Present and Future of the Educational System in Rural Areas in Japan

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ABSTRACT

The paper discusses the present and future of educational system in rural areas in Japan in comparison with that in urban areas in three aspects: 1) academic ability of students, 2) class size, and 3) expenditure for education. In 1964, there was a significant difference in academic ability between rural and urban areas. However, there is no longer a significant difference between rural and urban areas. It is due to three reasons: 1) nationwide standard for educational system, 2) own effort of local governments, and 3) social capital in rural areas. Rural areas, however, is now facing a serious decrease in population. To resolve this problem, the paper proposes a decision support system for school relocation planning.

I. Introduction: A Myth of Education in Rural Areas

It has long been widely believed in Japan that academic quality in rural areas are obviously lower to than that in urban areas. There has been a gap between urban and rural areas in average income, labor market, urban infrastructure, and the total quality of life. At least in 1960’s, such differences caused a serious gap in academic quality.

National academic achievement survey had been conducted from 1956 to 1964 in Japan. All the 6th grade pupils in elementary schools and 3th grade students in junior high schools took a common set of examinations on Japanese and mathematics. Shimizu et al. (2010) analyzes the result of the survey to find that the
test score is significantly higher in urban areas than in rural areas. The score is closely related to the family budget for children’s education and the ratio of students going to higher-level schools. Financial status, level of urbanization, and the quality of life all worked as an indicator of academic quality.

Since 1965, the national survey had not been conducted until 2007. This permitted the myth to survive almost for a half century. Shimizu et al. (2010), however, reports that the result of the national survey in 2007 is quite different from that of 1964. Test score had drastically increased in some rural areas, some of which were even higher than that of urban areas. The myth was denied.

In the following we discuss the significant improvement of academic quality in rural areas in more detail. The academic achievement, educational environment and public support are compared both qualitatively and quantitatively between urban and rural areas.

II. Definition of Rural Areas

There is no unique definition of rural areas applicable to every academic field. Basically, however, it is based on the definition of urban areas, which has been more clearly defined.

Though the definition of urban areas also varies across countries, one of the most essential variable used for the definition is population density. From 1960 to 1980, US census uses 1000 people per square mile (=386 people/km²) as the threshold (Ratcliffe, 2006). In 1990, however, the value decreased to 500 people per square mile in order to reflect the urban sprawl. Statistics Bureau of Japan defines Densely Inhabited District (DID) based on the population density of 40 people per hectare (=4000 people/km²). The threshold is even higher than that of the US due to the high population density of the whole country.

Another important key is the total amount of population of each urban area. UK census uses 1000 people as the minimum population for urban areas (UK Offices for National Statistics, 2001). Statistics Bureau of Japan applies 5000 people to the definition of DIDs.

The above definitions are applicable generally in academic study as well as policy
making. Since they are based on census tracts that are relatively smaller than higher-level administrative units such as counties, prefectures, and states.

In addition to the above, in educational administration in Japan, another category called hekichi is used. The term hekichi generally indicates the areas of extremely low population density. In educational administration, public schools in mountain areas and remote islands where natural, economical, and cultural conditions are severe and transportation facilities are not established are approved as hekichi schools. At present, 2640 out of 21680 elementary schools and 1233 out of 10578 junior high schools are approved as hekichi schools. Teachers of hekichi schools receive more salary than those in other schools in order to keep the educational environment of public schools in hekichi.

In the following, we focus on the population density as an indicator of rural areas. However, it is practically difficult to divide the whole country into the two categories. We thus calculate the population density of every prefecture and discuss educational status and systems with respect to population density. This permits us to consider the present status and systems of education in rural areas in contrast with those in urban areas.

### III. Academic Achievement in Urban and Rural Areas

This section analyzes the result of the national academic achievement survey conducted in 2007. All the 6th grade pupils in elementary schools and 3rd grade students in junior high schools took a common set of examinations on Japanese and mathematics. Similar to PISA, each test consists of two parts, one examines the amount of knowledge while the other evaluates the ability of using the knowledge.

The result of the test is summarized by prefectures and opens to public (Ministry of Education, Culture, Sports, Science and Technology of Japan, 2010). [Figure 1] shows the relationship between the population density of prefectures and the average score of the tests in 2009.
(a) Japanese test in elementary schools  (b) mathematics test in elementary schools

(c) Japanese test in junior high schools  (d) mathematics test in junior high schools.

[Figure 1] The average score of tests conducted in academic achievement survey in 2009.

Note. The horizontal axis indicates the population density of prefectures in habitable area in logarithmic scale.

In these figures we found no clear correlation between population size and academic achievement. Spearman’s rank correlation test indicates there is no statistically significant correlation between population density and test score in (a), (b), and (d) cases. In [Figure 1] (c), where a weak correlation is observed between the two variables, Spearman’s test shows a negative correlation between the population and the test score at five percent significance level, which means that the academic achievement level is higher in rural areas than in urban areas.

The above result is consistent with that of Shimizu et al. (2010). Academic quality is no lower in rural areas than in urban areas.
IV. Educational Environment in Urban and Rural Areas

This section discusses the educational environment in rural areas in comparison of that in urban areas. Class size and financial support are used evaluate the quality of educational environment.

1. Class size.

[Figure 2] shows the relationship between population density and the average class size of public schools. The figure clearly indicates a strong positive correlation between class size and population density. Spearman’s rank correlation is 0.726 and 0.579 in elementary and junior high schools, respectively. Both cases are statistically significant at significance level one percent.

![Figure 2](image)

(a) Elementary schools  
(b) junior high schools

[Figure 2] The relationship between population density and average class size

The largest class size is found in Tokyo prefecture whose population density is also the highest. Its class size is 30.3 and 32.6 in elementary and junior high schools, respectively. The smallest class size is 17.5 and 22.3, both of which are in Kochi prefecture. Its population density is not the lowest but is lower than the average of the whole country.

Small classes generally provide better educational environment. The above shows at least that educational environment represented by class size is better in rural areas than in urban areas.
We should note, however, some exceptional cases in Japan. When classes become inevitably too small (14 or below in elementary schools), classes of different grades are combined. In this case, teachers treat different subjects of different grades within the same time period in the same class, which significantly reduces the quality of education. It often happens in rural areas where population density is extremely low.

2 Financial support.

Figure 3 shows the relationship between population density and public financial support per pupil (student). This figure clearly shows a strong negative correlation between public financial support and population density. Spearman’s rank correlation is -0.571 and -0.472 in elementary and junior high schools, respectively. Both cases are statistically significant at significance level one percent.

The highest financial support is again found in Kochi prefecture. Small values are generally found in prefectures covered by urban and suburban areas. Typical examples include Saitama, Kanagawa, and Chiba prefectures that contain satellite cities of Tokyo.

The above analysis indicates that educational environment is not better in urban
areas than in rural areas in Japan as it has been generally believed. Nevertheless, there still exists a wide variety in academic achievement. To discuss this more deeply, next section performs a quantitative analysis of the result of academic achievement survey in detail.

V. Analysis of Academic Achievement

In this section, we use the following fourteen variables in order to describe the academic achievement in public schools.

1. Population density
2. Average class size in elementary schools
3. Average class size in junior high schools
4. Public financial support per pupil in kindergartens
5. Public financial support per pupil in elementary schools
6. Public financial support per class in elementary schools
7. Public financial support per pupil in junior high schools
8. Public financial support per class in junior high schools
9. Unemployment ratio
10. Households receiving public financial support
11. Divorces
12. Households of their own houses
13. Violence at schools
14. Bullying at schools
15. Truancy from schools

The last six variables are standardized by population in each prefecture.
<table>
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<td>-0.072</td>
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<td>0.368</td>
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</table>

Note: Numbers in the top row correspond to those shown in the above variable list. The left-hand column indicates the type of tests. The first letter shows the type of schools (E: Elementary schools, J: Junior high schools). The second letter shows the type of tests (J: Japanese, M: Mathematics). Since each type of test consists of two subcategories, categories are indicated by numbers. The lower four rows use the total scores of subcategories. Bold and underlined values: correlation is statistically significant at significance level 5 percent. Underlined values: correlation is statistically significant at significance level 10 percent.

Let us first discuss the result for junior high schools. Looking at the middle four rows, we notice that negative social variables numbered from 9 to 11 are negatively correlated with the test score. House ownership, on the other hand, is positively correlated with the score. Violence and truancy are also negative indicators of social environment at schools, both of which are negatively correlated with the score. Concerning financial support, though it generally has positive effect on the test score, it does not seem highly effective to improve the academic achievement. From this we can say that the social environment plays a key role in academic achievement at the junior high school level.

We then turn to the result for elementary schools. Though the correlation between
the score and social variables is similar to that in junior high schools, its significance is weaker. Instead, financial support represented by variables numbered from 4 to 6 plays a critical role. Though social environment is also important, unlike the junior high school level, financial support is most essential at the elementary school level.

**VI. Improvement of the Academic Quality In Rural Areas**

This section discusses the improvement of academic quality in rural areas. There are at least three factors that have been significantly improving the academic quality in rural areas.

1. Legal system of education

Legal system of education aims to provide the same opportunity of education for all the children and students in the whole country. Educational environment including educational facilities and teachers should be at the equal level in both urban and rural areas.

To this end, the central government financially supports local governments. For instance, the third of the salary of teachers is provided by the central government. In addition, local governments whose financial basis is relatively weak can receive additional support from the central government as a local-allocation tax²).

2. Own effort of local governments

In order to improve the academic quality, local governments have employed their own educational system. For instance, some governments allocate additional teachers of special ability to schools. Others conducted their own academic achievement survey to check the academic quality of each school. Since such local systems reflect

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²) Local-allocation tax is a financial system that aims to reduce the variance in financial basis among local governments. The revenue of local governments is based on local tax. However, it greatly varies among local governments due to geographical, economical and social environments. The central government transfers a part of its tax revenue to local government as a tax revenue of local governments.
the local environment, they often work more effectively than the standard system.

3. Social capital in rural areas

Physical, economical and social environments are all important in education. Among the three factors economical condition was the most critical in 1960s, which led to the lower level of academic quality in rural areas.

However, due to the improvement in economical environment of rural areas, social environment has become playing relatively an important role. Since social capital based on local communities and families has been traditionally stronger in rural areas, it has greatly helped the improvement of academic quality in rural areas. Though a new form of social capital based on NPOs, private businesses and other activities has been advocated in urban areas, whether it leads to an improvement in economical environment is not certain.

Ⅶ. Education in Rural Areas: Future Prospects

Education in rural areas, however, is not necessarily promising. Population has been constantly decreasing in rural areas. Young people move to urban areas to find better jobs. Average age of rural towns and villages has been monotonically increasing.

In addition, due to a decrease in birth rate, children have been gradually decreasing in Japan. Sadahiro (2010) indicates that many schools have only one class at each grade in 2035. In rural areas, schools have fewer pupils and students so that one class has to consist of two or more different grades.

Though small school and small class are widely recognized as a desirable environment of education, it does not necessarily hold in Japan. One reason lies in their economical inefficiency. In addition, schools and classes should be large enough to assure the social interaction among pupils and students. A certain size is necessary for schools and classes to promote the sociability. Moreover, academic activity is traditionally based on group activity in Japan, which is difficult in small classes and schools.
To resolve the problem, small schools have to be integrated into larger ones. However, since this involves with the closure of existing schools that work as the core of local communities. In addition, pupils and students usually go to schools by walk or by bicycle in Japan. Proximity is an important factor of school location that is violated by the closure of existing schools. Though school relocation is inevitable, its final goal is still so far.

Ⅷ. Decision Support System for School Relocation Planning

To support school relocation planning, the author’s research has been engaging in development of a decision support system for school relocation planning. Since public facility planning involves various sectors of population, group discussion and collaborative decision making are essential. In such a case, since the discussion often becomes rather vague and subjective, the final decision is not always persuasive enough for all the participants.

One option to keep the objectivity is to utilize spatial optimization technique that mathematically gives an optimal location of facilities (Drezner, 1995). It calculates the location of facilities that is optimal in a certain aspect such as the operation cost of facilities, travel cost of facility users, and so forth. Necessary conditions are represented as constraints, say, the capacity of facilities and the maximum travel distance of facility users.

One drawback of spatial optimization is that it highly abstracts the real world. Homogeneity is assumed throughout the model, from the properties of facilities to the preference of their users. Such abstraction is not easily acceptable in a practical sense, and consequently, facility location derived from spatial optimization is often unrealistic and infeasible.

To incorporate spatial optimization technique in collaborative school relocation planning, the author’s research group has developed a decision support system for school relocation planning. This system analyzes the present status of school location and the distribution of pupils and students, visually indicates the difficulties lying in the planning process, and proposes several alternatives for the final plan. Empirical applications of the system showed its effectiveness in collaborative school relocation planning.
REFERENCES


