promotion or qualification positions in inclusive settings for special teachers (Heimlich, Ostertag, and Wilfert, 2016) which is why ways must be found to intertwine the existing staff structure of the special schools with that of the regular schools (Avissar, 2017).

Some special education teachers in special schools do consider their own schools better than inclusive schools, as, in their opinion, they offer more support opportunities for students with special needs (Gebhardt, Schwab, Nusser, et al., 2015b; Saloviita, 2019). In this context, the problem of traditional funding becomes manifest, as resources for support in special schools continue to be alloted while resources for inclusive support have to be provided on top. In the case of Bavaria, Germany, schools offer different types of inclusive education, ranging from individual inclusion to segregated classes in a shared school building, but there are frequently only a few hours per week of support per student with special needs and hardly any team teaching (Heimlich, Ostertag, and Wilfert, 2016). Even though inclusion is supposed to take place in all schools, it is mainly the primary schools that teach inclusively (Gebhardt, Schwab, Nusser, et al., 2015b; Lutz and Gebhardt, 2021).

The attitude of teachers, head teachers, principals and other school administrative staff toward inclusion is crucial to the success of inclusive developments (Hammond and Ingalls, 2003; Boyle and Hernandez, 2016; Jungjohann, Führer, and Pusch, 2020; Scheer, 2021; Sider, Maich, Morvan, et al., 2021). But even though most teachers feel positive about inclusion (Miesera, DeVries, Jungjohann, et al., 2018; van Steen and Wilson, 2020), many of them are inclined to recommend for their students with special needs to be educated in a school(ing type) with more special educational support (Saloviita and Leskinen, 2016). Parental choice of school placement is often guided by teachers' assessments to ensure the best possible support for their child (Barusman, 2019; Gasteiger-Klicpera, Klicpera, Gebhardt, et al., 2013; Mann, 2017; Mann, Cuskelly, and Moni, 2018). This process incorporates the results of both informal and formal assessments to measure the status quo and the learning process (Looney, 2011; Jungjohann, DeVries, Gebhardt, et al., 2018; Gebhardt, Jungjohann, and Schurig, 2021).

Spatial placement effect of schools

Even if placement decisions (really) only base on pedagogical reasons, they are influenced by systemic factors as well. From a systemic point of view, all schools are autopoietic social systems aiming at self-preservation (Luhmann, 2008; Schurig, Weiß, Kiel, et al., 2020). On the way to inclusive structures, special schools are in danger of their funds being cut or of being closed down. The pull effect in this context is a spatial placement effect of schools to avoid closure or loss of influence. As special schools must justify their legitimacy, they need to fill as many places as possible or reach at least a minimum number of children to maintain a class according to the current school law. Therefore, special schools 'pull' students with special needs from their immediate environment (Helbig and Steinmetz, 2021). As all children in special schools must have a diagnosed special need, this practice affects diagnosis and special education rates.

Helbig and Steinmetz (2021) analysed school statistics in several German federal states and found that the number of students with special needs diagnosed in areas with a strong population decline was higher. By increasing the diagnostic rate, the total number of children with special needs remained the same. The number of children attending special schools did not change, although all other schools had fewer children attending. Helbig and Steinmetz (2021) attribute this contrast to the self-preservation interest of the special schools. The pull effect therefore confirms the assumption that the placement in special schools depends on systemic factors and is not solely based on diagnostic criteria (Gebhardt, 2013). Thus, the diagnosis of special needs is modified and more children with special needs are identified. That way, the system creates its own clientele depending on which forms of support are offered and which diagnostics are required to stabilise the system (Wocken, 2016; Frey, 2019).

The pull effect is an implicit effect of which the stakeholders and teachers are unaware. It refers to all schools that have to compete for students in a certain region and could therefore also be triggered by regular schools. In rural areas that are affected by population decline, small regular schools are also worried about being closed down. In the majority of the urban areas with a growing population, regular schools are usually full and the special school is a relief for regular schools taking students with strong behaviour and learning difficulties off their hands. Depending on how many free places a school must fill and on how many students are available, the pull effect in such a region is large or small.

The pull effect has already been demonstrated for the densely populated federal state of Nordrhein-Westfalen, Germany, as Goldan and Grosche (2021) were able to prove a distance effect of special schools. According to their findings, the proportion of students with special needs in primary schools decreases by 0.24 percentage points when the distance to the nearest special school increases by 1 km (Goldan and Grosche, 2021). Therefore, a special school has a pull effect, as, on the one hand, the children's school route is shorter and, on the other hand, there usually is a closer cooperation between the schools if they are located close together.

Research question

Inclusion in schools is not a status quo but a continuous development of the school system. This development is influenced by many factors, *for example*. the pull effect, population effects or spatial effects. Knowledge about systemic and spatial factors influencing the advancement of inclusion is necessary to take them into account in school policy decisions and to better advise parents in their choice of school.

Our study explores the question which influencing factors affect the placement of students with special needs in inclusion in urban and rural areas of countries with a long-standing special school system. Bavaria, Germany, has been governed by conservatives for decades and school developments have been happening only slowly, what makes it a sound example for a federal state with a developed traditional special school system. In the context of inclusion, Bavaria is also interesting, because it has the lowest inclusion rates in direct comparison with the other German federal states (Hollenbach-Biele and Klemm, 2020). The latter showing higher trends begs the question as to which conditions besides politics keep the system so stable in Bavaria.

To identify the factors that affect school placement in Bavaria and to which degree, data from official school statistics and other official data are evaluated statistically over time for the years 2010, 2015 and 2020. As settlement structure varies considerably across, the influence of spatial factors is also compared to enable a more differentiated statement about factors that facilitate and hinder inclusion.

Based on the preceding theoretical justifications, it is expected that school placements in Bavaria are influenced by a pull effect. We consider a pull effect to be recognised if there is a clear distance effect of the special schools and the inclusion rate also increases with increasing distance.

Materials and methods

Data base

Data were organised and analysed by descriptively using Educational Data Mining (Algarni, 2016), that is no own or new data were collected for the analysis, but information was derived from already existing primary data, that cannot be published in the sense of the open science approach. Five data sets were included in the analysis (Table 1).

Variables

Six variables were considered in the analyses (Table 2). Four of them describe the special schools directly while two of them characterise their region socio-economically.

The inclusion rate is the proportion of students with special needs who are educated in regular schools in relation to all students with disabilities. The support rate is the proportion of students with special needs who are educated in regular schools in relation to all students in regular schools. In Bavaria, the regular schools include the primary schools and the tripartite secondary school system (Regular Secondary Schools, Intermediate Secondary

Table 1: Data included in the analysis

Data	Content	Source
School statistics of Bavaria	Anonymised information on the Bavarian student body (*N* = 11 280 040) in 2010, 2015 and 2020 including the special needs status of the students and information on all schools (N = 4447) including type, key, district, and municipality	Bavarian State Office for Statistics
Administrative districts of Germany	Geolocated data on administrative districts including boundaries, keys, names, *etc*.	Federal Agency for Cartography and Geodesy, 2021a
Settlement structure of Germany	Geolocated data on settlement structure on district level providing information on the levels of urbanisation or rusticity	Federal Agency for Cartography and Geodesy, 2021b
Income of private households in Germany	Annual (1995–2019) data on private household income at district level	Volkswirtschaftliche Gesamtrechnungen der Länder, 2020
Accessibility of bus and rail services in Germany	Per district proportion of the population living in no more than 600 m (bus) or 1200 m (rail) linear distance from a stop with at least 20 departures per day in 2020	Allianz pro Schiene, 2021

Schools, Grammar Schools). The inclusion rate and the support rate are calculated within the districts. Both rates can be used to determine what proportion of students with special needs in a certain region have been placed in regular schools over the years. High rates are therefore seen as an indicator of the spread of inclusion in regular schools. Both rates serve as an independent variable each whose trend is measured by means of various influencing factors.

The average distance between special schools and regular schools is of interest, as the spatial location of a special school influences the number of diagnoses of special needs in the surrounding area (Orthmann Bless, 2007;

Table 2: Variables included in the analyses

Variables	Description	Source
Inclusion Rate	Proportion of students with special needs who are educated in a regular school	Calculation by school statistics
Distance	Average distance between special and regular schools in each district	Calculation by spatial data
Density	Number of special schools normalised per 1 km^2	Calculation by school statistics
Size	Average number of students per special school in every district	Calculation by school statistics
Income	Average household income in every district	Volkswirtschaftliche Gesamtrechnungen der Länder, 2020
Accessibility	Accessibility of the districts based on the bus and rail network	Allianz pro Schiene, 2021

Goldan and Grosche, 2021; Helbig and Steinmetz, 2021). In this study, the influence of the distance of special schools to primary schools (class 1–4) is examined, as the special needs are mostly diagnosed in the first 2 years of primary school. The linear distance between each primary school and the next special school is calculated based on their geographic locations and is then averaged per district.

For the school density, the number of special schools within a district was normalised per 1 km^2 for better comparability considering the fact that there is a different type of school for each type of disability in Bavaria. If there is no school with the required focus in the vicinity, it may prompt parents to opt for inclusion. The size of special schools is determined by the number of students. Larger schools may provide a greater range of services and therapy, which can be relevant for parental decisions. Moreover, funding and positions are distributed based on school size. It may therefore be assumed that the size of the school also has an influence on the distribution of funds in the region and accordingly on progress regarding inclusion.

In addition, household income and the accessibility of the region are considered. The influence of parents' income on the decisions they take regarding their children's schooling and education was highlighted in several studies (e.g., Taubman, 1989; Goldring and Phillips, 2007). In addition, parents with higher incomes may have a more positive attitude toward special education than those with lower incomes (Brantlinger, 1994). The average household income per region is therefore included in the analysis. The accessibility of a school district can be a criterion in the decision for or against inclusion. If the special school is difficult to reach, parents are more likely to opt for inclusive education because it takes place close to home (Bell, 2007; Barusman, 2019). This indicator is seen as a covariate and control variable for the models.

Workflow
Both the data processing and the analysis were performed using the open-source programming language R (R Core Team, 2020). The geographic co-ordinates of each school were derived using their address according to the approach of Schelhowe (2016), which is based on the geographical database OpenStreetMap.

The Bavarian school statistics of 2010, 2015 and 2020 were used to determine the inclusion rate and the support rate for each district to evaluate changes over time. The spatial component of these changes was analysed according to the settlement structure of the school districts which subdivides areas into 'independent large cities', 'urban districts', 'rural districts with densification approaches' and 'sparsely populated rural districts'. This information is based on the population share of large and medium-sized cities and the population density of the district region (Bundesinstitut für Bau-, Stadt- und Raumforschung, 2020).

To explain the development of the inclusion rate and the support rate, a multiple linear regression model for each rate is calculated. However, the secondary school system consists of different school types. This cannot be considered in the calculations, because the school statistics do not show which type of school is the appropriate school. Therefore, the calculation of the regression on all variables refers only to the primary school level. Inclusion rate in the regression model thus denotes the proportion of students with special needs who attend a primary school in relation to all students with special needs in primary and special schools. Support rate in the regression model denotes the proportion of students with special needs who attend a primary school in relation to all students at primary schools. The distance of primary schools to special schools is included with the density and size of special schools in the region in a regression model of the inclusion rate. Accessibility and household income are included as independent variables. The regression model includes the density of special schools, the size of special schools, the accessibility and the household income successively in a hierarchy.

Results

Spatiotemporal changes in inclusion
In Bavaria, there are 96 counties within seven government districts. The 96 counties are divided as follows in terms of their settlement structure: there are 34 sparsely populated counties, 34 rural counties with densification approaches, 20 urban counties and eight large cities.

There have been no changes in the Bavarian special school landscape during the last 10 years, as no special schools were closed. In total, about 8% of the schools in Bavaria are special schools. Of these, 29% are located in sparsely populated counties, 27% in rural counties, 21% in urban counties and 22% in large cities.

In rural areas, the density of special schools is lower than in urban areas. While in large cities, about 12% of the schools are special schools, the share in rural areas is about 8%. This allocation has remained the same over the years. The distribution of students does not show any major changes either. The proportion of students in special schools increased from 4% to 5% of the total pupil population between 2010 and 2020. The proportion of students with special needs increased from 4.3% in 2010 to 4.9% in 2015 to 6.1% in 2020. The proportion of these students who have special needs but do not attend a special school determines the inclusion rate in the following.

The inclusion rate in Bavaria rose in total from 28% to 33.3% between 2010 and 2020, but varies greatly between the districts. It ranges from 2% to 66.3% in 2010 and from 7.8% to 62.7% in 2020 (Figure 1). The change in the districts' inclusion rate between 2010 and 2020 is on average + 8.1%, with a minimum of −24.9% and a maximum of 37.7%.

Considered at the level of settlement structure, the inclusion rate has increased on average between 2010 and 2020 (Figure 2), in large cities (F (2,21) = 3.58, $P < .01$) and rural counties (F (2,99) = 3.81, $P < .1$), a slightly significant increase can be measured, while the inclusion rate in urban counties has increased very significantly (F (2,57) = 9.92, $P < .001$). However, there is no significant increase in sparsely populated areas, although this is where the highest inclusion rates on average are observed.

Influencing factors on the inclusion rate and support rate
The resulting regression model of the inclusion rate at primary school level is significant (F (5,86) = 6.21, $P < .001$) and can explain 26.5% of the variance (Table 3). The highest influence on the inclusion rate is exerted by the average distance between primary and special schools, followed by the size of special schools. As the number of variables increases, the influence of distance and size also increases. By adding the independent variables to the regression model, the influence of distance, size and density becomes stronger, and the fit improves from R^2 = .244 without control variables to R^2 = .265 with control variables.

Regarding the settlement structures, the influence of these variables on the inclusion rate differs. In large cities (R^2 = .402) (Table 4), the distance between primary and

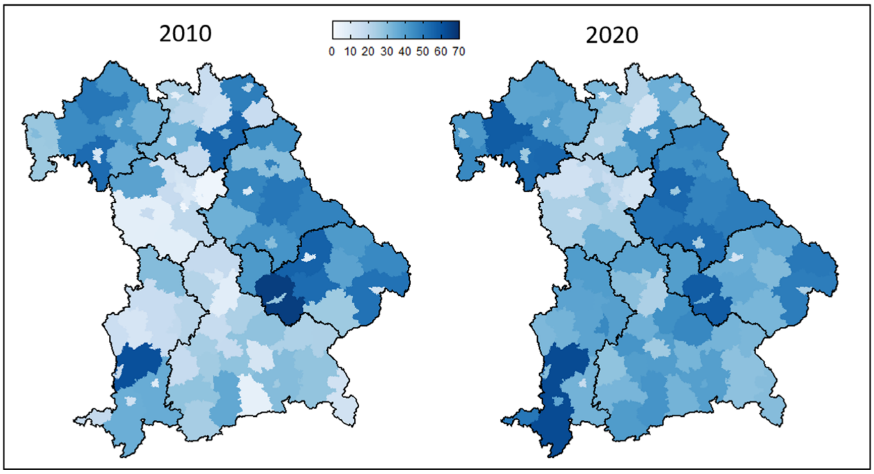
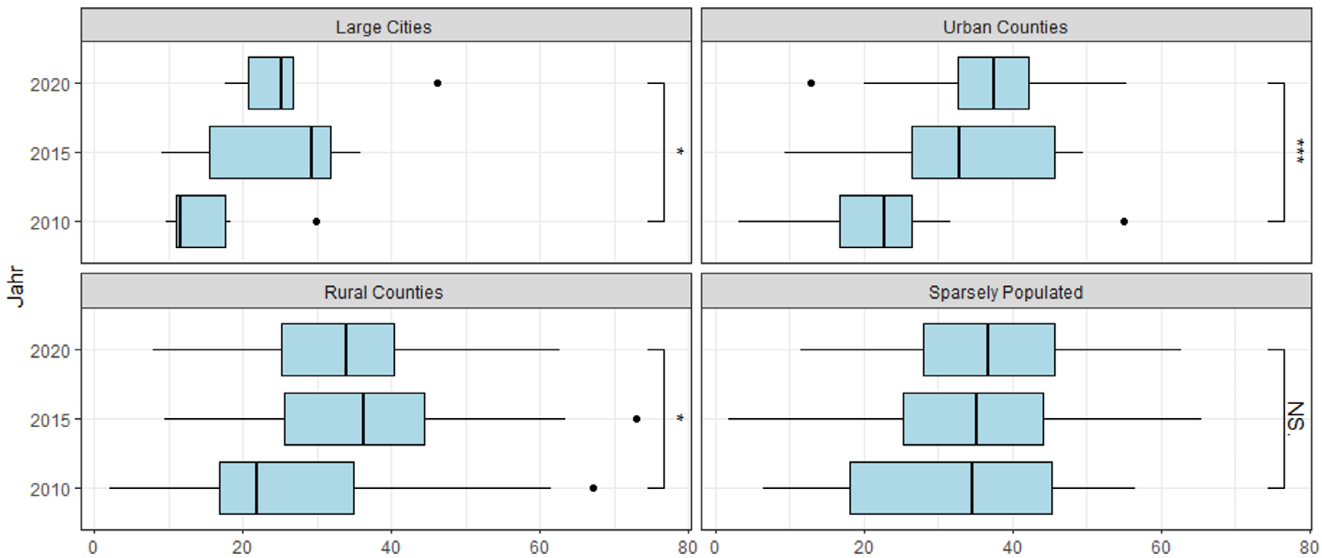


Figure 1: Inclusion Rate of all students in % in the 96 counties of Bavaria in 2010 und 2020 within the seven government districts

Figure 2: Inclusion rate of all students at the level of settlement structure in 2010, 2015 and 2020 with significant changes (*P < 0.05; **P < 0.01; ***P < 0.001) in large cities, urban counties and rural counties between 2010 and 2020



special schools (β = 3.68), the density of special schools (β = 3.73) and the size of special schools (β = −0.77) all carry weight. In urban (R^2 = .54) (Table 5), rural (R^2 = .317) (Table 6) and sparsely populated counties (R^2 = .381) (Table 7), the influence is much lower and takes β values between −0.54 and 0.84 (Figure 3).

As the influences of distance and density have the greatest variance, both of them are considered for the different settlement structures, as the effects are more pronounced in large cities than in more rural regions (Figures 4 and 5). With decreasing settlement density, the average distance in the counties and their variance increases while the number of schools in a district decreases. The average for urban areas (large cities and urban counties) is below the Bavarian median, while rural areas (rural districts and sparsely populated counties) are above it.

When changing the dependent variable of the regression model to support rate at primary school level and only adding distance, size and density as independent variables, the fit changes to R = .248. Thereby, size has no influence (β = 0), distance has little influence (β = 0.03) and density has great influence (β = 43.33) on the support rate (Table 8).

Discussion

Our study confirms that the placement of students in both special schools and inclusive schools is influenced by systematic effects, which suggests the existence of the pull effect. This influence shows that school placement is not made solely on the basis of pedagogical reasons. In various studies by different researchers such as Wocken (1996) or Klicpera and Gasteiger-Klicpera (2005), these effects have been pointed out,

Table 3: Regression results for all regions in Bavaria using the inclusion rate at primary schools as the criterion

Predictor	*b*	*b* 95% CI [LL, UL]	*β*	*β* 95% CI [LL, UL]	sr^2	sr^2 95% CI [LL, UL]	*r*	Fit	Difference
(Intercept)	14.48**	[9.73, 19.22]							
Distance	1.69**	[0.96, 2.41]	0.44	[0.25, 0.63]	0.19	[0.07, 0.33]	0.44**		
								R^2 = .191**	
								95% CI [0.07, 0.33]	
(Intercept)	18.39**	[10.01, 26.76]							
Distance	1.21*	[0.10, 2.32]	0.31	[0.03, 0.60]	0.04	[−0.03, 0.12]	0.44**		
Density	−64.88	[−179.48, 49.72]	−0.16	[−0.45, 0.12]	0.01	[−0.03, 0.05]	−0.40**		
								R^2 = .203**	ΔR^2 = .011
								95% CI [0.06, 0.33]	95% CI [−0.03, 0.05]
(Intercept)	27.66**	[15.95, 39.38]							
Distance	1.14*	[0.05, 2.23]	0.30	[0.01, 0.58]	0.04	[−0.03, 0.10]	0.44**		
Density	−61.20	[−173.47, 51.06]	−0.15	[−0.44, 0.13]	0.01	[−0.03, 0.05]	−0.40**		
Size	−0.06*	[−0.11, −0.01]	−0.21	[−0.39, −0.02]	0.04	[−0.03, 0.11]	−0.26*		
								R^2 = .244**	ΔR^2 = .042*
								95% CI [0.09, 0.37]	95% CI [−0.03, 0.11]
(Intercept)	15.94	[−2.87, 34.74]							
Distance	1.65*	[0.39, 2.91]	0.43	[0.10, 0.75]	0.06	[−0.02, 0.14]	.44**		
Density	−65.16	[−176.61, 46.30]	−0.16	[−0.44, 0.12]	0.01	[−0.03, 0.05]	−0.40**		
Size	−0.07*	[−0.12, −0.02]	−0.25	[−0.44, −0.06]	0.06	[−0.03, 0.14]	−0.26*		
Accessibility	13.29	[−3.46, 30.04]	0.21	[−0.05, 0.47]	0.02	[−0.03, 0.07]	−0.25*		
								R^2 = .265**	ΔR^2 = .021
								95% CI [0.09, 0.38]	95% CI [−0.03, 0.07]
(Intercept)	16.78	[−9.71, 43.27]							
Distance	1.65*	[0.39, 2.92]	0.43	[0.10, 0.76]	0.06	[−0.02, 0.14]	.44**		
Density	−66.23	[−180.78, 48.33]	−0.17	[−0.45, 0.12]	0.01	[−0.03, 0.05]	−0.40**		
Size	−0.07*	[−0.12, −0.02]	−0.25	[−0.44, −0.06]	0.06	[−0.03, 0.14]	−0.26*		
Accessibility	13.47	[−3.86, 30.81]	0.21	[−0.06, 0.49]	0.02	[−0.03, 0.07]	−0.25*		
Income	−0.00	[−0.00, 0.00]	−0.01	[−0.20, 0.18]	0.00	[−0.00, 0.00]	0.04		
								R^2 = .265**	ΔR^2 = .000
								95% CI [0.08, 0.37]	95% CI [−0.00, 0.00]

Note: $^*P < 0.05$; $^{**}P < 0.01$; $^{***}P < 0.001$.

especially during the transition phase to an inclusive school system.

In our analysis, the distance between primary and special schools ($\beta = 0.43$) has the strongest influence on the inclusion rate for the entire federal state of Bavaria. Greater distance between primary and special schools thus favours inclusion in schools in the region. The proportion of students with special needs in a district increases by 2.36 percentage points when the average distance between primary and special schools increases by 1 km. The distance effect in Bavaria is stronger than the distance effect measured by Goldan and Grosche (2021). We conclude that the strong distance effect can be explained by the fact that the Bavarian school administration is still supportive of the traditional school system. (Powell, 2011; Sansour and Bernhard, 2018; Linertova, Gonzalez-Guadarrama, Serrano-Aguilar, et al., 2019; Buchner, 2021) and does not focus on inclusion. Inclusion is not seen as a change to the system but as an additional framework or as an additional choice. The traditional special schools are supposed to be preserved as an option and their number has therefore not decreased so far (Heimlich and Wittko, 2018), but rather increased by building new special schools.

This assumption is also supported by the fact that the inclusion rate in the whole of Bavaria has in total increased from 28% to 33.3% between 2010 and 2020, whichputs the development of inclusion in Bavaria below the national average, where an inclusion rate of 43.1% was measured for the school year 2018/2019

Table 4: Regression results for large cities using the inclusion rate at primary schools as the criterion

Predictor	b	b 95% CI [LL, UL]	β	β 95% CI [LL, UL]	sr^2	sr^2 95% CI [LL, UL]	r	Fit
(Intercept)	−79.12	[−169.80, 11.56]						
Distance	57.43	[−270.50, 385.35]	3.68	[−17.35, 24.71]	0.17	[−0.25, 0.59]	0.04	
Density	871.76	[−3475.21, 5218.73]	3.73	[−14.88, 22.35]	0.22	[−0.24, 0.69]	0.06	
Size	−0.23	[−2.27, 1.81]	−0.77	[−7.49, 5.95]	0.07	[−0.21, 0.36]	0.16	
Accessibility	−1033.41	[−6890.04, 4823.23]	−0.55	[−3.67, 2.57]	0.17	[−0.25, 0.59]	−0.10	
Income	−0.00	[−0.01, 0.00]	−0.41	[−3.10, 2.28]	0.13	[−0.24, 0.50]	−0.26	
								R^2 = .402
								95% CI [0.00, 0.37]

Table 5: Regression results for urban counties using the inclusion rate at primary schools as the criterion

Predictor	b	b 95% CI [LL, UL]	β	β 95% CI [LL, UL]	sr^2	sr^2 95% CI [LL, UL]	r	Fit
(Intercept)	−8.66	[−47.31, 29.98]						
Distance	5.18**	[1.73, 8.63]	0.84	[0.28, 1.40]	0.37	[0.05, 0.70]	0.71**	
Density	83.39	[−452.04, 618.82]	0.08	[−0.45, 0.62]	0.00	[−0.03, 0.04]	−0.38	
Size	−0.01	[−0.13, 0.11]	−0.04	[−0.55, 0.47]	0.00	[−0.02, 0.02]	0.22	
Accessibility	18.79	[−28.98, 66.57]	0.20	[−0.31, 0.71]	0.03	[−0.07, 0.12]	−0.08	
Income	−0.00	[−0.00, 0.00]	−0.02	[−0.51, 0.48]	0.00	[−0.01, 0.01]	−0.04	
								R^2 = .540*
								95% CI [0.00, 0.65]

Note: *$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.

Table 6: Regression results for rural counties using the inclusion rate at primary schools as the criterion

Predictor	b	b 95% CI [LL, UL]	β	β 95% CI [LL, UL]	sr^2	sr^2 95% CI [LL, UL]	r	Fit
(Intercept)	17.69	[−35.75, 71.13]						
Distance	1.70	[−0.58, 3.98]	0.44	[−0.15, 1.03]	0.06	[−0.08, 0.21]	0.51**	
Density	−82.62	[−302.08, 136.83]	−0.22	[−0.80, 0.36]	0.02	[−0.06, 0.09]	−0.47**	
Size	−0.06	[−0.17, 0.05]	−0.22	[−0.60, 0.16]	0.04	[−0.07, 0.15]	−0.13	
Accessibility	7.14	[−26.60, 40.87]	0.11	[−0.41, 0.63]	0.01	[−0.04, 0.05]	−0.37*	
Income	0.00	[−0.00, 0.00]	0.01	[−0.36, 0.39]	0.00	[−0.01, 0.01]	0.10	
								R^2 = .317
								95% CI [0.00, 0.46]

Note: *$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.

(Hollenbach-Biele and Klemm, 2020). In sparsely populated counties of Bavaria, the inclusion rate did not rise significantly between 2010 and 2020, as, with average inclusion rates of 33% in 2010 and 38% in 2020, sparsely populated districts already had the highest inclusion rates compared with more rural areas. These results are in line with the assessments of Heimlich and Wittko (2018) which follow from their studies stating that inclusion in the different Bavarian regions will develop at different speeds and to different degrees. Also, the expansion of inclusion is more successful in rural and sparsely populated areas where special schools were either never built, far away or only reachable at great expense by children with special needs. Similar effects may be observed in developing countries where special schools were never built in many regions and inclusion may be implemented more easily because of the small number of special schools (Ojok and Wormnæs, 2013).

It is noteworthy that the size of the special school also has a small influence ($\beta = -0.25$). The larger the special schools in a district, the smaller the number of students

Table 7: Regression results for sparsely populated counties using the inclusion rate at primary schools as the criterion

Predictor	*b*	*b* 95% CI [LL, UL]	*β*	*β* 95% CI [LL, UL]	sr^2	sr^2 95% CI [LL, UL]	*r*	Fit
(Intercept)	23.50	[−55.49, 102.49]						
Distance	0.28	[−1.84, 2.41]	0.07	[−0.45, 0.59]	0.00	[−0.02, 0.02]	0.28	
Density	−114.21	[−373.05, 144.62]	−0.21	[−0.68, 0.26]	0.02	[−0.05, 0.09]	−0.33	
Size	−0.17**	[−0.27, −0.07]	−0.54	[−0.86, −0.22]	0.27	[0.03, 0.51]	−0.56**	
Accessibility	4.61	[−23.93, 33.15]	0.07	[−0.36, 0.50]	0.00	[−0.02, 0.03]	−0.18	
Income	0.00	[−0.00, 0.00]	0.09	[−0.24, 0.42]	0.01	[−0.04, 0.05]	0.06	
								R^2 = .381*
								95% CI [0.02, 0.51]

Note: $*P < 0.05$; $**P < 0.01$; $***P < 0.001$.

Figure 3: The strength of the influence of the distance between primary and special schools, the density and the size of special schools on the inclusion rate of primary students in a district for different settlement structures

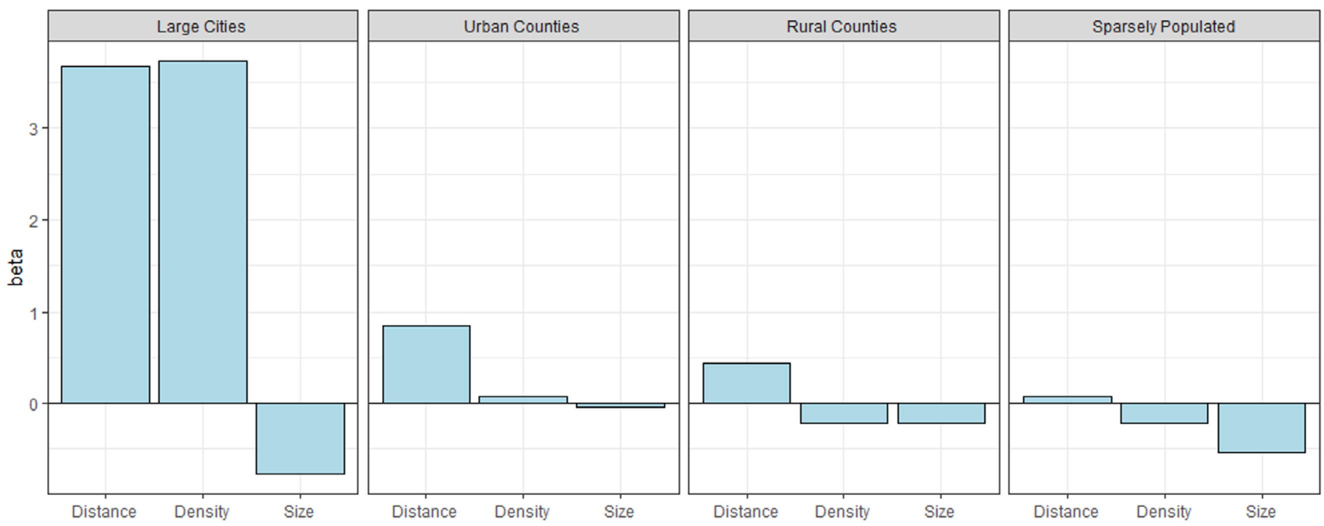


Figure 4: Distance between primary and special schools in districts for the level of settlement structure types with the overall median of all Bavaria (red)

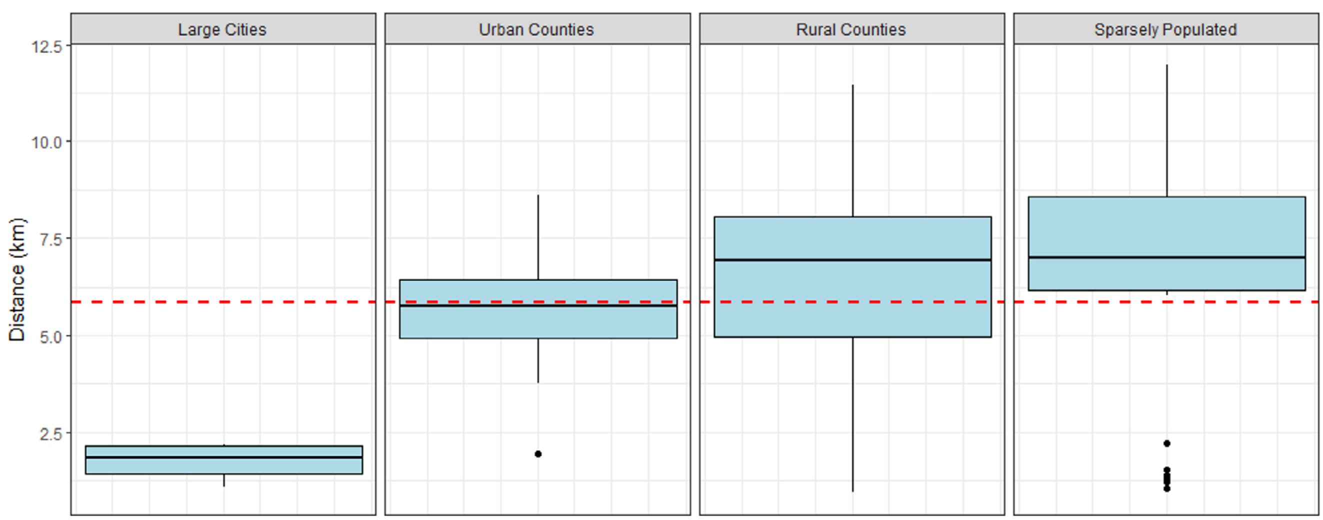


Figure 5: Average density e.g. number of special schools normalized per 1 km in districts for the level of settlement structure types with the overall median of all Bavaria (red)

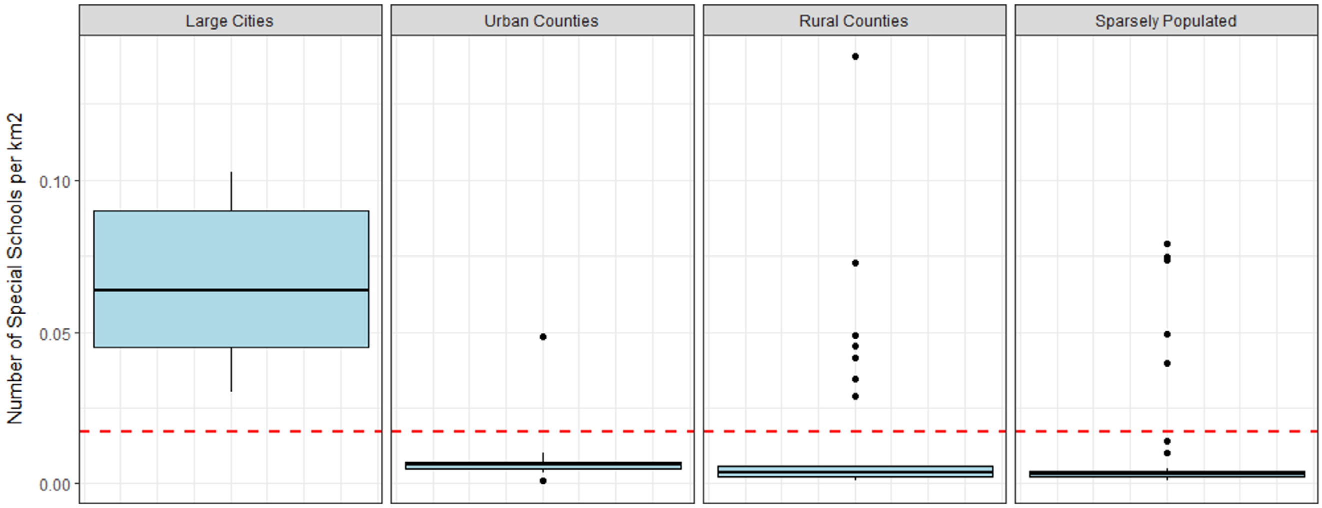


Table 8: Regression results using support rate at primary schools as the criterion

Predictor	*b*	*b* 95% CI [LL, UL]	*β*	*β* 95% CI [LL, UL]	sr^2	sr^2 95% CI [LL, UL]	*r*	Fit	Difference
(Intercept)	8.48**	[7.48, 9.49]							
Distance	−0.29**	[−0.45, −0.14]	−0.36	[−0.56, −0.17]	0.13	[0.03, 0.26]	−0.36**		
								R^2 = .132**	
								95% CI [0.03, 0.26]	
(Intercept)	5.86**	[4.17, 7.55]							
Distance	0.03	[−0.20, 0.25]	0.04	[−0.25, 0.32]	0.00	[−0.01, 0.01]	−0.36**		
Density	43.36**	[20.14, 66.57]	0.52	[0.24, 0.80]	0.12	[0.00, 0.23]	0.50**		
								R^2 = .248**	ΔR^2 = .115**
								95% CI [0.10, 0.37]	95% CI [0.00, 0.23]
(Intercept)	5.78**	[3.35, 8.22]							
Distance	0.03	[−0.20, 0.25]	0.04	[−0.25, 0.32]	0.00	[−0.01, 0.01]	−0.36**		
Density	43.33**	[19.97, 66.68]	0.52	[0.24, 0.81]	0.11	[0.00, 0.23]	0.50**		
Size	0.00	[−0.01, 0.01]	0.01	[−0.18, 0.19]	0.00	[−0.00, 0.00]	0.07		
								R^2 = .248**	ΔR^2 = .000
								95% CI [0.09, 0.37]	95% CI [−0.00, 0.00]

Note: *P < 0.05; **P < 0.01; ***P < 0.001.

with special needs that are placed in inclusive settings. The reason for this effect is assumed to be the fact that large schools receive more resources than small schools (Bray, 1987; Slate and Jones, 2005) which is why they can offer more services and are therefore more attractive for parents (Kantrabutra and Tang, 2006; Mann, Cuskelly, and Moni, 2018; Barusman, 2019). Likewise, these schools have more places to offer. The number of places in special schools is determined not only by the size of the school, but also by the density of special schools in a region. The density of special schools (β = −0.17) is a factor with a small negative influence on the inclusion rate and a high positive influence on the support rate (β = 43.33). Both rates are related to each other. A larger density of special schools in a region identifies more students. One possible reason may be that there are more places available in special schools. Similarly, it seems that despite what should be free consultation and decisions of parents, the places in special schools are taken before the places in the inclusion. Distance, size and density influences are systemic influences that are caused by the mere existence of the special schools. These influences can be explained by the pull effect of special schools (Orthmann Bless, 2007; Wocken, 2016) whose strength is dependent on the number of free places at special schools in the region and on where they are located. This effect varies regionally and was increasingly observed in large cities where the distance effect ($\beta = 3.68$), the density effect ($\beta = 3.73$) and the size effect ($\beta = -0.77$) are higher than in the rural Bavarian regions. Assuming that the proportion of students with special needs is independent of the settlement types, it is noteworthy that the proportion of special schools is with 12% of all schools about 4 per cent points higher in larger cities than in rural areas. Furthermore, the average distance between primary and special schools is lowest in large cities as compared with other areas. If special and primary schools are located closer together, counselling of parents by teachers referring them to special education may be more widespread when the special school is easier to reach because it is closer to home. This combination of the distance between schools and the size and number of special schools results in a stronger pull effect of special schools in large cities.

Limitations und outlook

The results obtained and interpretations performed in this study for Bavaria, Germany, presumably are transferable to all those countries with similar structures in their school systems and a similar development of inclusive education. The extent to which undesirable systemic factors influence the placement of students with special needs should therefore also be studied for other areas. Inclusion rates and their development vary greatly from region to region across Bavaria, although the legal framework and requirements are the same throughout the entire federal state. However, as countries with advanced school systems such as Germany are only developing slowly (Gebhardt, Sälzer, Mang, et al., 2015a; DeVries, Voss, and Gebhardt, 2018), analyses such as this should be designed and conducted over a longer period than only 10 years. For a better assessment of the regional inclusion status, Wocken (2016) recommends to record the type of support and the support rate in addition to the inclusion rate. The support rate focuses on the type of support for students with special needs and is therefore useful as regards further pedagogical conclusions. To estimate the support rate, further data are needed, such as the number of teaching hours and special needs teachers per pupil, the precise special needs of the individual students and data on the individual child's participation and learning progress. These data were not available for this evaluation and are therefore a limitation of the article. Likewise, as the relevant information was not contained in the data, no distinction could be made between the various inclusive support measures such as shared classes, individual inclusion or external classes. Hence, only the placement of students with special needs could therefore be considered to determine the inclusion rate.

Data availability statement

R Syntax, Version 1.4, is available in the project "The Systemic Placement Effects of Special Schools" on OSF.io - https://osf.io/c6axj

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Address for correspondence
Nikola Ebenbeck,
Pedagogy for Learning Disabilities Including Inclusive Pedagogy,
University of Regensburg,
Regensburg,
Germany.
Email: nikola.ebenbeck@ur.de

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