Spatial analysis of primary education centers (Case Study: Ardabil city)

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Abstract:

Educational spaces are one of the most important urban uses, and considering the activities that take place in these spaces, they are of significant importance compared to other service uses of the city. The imbalance in the distribution system and the inadequacy of the service system, including educational spaces, is one of the important issues that can be seen in most cities of the country. Therefore, in order to increase the efficiency of these spaces, it is necessary to pay attention to proper organization and distribution. The purpose of this research is the spatial analysis of educational centers with the approach of spatial justice in Ardabil city. The research method in this article is descriptive-analytical and its nature is applied. Techniques such as kernel density, Moran's coefficient, general G coefficient, nearest proximity and geographical weighted regression have been used to analyze the research data. The results of the data analysis showed that the primary educational spaces in the neighborhoods of Ardabil city have a cluster distribution and certain areas (the city center) are the concentration of educational centers and follow a centralized pattern, on the opposite point in some parts of the area (periphery areas) city) in terms of the presence of such spaces, they are considered deprived areas. The main reason for the concentration of primary education centers in the central part of the city, access to better communication networks, concentration of services And the center of gravity and the better traction of these areas compared to other areas. Also, the results of the geographic weighted regression method showed the fact that; There is a direct relationship between population density at the neighborhood level and the condition of the neighborhood, that is, following the increase in population and the improvement of the condition of the neighborhood, the distribution of primary education centers also increases.

Keywords: *Spatial justice, inequality, educational centers, GIS, Ardabil city.*

1. Introduction

United Nations forecasts show that by 2030, more than 60 percent of the world's population will be urban dwellers (Baser, 2020: 9). The rapid growth of the urban population in the past few decades and the lack of financial, technical and infrastructure facilities for the creation of public and social uses in the city have created a heterogeneity and imbalance in the distribution of various facilities in the city (Pourmohammadi, 2019: 92).

This has led to the weakening of social justice at the regional and national level (Veneri & Brezzi, 2015:13). Today, many efforts have been made to improve the quality of life and establish social justice and move towards sustainable development at the level of cities, and in the meantime, citizens' proper enjoyment of services and proper access to these services can play an important role in achieving the above goals. (Boussau et al., 2014: 6). The imbalance in the distribution system and the failure of the service system is one of the important issues that can be seen in the big cities of Iran now (Derakhshanzadeh and Dadres, 2017: 3). Heterogeneous, unplanned development and rapid population growth can be considered as the main reasons for this problem (Ganji et al., 2017: 14). One of the important social indicators that is important for

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measuring the state of the society It is an educational index that is mentioned along with the indicators of social security, employment, health, etc. in the topic of social justice (Hadidi et al., 2015:2). Educational services are very important urban services, and proper access of citizens to these services can play an essential role in the process of sustainable urban development, reducing environmental pollution and increasing the quality of life (Niyazkhani and Latifi, 2013: 4). The spatial distribution of educational centers is very sensitive in terms of its direct effect on the comfort of households, and in general, Iranian cities have problems in this regard due to the growth of cars and without a plan (Panahi et al., 1397: 16). The lack of population planning, financial limitations, lack of suitable land, not using urban planners and geographic information systems, have caused basic location not to be applied in most educational spaces. Ignoring these categories has not only caused problems such as spending time and money to reach educational centers, deterioration of students' physical and mental health, fatigue and boredom, and finally their academic failure (Rostaei et al., 2015: 3). . Therefore, the efforts of urban planners to eliminate this deficiency and observe social justice in the distribution of educational centers is one of the necessities of today's urban planning and urban development of the country. In recent decades, due to its physical development and increasing population, the city of Ardabil has witnessed an imbalance in the distribution system of public uses, including educational use, and apparently the balance of the spatial distribution of uses and educational centers has been disturbed, and the wave of spatial inequality in the level of access to facilities and facilities has been According to this issue, the purpose of the current research is to analyze the spatial distribution of primary education services and investigate spatial justice and recognize the existing inequalities The existing inequalities in the enjoyment of primary education services are at the level of the districts of Ardabil city, because paying attention to the fair distribution of these services will increase the amount of social welfare, spatial balance of the population, maintain the safety of citizens and reduce social tensions.

Literature review

۲. Methodology Research

The research method in this article is descriptive-analytical and its nature is applied. Its data includes the map of Ardabil city, divided by regions, districts and municipal districts along with the population density of Ardabil city, which is compiled from the comprehensive plan and detailed plan. Other data needed for this research is the statistics and information available in the area of educational centers (primary) in Ardabil city, which address and information of these It was obtained from the education department of the province. Next, the classified database related to each of the variables was created in EXCEL software. In the next step, due to the fact that the geographic coordinates (x, y) related to the educational centers of the city were not recorded, the points related to the educational centers were placed on the large city scale map (1:500) using The city map and Google Maps were used to record the addresses and code the addresses. Next, the addresses and coding of the registered educational centers were transferred to the ARC GIS environment. The network information database, which was created in EXCEL, was connected to spatial data including point features (educational centers) and surface features And the basis of the analysis was placed in GIS using the spatial statistics method. Among the techniques used in this research are kernel density, Moran coefficient, general G coefficient, nearest proximity and geographically weighted regression .

Ardabil city is located at the coordinates of 12 minutes and 38 degrees to 13 minutes and 38 degrees of latitude and 19 and 48 to 28 and 48 degrees of longitude. The coordinates of the city center are around 19 and 38 latitude and 13 and 48 longitude. This city is located in a circle-shaped plateau, in the southwest of the Caspian Sea, between two mountain ranges, Sablan and Baghro or Talash, and its height is 1350 meters above sea level. The urban texture is in the form of a spider's web, as a result of which most of the streets in the city are curved or sword-shaped, with the exception of a few cases. This city had a population of about 530 thousand people and an area of 7 thousand hectares until 2015 (Iran Statistics Center, 2015).

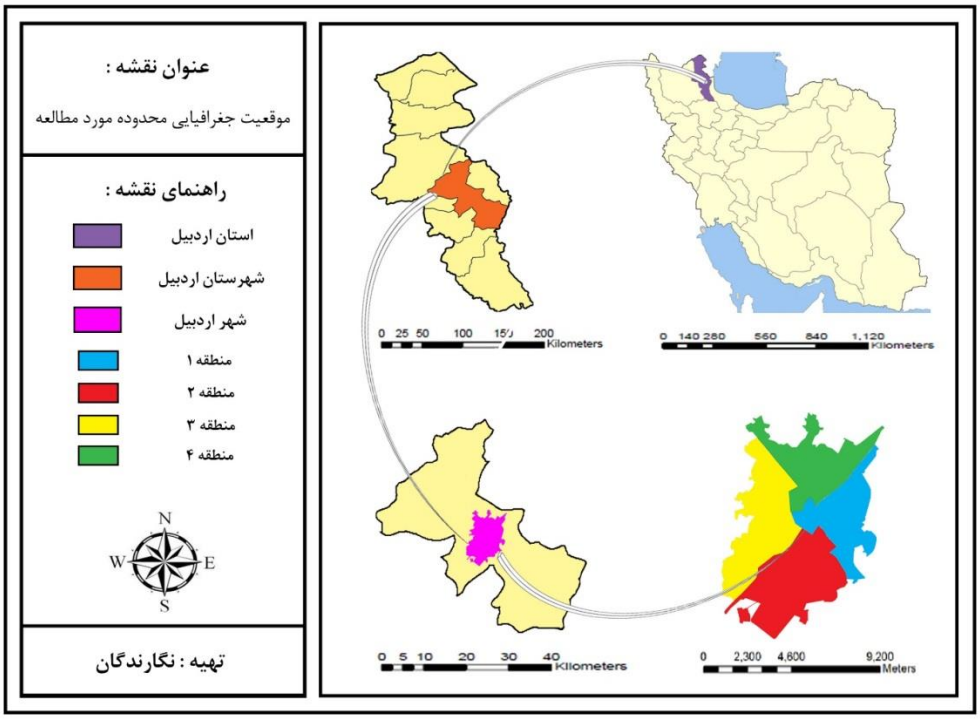


Fig1. Map of the studied area (Ardebil city).

۳. Data Analysis

Frequency and distribution of schools in Ardabil city

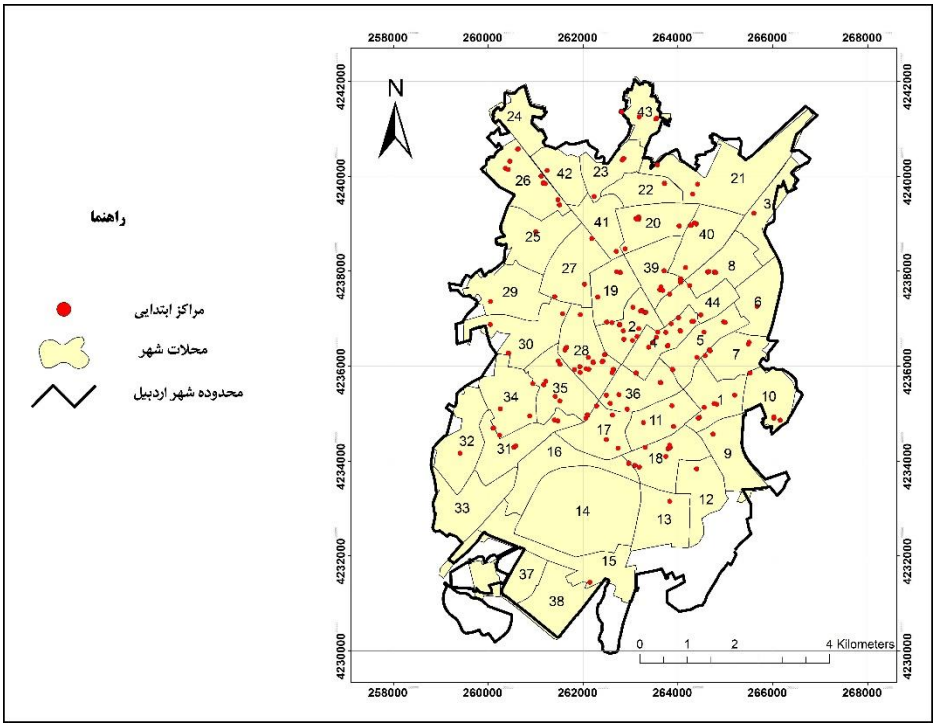
According to the obtained information, Ardabil city has 193 primary education centers. In terms of the number of primary school centers, neighborhoods number 35, 28, 26, 4 and 2 have the most primary school centers. Localities 38, 37, 33, 24, and 14 also without centers They are primary school. Table (1) shows the frequency and percentage of each neighborhood in terms of having primary schools and Figure (2) shows the way of distribution at the neighborhood level.

Table 1. The extent of Ardabil neighborhoods having educational centers

neighborhood	number	neighborhood	percentage	number	neighborhood
۱/۵۵	۳	**۲۳**	۳/۶۳	۷	**۱**
۰/۰۰	۳	**۲۴**	۸/۲۹	۱۶	**۲**
۱/۰۴	۲	**۲۵**	۰/۵۲	۱	**۳**

۴	۱۵	۷/۷۷	**۲۶**	۱۳	۶/۷۴
۵	۶	۳/۱۱	**۲۷**	۳	۱/۵۵
۶	۲	۱/۰۴	**۲۸**	۱۹	۹/۸۴
۷	۵	۲/۵۹	**۲۹**	۱	۰/۵۲
۸	۵	۲/۵۹	**۳۰**	۴	۲/۰۷
۹	۱	۰/۵۲	**۳۱**	۴	۲/۰۷
۱۰	۶	۳/۱۱	**۳۲**	۱	۰/۵۲
۱۱	۳	۱/۵۵	**۳۳**	۰	۰/۰۰
۱۲	۱	۰/۵۲	**۳۴**	۳	۱/۵۵
۱۳	۱	۰/۵۲	**۳۵**	۱۲	۶/۲۲
۱۴	۰	۰/۰۰	**۳۶**	۶	۳/۱۱
۱۵	۱	۰/۵۲	**۳۷**	۰	۰/۰۰
۱۶	۲	۱/۰۴	**۳۸**	۰	۰/۰۰
۱۷	۴	۲/۰۷	**۳۹**	۷	۳/۶۳
۱۸	۹	۴/۶۶	**۴۰**	۵	۲/۵۹
۱۹	۴	۲/۰۷	**۴۱**	۱	۰/۵۲
۲۰	۷	۳/۶۳	**۴۲**	۱	۰/۵۲
۲۱	۳	۱/۵۵	**۴۳**	۵	۲/۵۹
۲۲	۲	۱/۰۴	**۴۴**	۲	۱/۰۴

Fig2. How to distribute educational centers in the neighborhoods of Ardabil city

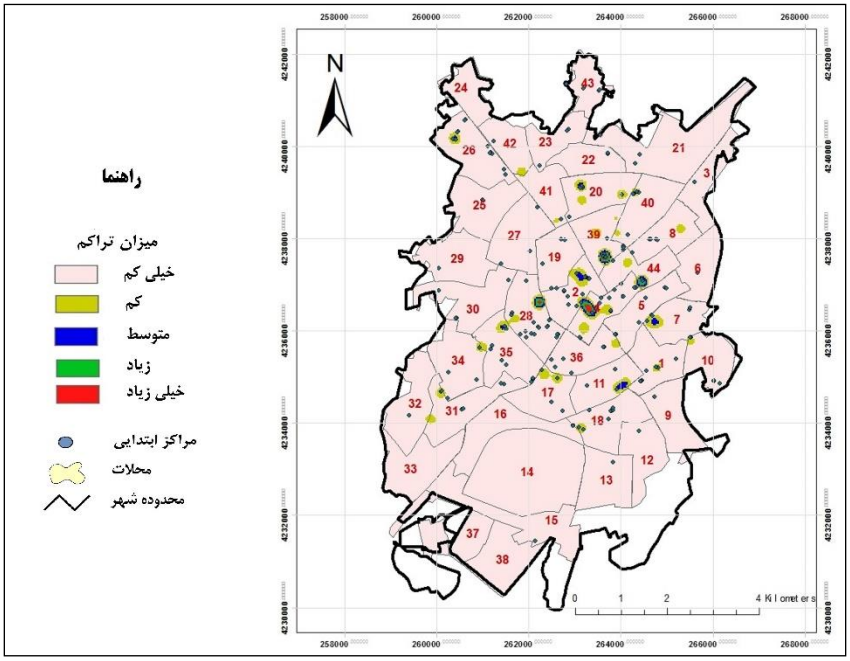


Kernel compression method

One of the most suitable methods for depicting educational spaces in a continuous manner is the kernel density test. Kernel density estimation test creates a smooth surface of changes in the density of educational centers on the range. Based on the mentioned method and educational centers in Ardabil city, these calculations were done in the ARC GIS environment. In this research, based on the recorded data of primary education centers in Ardabil city, the use of kernel density method to determine the privileged areas is shown in figure (3).

Based on the results of Cornell's density method, only neighborhoods number 2 and 4 are located in the geographical area with high and very high density of educational centers. Clearly, the proximity of educational centers in these neighborhoods is high, and in terms of the density of educational centers, these neighborhoods can be introduced among the privileged neighborhoods of the city. Except for a few neighborhoods that have medium density, the rest of the city's neighborhoods are among the neighborhoods with low and very low density, which make up a high percentage of the neighborhoods. It seems that the main reason for the concentration of educational centers in the neighborhoods of the central part of the city is the access to better communication networks, the concentration of services and being the center of gravity and the better elasticity of these neighborhoods compared to other localities.

Fig3..Kernel density of educational centers



Average nearest neighbor

In order to measure the spatial distribution of educational centers in the city of Ardabil, the nearest neighborhood average tool has been used to investigate whether the distribution of primary educational centers has been formed uniformly at the neighborhood level. or not In order to finally measure the distribution and concentration of these spaces at the neighborhood level and their availability. The calculations made with the mean of the nearest neighborhood indicated that the elementary education centers are distributed in clusters and unbalanced at the neighborhood level.

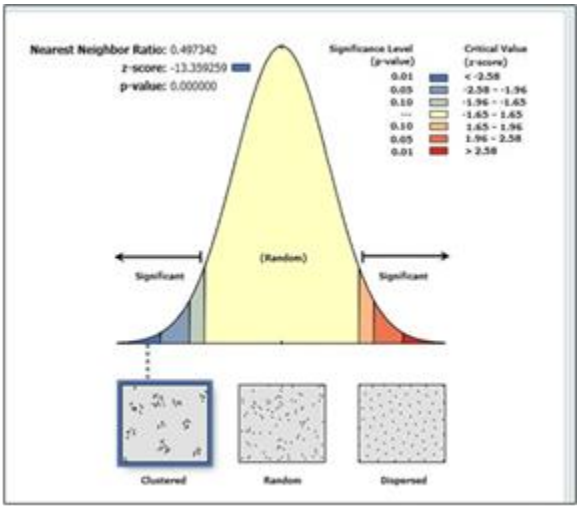
Table 2 .The results of the coefficient of the closest neighborhood of educational centers and its distribution pattern in Ardabil city

distribution pattern	significant level (P-Value)	Value Z	Nearest neighborhood index
a cluster	۰,۰۰	-۴,۳۰	۰,۷۹

The coefficient of the nearest neighborhood for primary centers is 0.49. If the value of the coefficient of the nearest neighborhood is positive and numerically close to one, it means that the spatial distribution of spatial complications is clustered, and therefore, the primary education centers had a clustered distribution. Here is the exception that only the positive and high amount of the calculated coefficient is not the reason for the clustering of the complications distribution, and the second condition must also be met. This second condition is to have a large negative Z value calculated in the process of determining the spatial distribution of complications, in such a way that in determining the spatial distribution pattern of educational units, a large and negative

numerical value was obtained and it can be acknowledged with 99% confidence. The primary educational spaces in the neighborhoods of Ardabil city have a cluster distribution. According to the above description, it can be seen that certain areas are the focus of educational centers and follow the centralized pattern, and on the other hand, parts of the area are considered deprived areas in terms of the existence of such spaces. In the form of figure number (3), the results of the calculation of the nearest neighborhood index are displayed.

Fig4.. Nearest neighbor average coefficient



The relationship between the distribution of educational centers and the investigated criteria

The relationship between educational centers and population density

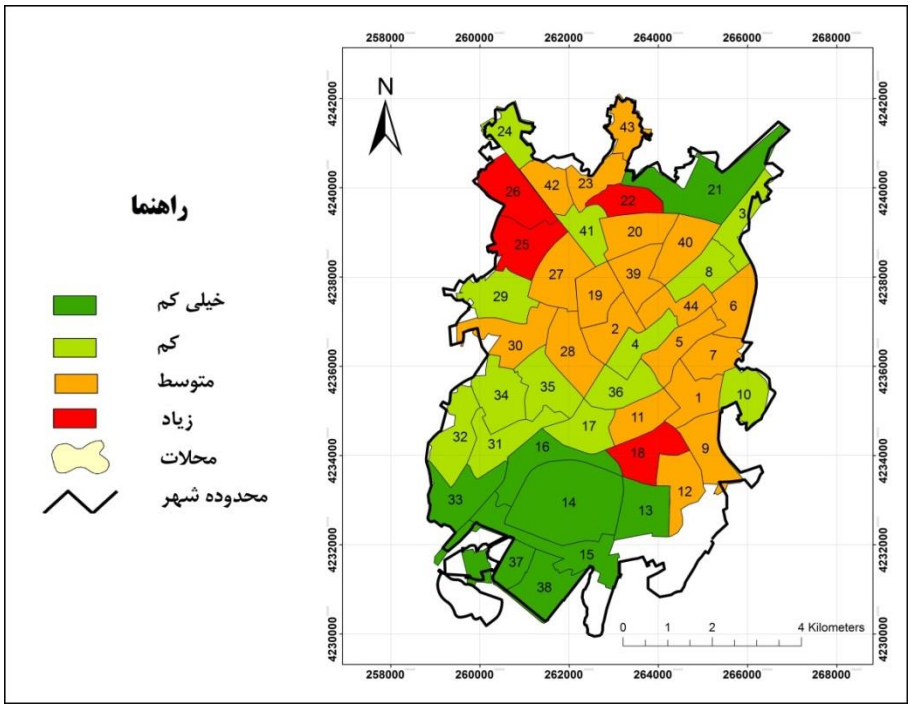
Population density is one of the influential variables in the emergence of educational spaces. So that the radius of students' access to educational spaces depends on several factors such as population density. Although the radius of access decreases with the increase in population density and the increase in school capacity, but it cannot be higher than a certain value and it is 2000 meters for secondary level. For each educational level, a population threshold is considered, which varies according to the conditions of each country and according to the age structure of the population and population density at the regional level. Table (3) shows a criterion for determining the population threshold of each educational level, which can change to some extent according to the conditions of each city.

Table 3. The type of educational unit and the population using it

Unit type	population (people)			
Educational unit	۱۸۰۰–۲۵۰۰	۳۵۰۰–۵۵۰۰	۸۰۰۰–۱۲۰۰۰	۱۶۰۰۰–۲۲۰۰۰
Kindergarten	❊			
elementary		❊		
guidance			❊	
high school				❊

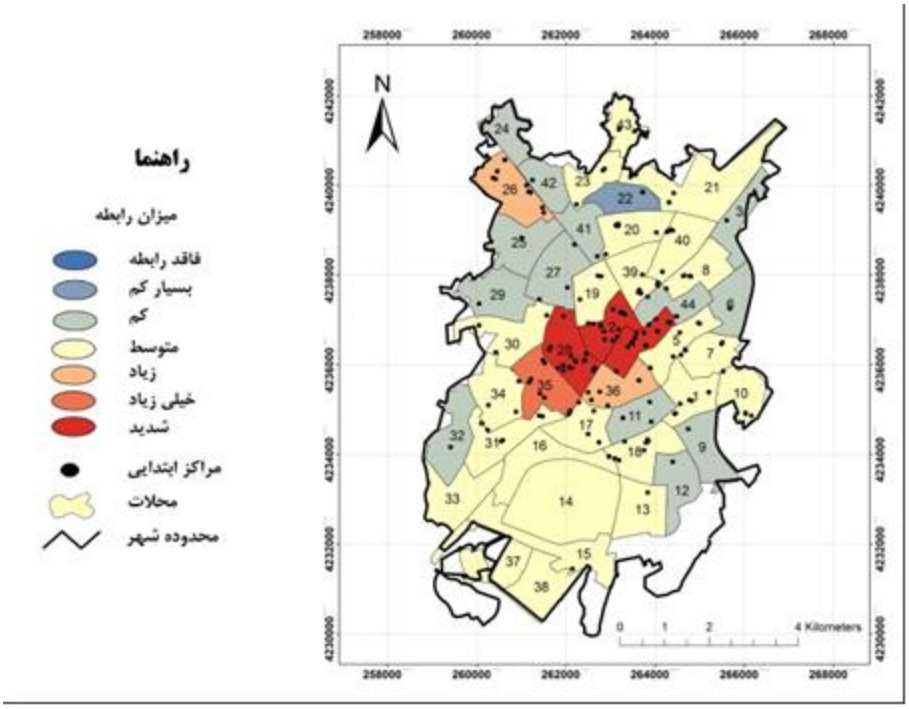
In order to determine the relationship between population density and the distribution of educational spaces at the level of the neighborhoods of Ardabil city, a population density map was prepared according to the available information. The calculations based on the latest population estimates of Ardabil until 2015 show that the population density was 296 people per hectare on average this year. As the figure shows, the population density is often higher than the average in the middle and peripheral parts of the city.

Fig4. *Population density in the neighborhoods of Ardabil city*



To determine the relationship between primary education spaces and population density, the weighted regression method of geography or GWR has been used. The results obtained from this method show that there is a significant relationship between all primary education centers and population density in the localities. Especially in neighborhoods No. 4 and 28, this relationship is intense, and in neighborhoods No. 2 and 35, the relationship is significant and its intensity is very high, and in neighborhoods No. 39, 36, 26, and 20, the relationship is high. In other words, following the increase in population in these areas, the number of educational centers has also increased. In the rest of the localities, this relationship has an average significance or a low and very low relationship (Figure 6).

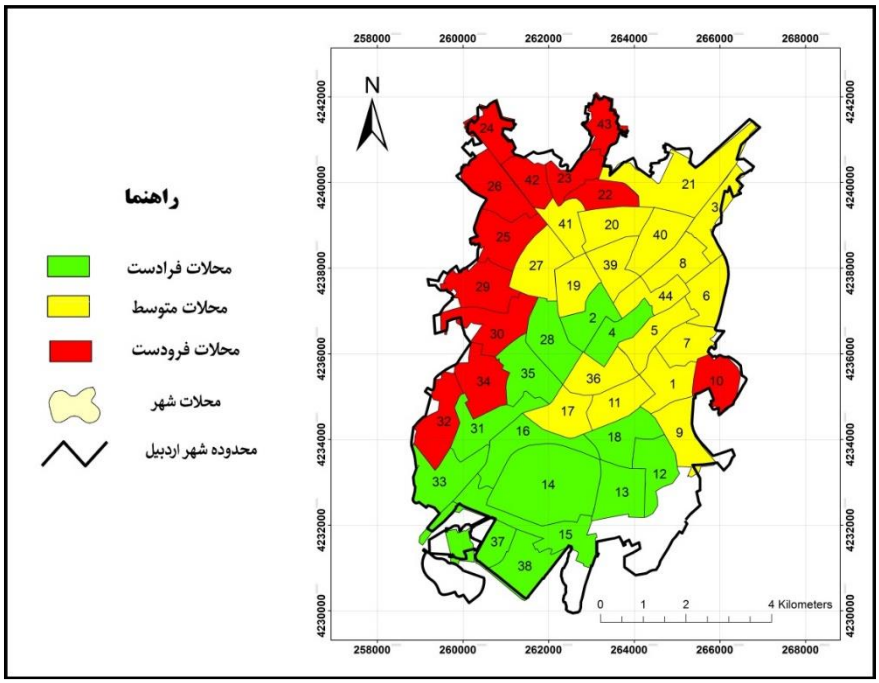
Fig6. The relationship between population density and primary education centers



The relationship between educational centers and the state of neighborhoods

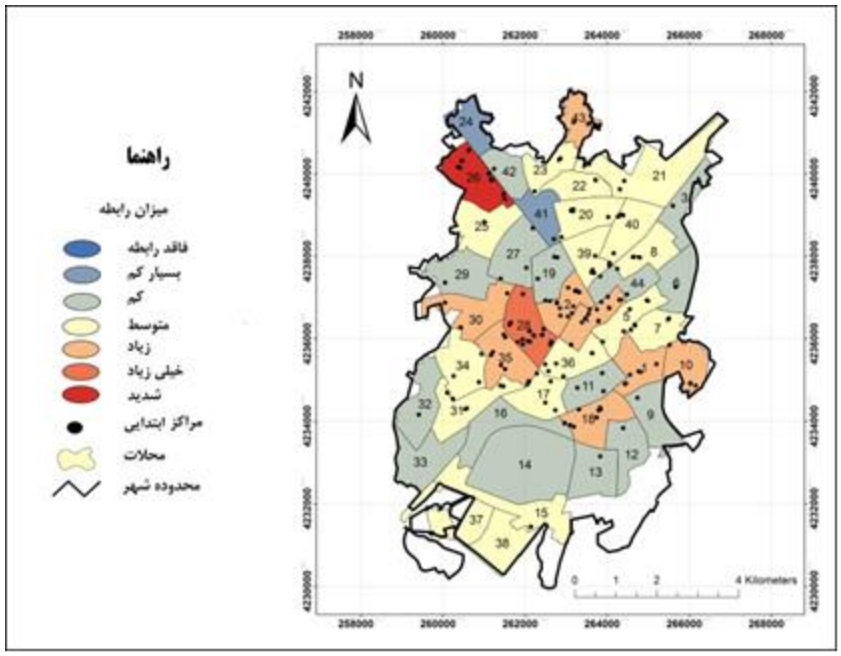
Settlement of a certain segment of the society, especially high-income groups, can be effective in creating educational spaces in an indirect and direct way, according to the type of traction they have. Also, the policies of planners and statesmen to create such centers in low-lying areas are also one-sided. Considering this, according to the maps and studies of the master plan of Ardabil city, it was started to prepare a map of the situation of the localities (income groups) in the city of Ardabil. This shows that the northwest neighborhoods of the city are the settlements of inferior groups, part of the neighborhoods in the central and northeastern parts are the concentration of middle groups, and part of the central part and the neighborhoods in the south of the city are among the inferior neighborhoods (Figure 7).

Fig7. The situation of the neighborhoods of Ardabil city



To determine the relationship between primary education centers and the state of localities, the weighted regression method of geography or GWR has been used. The results obtained from this method show that there is a significant relationship between all primary education centers and the condition of neighborhoods at the city neighborhood level. Especially in neighborhood No. 26, the relationship is significant and its intensity is strong, and in neighborhoods No. 28, 18, and 4, the relationship is very high, and in neighborhoods No. 39, 35, 31, 30, 20, 11, and 10, the intensity of the relationship is high. In the rest of the regions, this relationship has moderate significance or a low or very low relationship (Figure 8).

Fig8. The relationship between the status of neighborhoods and primary education centers



٤. Conclusion:

Ignoring the proper and principled spatial distribution of service centers, especially educational centers, causes inequality in access, reduces the efficiency of the educational system, and creates problems for students. In the current research, after collecting the necessary basic information and data, the kernel density method was used to determine the areas with educational centers in Ardabil city. Clearly, the proximity of educational centers in these neighborhoods is high, and in terms of the density of educational centers, these neighborhoods can be introduced among the privileged neighborhoods of the city. Except for a few neighborhoods that have medium density, the rest of the city's neighborhoods were among the neighborhoods with low and very low density. Also, the results of the nearest neighbor method showed; The primary educational spaces in the neighborhoods of Ardabil city have a cluster distribution And certain areas (city center and privileged neighborhoods) are the focus of educational centers and follow the centralized pattern, and on the opposite point, parts of the area are considered deprived areas (marginal areas) in terms of the presence of such spaces. As the distance from the central core of the city decreases, the number and density of schools decreases. In fact, the central areas of the city have more educational facilities, and as you move away from the city center, their amount decreases and reaches its lowest level. Finally, to determine the relationship between educational centers with population density and the state of localities, the weighted geography regression method or GWR was used. And the results showed; There is a direct relationship between population density at the neighborhood level and the condition of the neighborhood, that is, following the increase in population and the improvement of the condition of the neighborhood, the distribution of educational centers also increases. According to the findings of the research, suggestions are presented as follows.

1- The need to consider a systemic approach in the distribution and arrangement of educational centers in the city;

2- Balanced distribution of educational services and infrastructure in the residential areas of the city in order to achieve proper social stability in the city neighborhoods;

3- Developing efficient programs to prevent the formation of a dual urban economy, which causes poverty, unemployment, marginalization, migration, urban social segregation, which consequently increases spatial inequalities and injustice;

4- Provision of appropriate credits for the acquisition of lands that are known to have educational uses in the detailed plan of the city and the construction of educational units from the country's general budget;

5- Provision of appropriate credits for the occupation of lands that are known to have educational uses in the detailed plan of the city and the construction of educational units from the country's general budget.

6- Locating and establishing educational spaces in the outskirts of the city is necessary due to the existence of suitable and barren land and the increase in its population density and the lack of educational spaces;

7-In order to fully cover urban areas by educational centers, it is necessary to pay attention to the three factors of students' educational levels, population density and maximum access radius, especially in the parts of the city outskirts that are outside the coverage of educational spaces. Because these areas are rapidly developed and there will be problems for the student population in terms of access to these centers.

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