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Where Children Live and Where They Learn: Spatial Inequality in Access to Schools in Peri-Urban Areas

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ABSTRACT
Access to school is often measured through enrolment rates or the number of facilities available within an administrative area. Those measures say little about whether children living at the urban edge can reach a suitable school without carrying a heavier daily burden than children in better served locations. This article reviewed recent research on school distribution, home-to-school mobility, and residence-based admission in order to examine how spatial inequality takes shape in peri-urban areas. An integrative literature review was conducted using peer-reviewed journal articles. The studies were read for evidence on school location, travel conditions, settlement growth, school capacity, and zoning. The review found that school provision often adjusts more slowly than peripheral residential growth. Distance also became unequal through road networks, transport availability, and differences in household resources. Admission policies could improve access, but their effect remained limited when school locations and capacities are already uneven. School accessibility was therefore better understood as a relation between residence, mobility, infrastructure, and institutional rules rather than as distance alone.

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INTRODUCTION

Administrative measures can make school access look more equal than it is. A district may report enough schools for its total population while some settlements remain far from a public school or connected to one only through difficult travel. The problem becomes sharper when population growth moves outward from the established city. New housing can appear beside older villages, industrial land, and arterial roads while the location of public schools still reflects an earlier pattern of settlement. Research in Jakarta has shown that the apparent coverage of schools changes when accessibility is measured through the street network rather than through simple radius calculations (Muhaimin et al., 2022). Studies in Greater Mumbai reach a related conclusion by showing that educational accessibility has a social as well as a spatial distribution (Sharma & Patil, 2022). A school may exist within a reasonable distance on paper, but that does not settle the question of who can reach it easily. District averages can therefore coexist with local scarcity, especially where one part of a municipality has long-established services and another has expanded recently.

Peri-urban areas deserve separate attention because their service geography is often unsettled. Population density can rise without the full range of urban infrastructure, and administrative categories do not always describe everyday conditions well. Some settlements have urban traffic and expensive land but weak public transport. Others sit near new residential development while public schools remain concentrated around older centres. Djufri (2025) describes this problem through the absence of schools in an urban fringe setting. School-mapping work in Cianjur and Subang also shows that population distribution, roads, existing facilities, and available land do not always align in ways that support equal access (Ruhimat et al., 2024). Lesnawati et al. (2025) show the same planning difficulty when identifying effective locations for new junior high schools in Subang.

Much of the research still approaches these issues from separate directions. GIS studies usually ask where schools are located and which areas fall inside a service range. Travel-to-school studies focus

on distance, route choice, or transport mode. Education policy research examines zoning, admission, or the distribution of students between schools. Each tradition identifies part of the problem, but the separation is awkward in peri-urban areas. A child does not encounter school location, road access, and admission rules as separate systems. These conditions meet in the same daily decision about which school can realistically be attended. The separation also affects how inequality is interpreted. A mapping study may label a settlement as covered because a school falls within a threshold, while travel research may show that the route is difficult in practice. A policy study can then record successful placement without asking whether the assigned school creates a higher travel burden for some households. Reading the three literatures together makes those gaps easier to see.

Distance itself is less stable than it first appears. Liao and Dai (2022) found that a policy expectation of nearby attendance did not necessarily produce short school journeys in Beijing. Mandic et al. (2023) likewise show that school choice and distance interact with travel patterns among adolescents. Road layout, transport mode, and the location of preferred schools can change the practical meaning of proximity. For a family with a private vehicle, several kilometres may be manageable. The same distance can become a recurring problem for a household that relies on walking, shared transport, or a parent who must accompany a younger child. Pizzol et al. (2021) add another complication by arguing that accessibility should account for the quality of educational opportunities, since physical proximity to a school does not necessarily create an equivalent choice.

Indonesian zoning policy makes the relationship between residence and schooling especially important. Residence-based admission was intended to broaden access and reduce the concentration of students in a small number of preferred schools. Evidence suggests that zoning can support a more even distribution of access, although mismatches between prospective students and public-school capacity continue to appear (Sulistyosari et al., 2023). Musadad and Purwanta (2023) also report that residence-based placement does not remove wider differences within the school system. Questions about educational quality remain important because families may continue to seek alternatives when nearby schools are not regarded as comparable (Rohman et al., 2023). Zoning changes the rule through which students enter schools, but it cannot move a school building or increase capacity in an underserved settlement by itself. This matters more at the urban edge because the number and location of schools may already lag behind new residential growth. In that setting, a policy based on proximity can reveal the shortage very clearly, yet the shortage remains a planning problem rather than an admission problem.

The gap addressed here lies in that intersection. Recent work provides increasingly detailed measures of school distribution and travel, while policy studies explain how admission rules redistribute students. Less attention is given to how these processes work together at the urban edge, where settlement growth can outpace public provision. The review therefore asks how residential location becomes unequal school access in peri-urban areas and which mechanisms make that inequality persist. The discussion stays close to three linked issues. The first concerns where schools are placed as settlements expand. The second concerns the daily mobility needed to reach them. The third concerns what happens when equity-oriented admission policy operates on a school geography that is already uneven.

RESEARCH METHODS

An integrative literature review was used because the relevant evidence comes from several research traditions that do not share one measure of accessibility. The review included peer-reviewed journal articles. Searches used combinations of school accessibility, spatial inequality, school distribution, travel to school, school mapping, educational equity, peri-urban education, urban fringe, and school zoning. Relevant articles were identified through journal databases, publisher search pages, and reference tracing from studies that directly addressed the relationship between school location and access. Search results were screened first through titles and abstracts. Full texts were then checked when the spatial component or school level was unclear. The aim was not to reproduce a systematic review with a pooled effect size, since the studies differ substantially in design and outcome. Some papers estimate network accessibility, others examine travel behaviour, while the Indonesian policy literature is mainly concerned with admission and equity. Combining them is useful only when those differences are kept visible.

Articles were retained when they dealt with school-age education and included a clear spatial element involving residence, school location, catchment areas, travel, service coverage, peripheral urban growth, or geographically structured admission. Studies concerned only with higher education, online learning, classroom instruction, or educational outcomes without a spatial access component were not included. The final set contained 26 journal articles. Indonesian studies were given particular weight because zoning policy and rapid peripheral growth are central to the argument, while international studies were used when they clarified a similar access mechanism under a different urban or school system.

Analysis was conducted through close comparative reading. Notes from each article recorded the access problem being studied, the spatial measure or evidence used, and the consequence for children or households. Findings were then grouped around recurring mechanisms rather than around country. Three groups became clear during the reading. One concerned the mismatch between settlement growth and school provision. Another concerned the burden created by travel between home and school. The last concerned zoning and other equity policies that work within an uneven distribution of facilities. GIS findings were treated as evidence about spatial pattern, not as a complete explanation of inequality.

RESULTS AND DISCUSSION

1. Uneven School Distribution in Expanding Peri-Urban Areas

Public schools tend to reflect earlier rounds of settlement and investment. Peri-urban growth can disturb that fit quickly. Housing estates may be occupied before public facilities are completed, older villages may be absorbed into a metropolitan corridor, and new clusters of residents can emerge where school provision was planned for a much smaller population. Similar spatial imbalances have been documented in different urban settings. AlQuhtani (2023) found uneven distribution of elementary schools in Najran, while Abulibdeh et al. (2024) identified important differences in the distribution and accessibility of schools in Qatar. Lawal and Abdullahi (2025) report a related pattern in Sokoto, where provision was stronger in central areas than in parts of the periphery. Existing school networks often respond slowly to population moving toward the edge. That lag becomes socially important when school-age populations create daily demand but remain too dispersed to receive immediate investment. A peripheral settlement can therefore remain poorly served even after its population is no longer small in practical terms.

Indonesian studies show how that delay enters planning decisions. Ruhimat et al. (2024) used school mapping in Cianjur to identify areas where new junior high schools were needed. Their analysis linked proposed provision to the location of existing schools and areas of demand rather than assuming that district-level totals were enough. Lesnawati et al. (2025) took a similar problem in Subang and combined population, road access, land use, and environmental constraints to identify feasible sites. These studies are often read as examples of GIS application. Their more important contribution here is simpler. Educational access depends on land decisions made before students compete for places.

The timing of those decisions matters. Once peripheral land has been converted to housing, commerce, or other urban uses, finding a well-connected site for a new public school can become harder and more expensive. Djufri (2025) links the absence of schools in an urban fringe area to the wider production and planning of space. That account helps explain why a shortage should not be treated only as a technical failure to calculate demand. Development approvals, land prices, jurisdictional boundaries, and the priority given to education all influence whether a new settlement receives a school early enough. A delay that looks temporary from a planning office can cover most of a child's primary or lower-secondary schooling. The burden created during that delay is shifted away from the planning process and into household routines. Parents arrange transport, children accept longer journeys, and nearby schools face pressure on available places. Once those adjustments become normal, the original spatial mismatch can disappear from official discussion even though families continue to absorb its cost.

Jakarta provides a useful example of why simple counts can hide this unevenness. Muhaimin et al. (2022) found differences in school accessibility between formal and informal settlement contexts and showed that network-based measures change the picture produced by conventional service areas. The result matters beyond Jakarta. Dense metropolitan regions can contain many schools and still leave particular neighbourhoods poorly connected to them. Peri-urban districts face the same problem with

an additional layer of rapid change, because today's low-density edge may become tomorrow's large residential concentration.

Location-allocation methods can help identify where new provision would reduce gaps, but the objective chosen in the model matters. AlFanatseh (2024) shows how GIS can be used to assess school distribution and accessibility in Mafraq. Xu et al. (2024) connect school siting to territorial spatial planning. Meena et al. (2023) likewise demonstrate that spatial analysis can reveal uneven primary-school access in Prayagraj. A model that maximizes the number of people covered may still favour dense locations because one facility serves more residents there. Smaller peripheral settlements can remain outside the preferred solution even when the daily burden on those households is high.

For peri-urban education, the practical issue is therefore not whether every settlement can support its own school. The stronger question is whether the pattern of provision keeps pace with the movement of school-age populations. Planning that waits for severe overcrowding or visible enrolment pressure acts after inequality has already been transferred to households. Children then compensate through longer journeys, private schooling, relocation, or competition for a limited number of nearby places. Those responses can look like individual choices even when they began with a spatial shortage.

2. Travel Distance, Mobility, and Unequal School Access

School access becomes more unequal once the journey from home is taken seriously. Road-network distance is already more informative than a straight-line radius, but even network distance does not describe the same experience for every child. Han et al. (2022) show that built-environment conditions affect route choice among rural students. Voulgaris et al. (2021) also found that distance and neighbourhood conditions influence active travel to school. A route that crosses heavy traffic or lacks a safe pedestrian connection can make a nearby school difficult to reach, especially for younger children. Travel time can also vary across the day, which matters when school arrival is fixed but public transport is irregular. Weather and local road conditions add another layer in places where walking or motorcycles are the common modes. None of these factors makes distance irrelevant. They show why distance has to be read through the conditions under which it is travelled. Two children can live the same number of kilometres from school and still face quite different access.

Transport mode changes the burden further. Families with private vehicles can absorb distance in ways that households relying on walking or shared transport cannot. Travel also depends on whether an adult is available at the right time, since younger children are less able to make difficult routes alone. These differences mean that the same measured distance can produce very different daily costs. Sharma and Patil (2022) address this directly by combining spatial and social dimensions of educational accessibility in Greater Mumbai.

School choice adds another layer because children do not always attend the nearest facility. Liao and Dai (2022) found long school journeys among primary students in Beijing even within a system built around nearby attendance. Mandic et al. (2023) found that distance and school choice were closely related to travel patterns. Roulston and Cook (2023) show how the structure of a divided school system in Northern Ireland generates substantial home-to-school movement. The institutional setting differs in each case, yet the same warning appears. Physical proximity does not predict actual attendance when families consider school type, reputation, capacity, or other admission constraints.

Calling the resulting journey a choice can be misleading. A household may travel farther because the nearest school is full, because the available programme does not fit the child, or because nearby schools are regarded as substantially different in quality. Pizzol et al. (2021) argue that accessibility analysis should incorporate the quality of the opportunities that can be reached. That approach avoids treating every school place as interchangeable. From the household side, the relevant opportunity set is made up of schools that can actually be entered and reached under ordinary daily conditions.

Longer travel should not be treated as a direct cause of poor educational outcomes without evidence. The more defensible point is that travel adds pressure to households that already have limited resources. Petre et al. (2024), examining school dropout in satellite towns around Bucharest, show how peripheral social conditions can be associated with educational disadvantage. Distance may contribute to that environment through time, transport cost, and dependence on household schedules, but the effect is likely to interact with income and other constraints. Keeping the claim narrow is important because spatial access is the subject of this review, not dropout itself.

Research on active school travel points to a policy tension that is easy to miss. Sandretto et al. (2020) note that school-choice policies can work against efforts to encourage active travel when preferred schools are farther from home. Mandic et al. (2023) reach a similar practical issue through observed travel patterns. Education policy may encourage choice while transport planning assumes local attendance. Housing approval may proceed on yet another timetable. Peri-urban families then have to make those separate systems work together each morning.

The usual urban and rural labels are not enough to describe this burden. Petre et al. (2025) identify major differences in high-school accessibility across Romania, but many peri-urban settlements contain a mixture of conditions. Traffic may be urban while public transport remains thin. Housing density may rise before sidewalks or local connections are improved. A short physical distance can therefore coexist with a difficult trip.

Accessibility measures are stronger when they start from the journey children can realistically make. Network distance remains useful, and school catchment modelling can improve estimates when population and travel conditions are considered together, as shown by Macharia et al. (2023). Yet the measure should not assume a car where many households do not have one or treat a road crossing as neutral when it is unsafe for a child. The point is not to replace GIS with household accounts. Both forms of evidence answer different parts of the same question.

3. School Zoning and the Spatial Limits of Educational Equity

Indonesia's zoning policy places residence directly inside the admission process, which makes uneven school geography difficult to ignore. Sulistyosari et al. (2023) found that zoning supported equal access but also exposed mismatches between prospective students and available public-school places. Musadad and Purwanta (2023) report a similar tension. Residence can determine priority, yet the value of that priority depends on whether a suitable school with enough capacity exists within reach. In a peripheral area with sparse provision, zoning may distribute scarcity more transparently without removing it. The problem becomes clearer when population growth is concentrated in new housing areas while school capacity remains tied to older settlement centres. Families may follow the admission rule correctly and still face limited options. Zoning should therefore not be judged only through the fairness of its selection procedure. The spatial distribution of capacity has to be considered at the same time.

Differences in perceived school quality make the problem harder. Rohman et al. (2023) question whether zoning can equalize educational quality, which matters because families do not evaluate access only by distance. A nearby place may be formally available but still be avoided when parents believe another school offers a substantially better environment or academic opportunity. When those perceptions are widespread, housing location and school reputation can reinforce each other. Families with more resources have more ways to respond through transport, relocation, or private education.

Free education policy reduces another important barrier but cannot remove the spatial cost of attendance. Romlah et al. (2023) report that free education policy in Indonesia can support more equitable access and better learning conditions. Even so, a household may still pay daily transport costs or lose work time while accompanying a child. Those expenses sit outside the school fee and are easy to miss in assessments of formal affordability.

Educational equity becomes difficult to judge when each policy addresses a different part of the problem. Levinson et al. (2022) show that equity can refer to resources, experiences, outcomes, or distributions across groups. A zoning policy can make admission more even while leaving travel unequal. A new school can improve average distance while a poorly connected settlement remains outside reasonable reach. Transport support may help enrolled students without correcting a shortage of facilities. These outcomes should not be collapsed into a single verdict that access has become equal or unequal.

School mapping offers a practical way to bring spatial evidence into policy before admission pressure becomes severe. Work in Cianjur and Subang shows that the location of school-age populations, existing facilities, roads, and available land can be considered together when identifying new school sites (Ruhimat et al., 2024). Lesnawati et al. (2025) also demonstrate how environmental and land constraints can be included without reducing the analysis to distance alone. The findings do

not prove that technical planning will solve the political and budgetary problems of school provision. They do show that peripheral gaps can be identified before they are treated as unavoidable.

Rigid distance standards remain a weakness when local travel conditions vary. Primary-school children and older students do not have the same mobility. A two-kilometre journey on connected local streets differs from the same distance across a major arterial road. Muhaimin et al. (2022) show why network-based measurement can produce a different picture from simple radius coverage in Jakarta. Using that information well requires local thresholds that reflect age and ordinary travel modes rather than one uniform definition of proximity.

Administrative fragmentation can also hide demand. Metropolitan growth frequently crosses municipal or district boundaries, while school planning and budgeting remain tied to administrative units. A settlement may function as part of the city in housing and employment terms but remain peripheral in public-service provision. Djufri (2025) shows how school absence in an urban fringe area can be related to the planning process itself. This matters because a shortage may appear small when residents are divided between jurisdictions even though the combined settlement has substantial school-age demand.

The policy implication is fairly direct. Residence-based admission works best when school location and capacity have already been adjusted to population change. Where that has not happened, zoning should be read together with spatial monitoring rather than treated as a stand-alone equity measure. Coordinates of schools, enrolment capacity, school-age population, road networks, and recent settlement growth can show where pressure is emerging. Household travel evidence can then test whether the mapped gap is actually experienced as extra cost, time, or restricted choice. Lawal and Abdullahi (2025) and Petre et al. (2025) illustrate the value of identifying peripheral gaps at a fine spatial scale, although the appropriate threshold still depends on local conditions.

Peri-urban inequality is therefore not created by one policy failure. The problem develops when residential growth, school investment, transport planning, and admission rules move on different schedules. Some families can compensate for the mismatch and others cannot. A public system concerned with equal access needs to pay attention to that difference rather than assuming that a formally available school place carries the same practical value everywhere.

CONCLUSION

Recent research on school location, home-to-school travel, and admission policy points to a common problem in peri-urban areas. School networks often adjust more slowly than residential growth, so the location of new households can become disconnected from the location of public provision. The resulting inequality is not captured well by school counts or straight-line distance. Road networks and transport options change what proximity means, while school capacity and perceived quality affect whether a nearby facility is a realistic option.

The Indonesian evidence is especially useful because zoning links residence directly to access. Zoning can improve the distribution of opportunities, but its effect is constrained when public schools are sparse or uneven in capacity. Free schooling faces a similar limit because transport costs and travel time remain with the household. Spatial planning and education policy therefore need to be read together in expanding urban regions. Further research should combine modest spatial analysis with evidence on actual journeys. School coordinates, network distance, capacity, and school-age population can identify likely gaps. Interviews or travel surveys can then show how those gaps are experienced by households. Such a design would keep the geographical element visible without treating GIS output as the whole explanation. For peri-urban communities, equal educational access depends not only on whether a school exists, but on whether children living in different parts of the urban edge can reach a suitable place without systematically different burdens.

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