Study on the Factors Affecting Scholastic Achievement

- A Case of Mandalay Region-

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Summary

A study on the Factors Affecting Scholastic Achievement of Grade 5 and Grade 9 in February 2015 was conducted using the data in Chin State. According to the analysis, it was found that educational conditions such as "student/teacher ratio," "quality of teachers," and "number of students" can contribute to increasing the pass rate more significantly than the type of school or school ranking, which are considered to be proxy variables of student motivation and socio-economic status.

However, there is no guarantee that the results are applicable to other States/Regions, therefore a similar analysis was conducted using the data in Mandalay Region where the socio-economic conditions are different from Chin State. As a result of the analysis, it was found that the similar results such as "student/teacher ratio," "quality of teachers," and "number of students" can contribute to increasing the pass rate. These findings also seem to be common among other States/ Regions.

It was estimated that the pass rate of local and small schools may have been lower to some extent if there were no daily wage temporary teachers. Unlike Chin State, the District greatly contributed to the pass rate of grade 9 in Mandalay Region, maybe because of a larger number of student transfers from districts seeking a better educational environment.

1. Purpose

A study on the factors affecting the scholastic achievement of Grade 5 and Grade 9 in February 2015 was conducted using the data in Chin State. According to the analysis, it was found that educational conditions such as “student/teacher ratio,” “quality of teachers,” and “number of students” can contribute to increasing the pass rate more significantly than the type of school or school ranking, which are considered to be proxy variables of student motivation and socio-economic status.

However, there is no guarantee that the results are applicable to other States/Regions. Therefore, a similar analysis was conducted using the data in Mandalay Region where the socio-economic conditions are different from Chin State.

2. Method

A nationwide examination was conducted in February 2015 for Grade 5 and Grade 9 students by the Ministry of Education. The examination questions were developed at the District level for Grade 5 and at the State/Region level for Grade 9. The examinations were given in five core subjects for Grade 5, and in six core subjects for Grade 9. The results were marked as "A," "B," "C," "D," and a "D" was defined as a fail. Students who received a "D" in any subject had to take supplementary classes for two weeks in April as well as the supplementary examination between May 14 and 16. The supplementary classes and examination were conducted only for the subject the students had failed.

The currently available data on the examination is the registered number of students, number of students who took the examination, the number of students who passed all of the subjects for Grade 5 and Grade 9 by school. The pass rate is easily calculated by dividing the number of students who passed by the number of students who took the examination. The pass rate was calculated for all the schools and a dataset was constructed (hereafter referred to as “Pass Rate Dataset”). This dataset included some monastic schools and private schools that participated in the examination.

The average figures of the initial pass rate by State/Region ranged from 49.50% to 96.03; and the national average was 75.35% for Grade 5. From the standpoint of examination content and ways of marking the examination, the difference between Districts and States/Regions may be due mostly to a difference in difficulty rather than a difference in

student abilities. In terms of the socio-economic index, it was expected that the achievement results would be higher in the wealthier States/Regions such as Yangon and Mandalay, but in actuality, they ranked in the middle for all States/Regions. The average figures for the final pass rate by State/Region ranged from 87.05% to 97.70%, and the national average was 94.16%. For Grade 9, the average figures for the initial pass rate by State/Region ranged from 21.81% to 85.60%, and the national average was 51.60%. The average figures for the final pass rate by State/Region ranged from 83.20% to 95.52%, and the national average was 88.91%.

The initial pass rate of Chin State for Grade 5 was 52.53% and the rate for Grade 9 was 26.62%. These rates were rather lower than average. Mandalay Region was chosen because the rates were close to the average and the socio-economic condition was different from Chin State.

In contrast, some variables related to school are obtainable from individual school data such as address, type of school, school ranking, number of students, number of teachers by qualification, etc. These variables were obtained from the dataset as of October 2014 (Muta 2015b), (hereafter referred as "School Basic Dataset"). If the “Pass Rate Dataset” and the “School Basic Dataset” are combined, it becomes possible to analyze the school conditions that contribute to the pass rate. To merge both datasets, it is important to have the same variable. The merging is easy if both datasets have a unified school code that does not change. However, in actuality, there is no such a code, only the name of the school. It is very difficult to merge two datasets based on the name of school because the same names in the two datasets sometimes differ slightly and they cannot be merged automatically. For example, one name may be the abbreviation of another name, or the basic characters are the same, but the tonal symbols are slightly different. Finally, all the names are confirmed by visual inspection after sorting the names in the same order in both datasets.

A dataset for further analysis, the “Combined Dataset” was obtained by merging the two datasets, “Pass Rate Dataset” and “School Basic Dataset.” A few number of monastic schools and private schools were included in the “Pass Rate Dataset,” but not in the “School Basic Dataset.” The monastic schools and the private schools were omitted from the merge. After cleaning and merging the two datasets, the “Combined Dataset” for further analyses was obtained and the results for the reduced number of schools and students compared to the “Pass Rate Dataset” are shown in Table 1. The number of schools was reduced to 93%, and the number of students was reduced to 92% for Grade

5. The number of schools was reduced to 91%, and the number of students was reduced to 92% for Grade 9. The initial pass rate for Grade 5 and Grade 9 decreased slightly in the "Combined Data Set." It may have been due to the drop in private schools, which showed higher pass rates in general. Since most of the schools that had a Grade 9 were included in the schools that had a Grade 5, the total number of schools was 4,066.

Table 1 Result of the Combined Data

Data Set	Pass Rate Data Set					Combined Data Set				
Grade	Schools	Registered Students	Students Took Test	Initial Pass Rate	Final Pass Rate	Schools	Registered Students	Students Took Test	Initial Pass Rate	Final Pass Rate
G5	4,323	105,443	104,211	77.19%	94.98%	4,038	96,697	95,743	76.26%	95.13%
G9	867	72,797	71,819	40.80%	85.95%	785	67,040	66,127	38.05%	85.17%

3. Analysis

3.1 Consistency of Data between the Two Datasets

The number of registered students in Grade 5 and Grade 9 are included in both the "Pass Rate Dataset" and "School Basic Dataset." The difference was in the timing when the data was taken, which was 3 and a half months. If students moved from one school to another, dropped out, and moved in from another State/Region or moved out to another State/Region, the number may be different. Table 2 shows the difference in the number of students at each school between the two the datasets. For example, the number of students increased in some schools and decreased in others, but in summary, the total number of students in Grade 5 decreased 2,786 from 99,483 to 96,697 (2.86%), and the total number of students in Grade 9 decreased 2,535 from 69,575 to 67,040 (3.64%). This amount of moving in and moving out that was observed toward the end of academic year in Grade 5 and Grade 9 appears to be normal (Muta 2014a) as in the case of Chin (Muta 2015c); and there were no strange inconsistencies between the two datasets.

Table 2 Difference in the Number of Students between Two Datasets

Increase/ decrease		Decrease			Same	Increase			Total
		21−	11-20	1-10	0	1-10	11-20	21-	
G5	Numbe of schools	12	41	1,244	2,479	241	17	4	4,038
	Number of students	-479	-566	-2,747	0	630	225	151	-2,786
G9	Numbe of schools	32	48	426	237	29	6	7	785
	Number of students	-962	-716	-1,387	0	88	93	349	-2,535

3.2 Factors Affecting the Pass Rates of Grade 5 and Grade 9

(1) Variables on Type of school and Location

Family-related factors such as the SES (Socio-Economic Status) of families and study motivation of students are important variables that explain the overall academic achievement of students. These variables are usually obtained through student questionnaires. In this study, such data were not available and the only available variables were schools that were somewhat related. The following variables can be used as proxies of family-related variables.

One variable is the type of school. The basic education schools under the Ministry of Education in the Republic of the Union of Myanmar are classified as High School, Branch High School, Middle School, Branch Middle School, Post Primary School, Primary School, and Branch Primary School based on the highest class grade and the number of students. “Branch” means “less than standard scale” in this case. In general, a High School includes middle school and primary school level classes; and a Middle School includes primary school level classes. If a student is motivated to study to the high school level, it is convenient to enroll in a High School even from a primary school level. Of course, there are cases where the neighboring school happens to be a High School or Middle School, but not a Primary School. However, from previous studies (Muta 2014b), a motivated student tends to transfer from the neighboring Primary School to Middle School or High School whenever it becomes possible to commute to a higher level school. In this sense, those who are registered in High Schools are more motivated than those registered in Middle Schools, and those registered in Middle Schools are more motivated generally than those registered in Primary Schools for Grade 5 and Grade 9.

Another variable is the school location or ranking. School ranking is classified as "A," "B," "C," "D," and "E" based on the accessibility from the Township Education Office. For example, school rank "A" means the school is located within a traveling distance of one hour from the Township Education Office and it is usually located in the central part of the township. In contrast, school rank "E" means the school is located in a local area and it may take more than one day to get to and from the Township Education Office. Families living within the center of a Township are generally wealthier than families living in local areas. That is why the variable for school ranking has a strong correlation with the economic condition of the family (World Bank 2015). Thus, this can be a good proxy variable of student SES.

Using the same logic, a district may have some influence on student SES for Grade 5 and Grade 9. But, for the Grade 5 examination, the district must have had a strong impact on achievement examination results because the examination questions were made and marked by the district level. Since the examination questions and the marking method depend on the district, it is important to take into account its influence on Grade 5.

(2) Variables on Educational Conditions

One condition that must have influenced scholastic achievement is the number of students per teacher (S/T ratio). It is generally believed that the smaller the S/T ratio, the better the achievement score (Glass G.V. and Smith M.L 1979). As the purpose of this research was to explain the impact on the Pass Rate for Grade 5 and Grade 9, the S/T ratio based on the number of teachers and students specific to Grade 5 and Grade 9 should have been calculated; however, the data on teachers was not available by class grade. As a result, the S/T ratios at the primary school and middle school levels were used as the S/T ratios for Grade 5 and Grade 9.

The quality of teachers was also important (Muta 2015a, 2015b). Information on teacher rank and level were available only for the primary school level. These were the principals, middle-school level teachers who taught at the primary school level, primary school teachers whose salary scale was the same as middle school teachers, primary school teachers, and daily wage temporary teachers. Teacher rank and level depended on qualifications, experience, and performance. As there was no data on the rank and level specific to Grade 5 teachers, the average rank and level of the school as a whole was used instead. Specifically, the ratio of teachers whose salary scale was the same as middle school teachers or above among the total number of teachers at the primary school level was used as the variable for teacher quality.

The number of students may also be an influential factor on achievement results. Generally, school or class management is easier if the number of students is small because a teacher can take very good care of the students. In contrast, there may be an optimal number of students. If the number of students is too small, they cannot cooperate or compete with each other. Certain numbers of students may be elements that contribute to developing their abilities. The numbers of Grade 5 and Grade 9 students were used as the variables for the number of students.

3.3 Relationship between the Pass Rate and Factors Affecting It

(1) Pass Rate and Type of school

Firstly, the relationship between the pass rate and factors that may be influential were analyzed. The pass rate of a group was defined as the number of students who passed among those who took the examination. Since the number of students who took the examination and passed was known, the rate was calculated. As a matter of fact, it was easier to calculate the pass rate by each school first, then to calculate the mean of the school pass rate weighted by the number of students who took the examination.

Figure 1 shows the pass rate of Grade 5 by type of school. The figure shows not only the mean figure, but the 95% confidence interval to show the variance. Contrary to the assumption that the pass rate would be the highest at the high school and the lowest at the branch primary school, there was no clear trend; and in actuality, the pass rate was the highest at the primary school. Figure 2 shows the case of Grade 9. The pass rate was the highest at the middle school as well as the high school. An interpretation of these phenomena is given later.

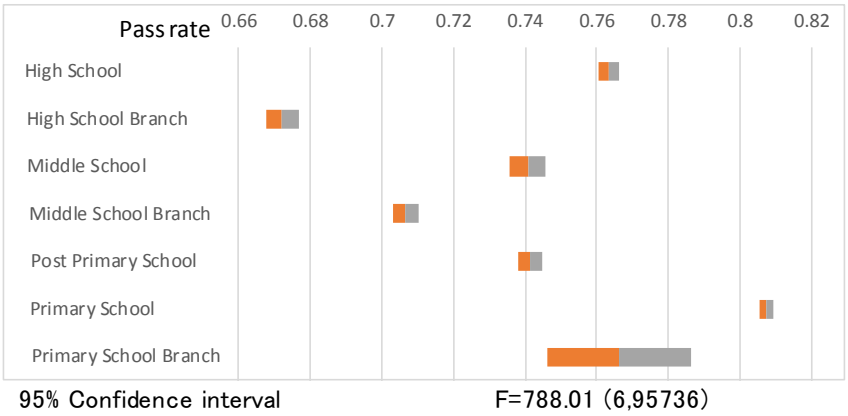


Figure 1 Pass Rate of Grade 5 by Type of school

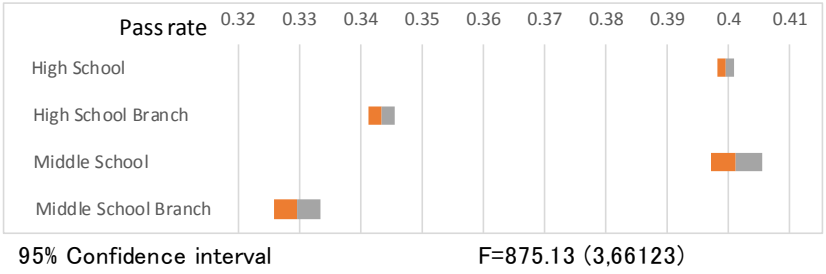


Figure 2 Pass Rate of Grade 9 by Type of school

(2) Pass Rate and School Ranking

Figure 3 shows the pass rate by school ranking for Grade 5. Although "A" showed the highest score as expected, “D” and “C” were also rather high. There were no clear tendencies such as the pass rate would be the highest for “A” and the lowest for “E,” contrary to the assumption. Figure 4 shows the pass rate by school ranking in Grade 9. The trend was not clear and "A" showed the highest pass rate. Compared to "E" and others, the variance was large for "E" for both Grade 5 and Grade 9.

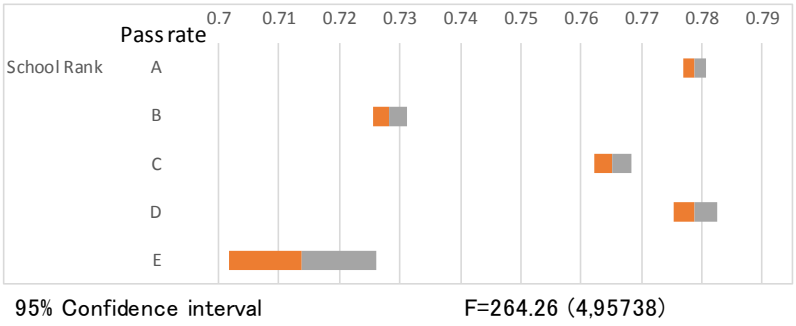


Figure 3 Pass Rate of Grade 5 by School Ranking

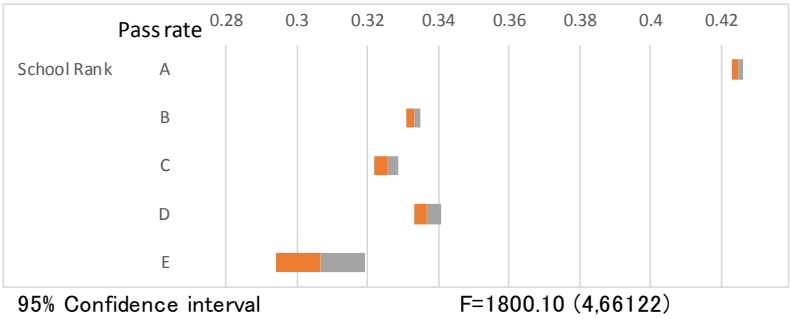


Figure 4 Pass Rate of Grade 9 by School Ranking

(3) Pass Rate and District

Figure 5 shows the pass rate by district for Grade 5. Compared to five other Districts, the pass rate for Myingyan District was high and the pass rate for Nyaung-U District was low. Since the examination questions were developed and marked at the district level, the figure did not mean that the ability of students in Nyaung-U District was low, but that the level was simply difficult. Figure 6 shows the pass rate by district for Grade 9. In this case, there should be no clear difference among Districts because the examination questions were developed and marked by the State/Region, and the difference among Districts should be minimized. In actuality, Mandalay District showed the highest pass

rate perhaps due to its high socio-economic conditions.

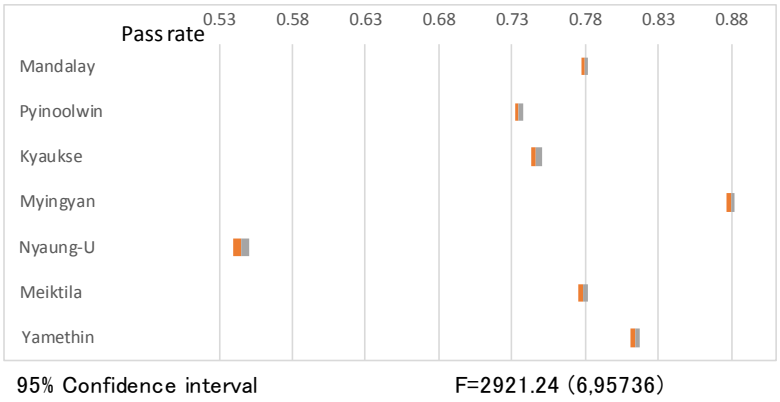


Figure 5 Pass Rate of Grade 5 by District

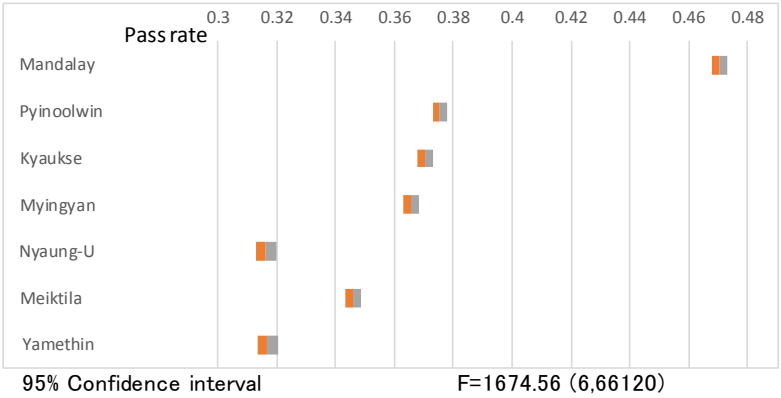


Figure 6 Pass Rate of Grade 9 by District

(4) Pass Rate and S/T Ratio

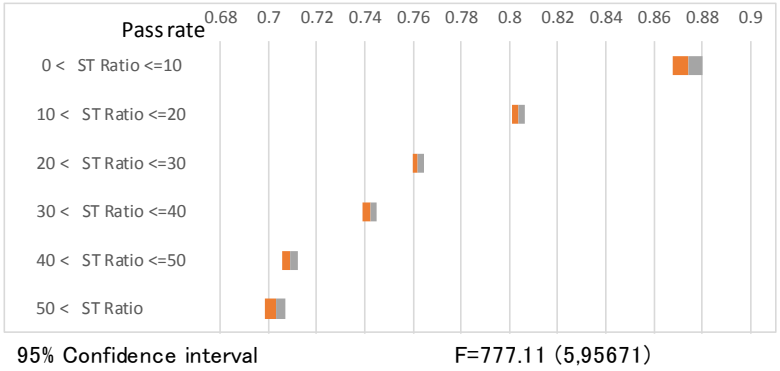


Figure 7 Pass Rate of Grade 5 by S/T Ratio of Primary School Level

Figure 7 shows the pass rate according to S/T ratio for Grade 5. The results were as

anticipated. It is clear that if the S/T ratio was smaller, the pass rate was higher. The pass rate was adequately high when the S/T ratio was less than 20. Figure 8 also shows the pass rate by S/T ratio for Grade 9. It generally showed a similar trend, however, the pass rate was the highest when the S/T ratio was "more than 10 and equal to or less than 20."

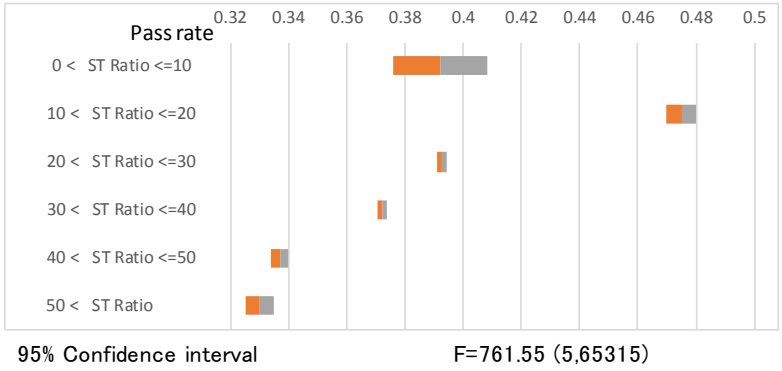


Figure 8 Pass Rate of Grade 9 by S/T Ratio of Middle School Level

(5) Pass Rate and Number of Students

Figure 9 shows the pass rate according to the number of Grade 5 students. The tendency for the pass rate to be higher when the number of students was smaller was seen, although there was sign of a partial reversal such as the number was "more than 30 students and equal to or less than 35." A smaller number of students allows for easier management, but there may also be some correlation to the S/T ratio. Figure 10 depicts what happens in the case of Grade 9. As the variance was slightly high, a clear tendency was not found, but the pass rate was the highest when the number was "more than 80 students."

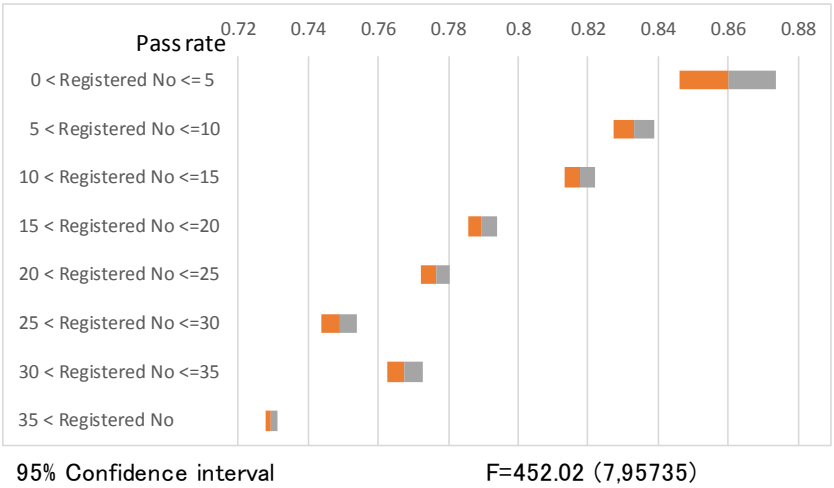


Figure 9 Pass Rate of Grade 5 by Number of Grade 5 Students

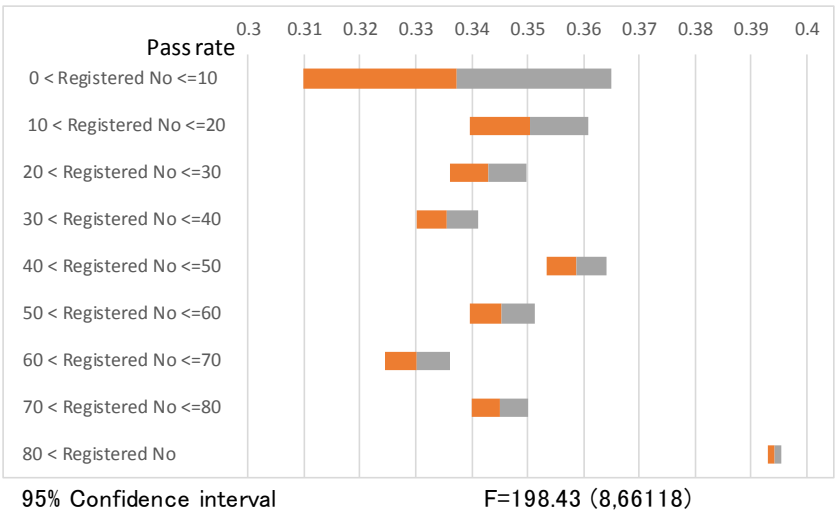


Figure 10 Pass Rate of Grade 9 by Number of Grade 9 Students

(6) Pass Rate and Quality of Teachers

Figure 11 shows the pass rate according to the quality of teachers at the primary school level. The overall pass rate was high if the quality of primary school level teachers was high, although there were signs of a partial reversal. The pass rate was very high when the quality of teachers was "higher than 0.8."

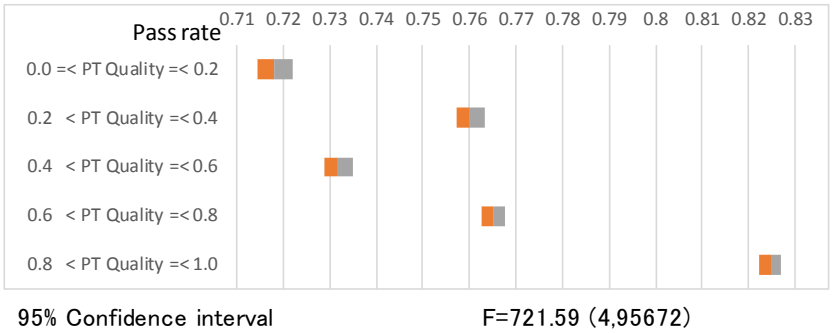


Figure 11 Pass Rate of Grade 5 by Quality of Teachers

(7) Correlation of Variables Affecting the Pass Rate

As described above, the anticipated influences of several factors on the pass rates were not always confirmed. It may be possible that a few of the expectations were wrong. However, it is also possible the analysis results were influenced by a correlation between factors underlying the pass rate. The main correlations are shown in Figure 12 to Figure 21.

For example, Figure 12 shows the relationship between the type of school and the number of Grade 5 students per school. A large number of students tended to attend high schools or middle schools. If the school was considered prestigious, they tended to have a larger number of students. This is understandable as a condition of a high school or middle school. However, a large number of students means a low pass rate as shown in Figure 9. The large number of Grade 5 students appears to offset the advantage of high schools and middle schools.

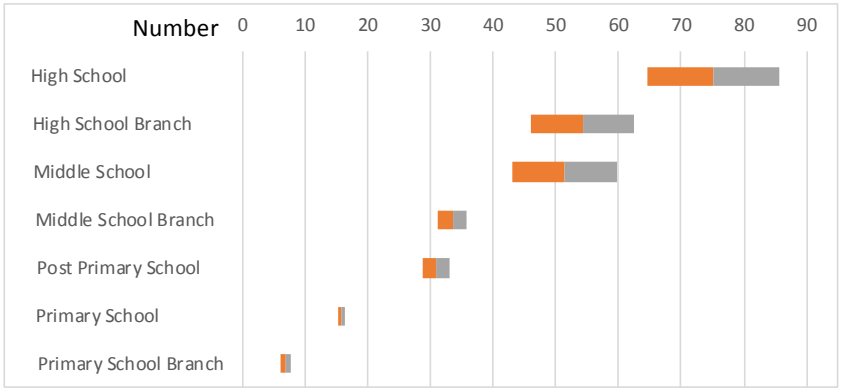


Figure 12 Number of Grade 5 Students per School by Type of school

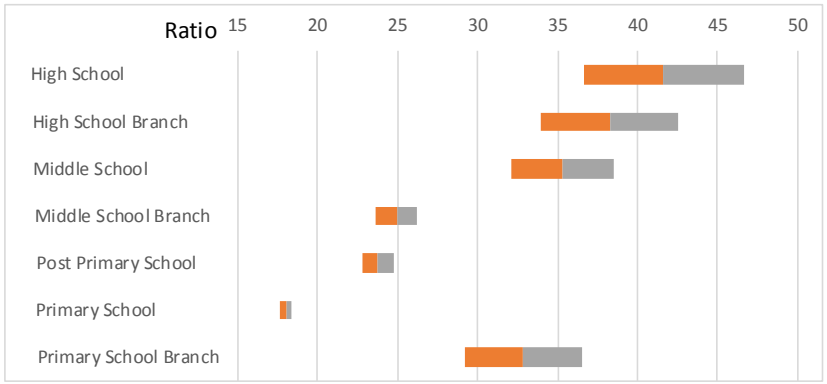


Figure 13 S/T Ratio at the Primary School Level by Type of school

Figure 13 shows the relationship between the S/T ratio and the type of school. If the level of the type of school was high, the S/T ratio was also high with the exception of the branch primary school. According to the vast increase in the number of daily wage temporary teachers, who were mainly introduced in local and small schools, the S/T ratio at the primary school level of primary schools, post primary schools, and branch middle schools improved rapidly (Muta 2015a, 2015b). In contrast, although the branch

primary schools were established to improve enrollment, the number of teachers was still inadequate. Ironically, the high S/T ratio may decrease the pass rate even at high schools where the pass rate is expected to be high.

As described above, if the status of the school is prestigious such as a high school, students with higher motivation and students whose families are wealthy tended to gather at these schools. However, this contributed to a larger number of students and a higher S/T ratio. The positive factors for higher achievement were offset by negative factors; and the results became unclear as shown in Figure 1.

Figure 14 showed the relationship between the type of school and the quality of teachers. It is not necessarily true that the prestigious schools have high quality of teachers. As a technical problem, the school head master was included to calculate the quality of teachers. This problem made the quality of teachers lower at high school and middle schools where the school head master was not counted as an experienced primary school teacher. However, the difference in the quality of teachers among types of schools in Figure 14 seems greater than this technical problem. This tendency may lower the pass rates for Grade 5 at high schools and middle schools.

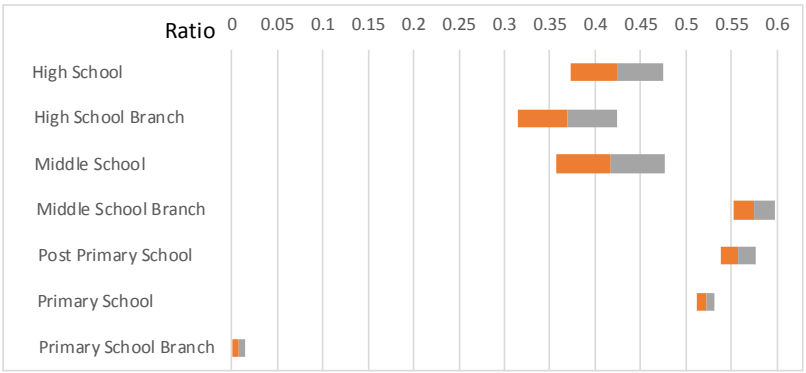


Figure 14 Quality of Primary School Teacher Level by Type of school

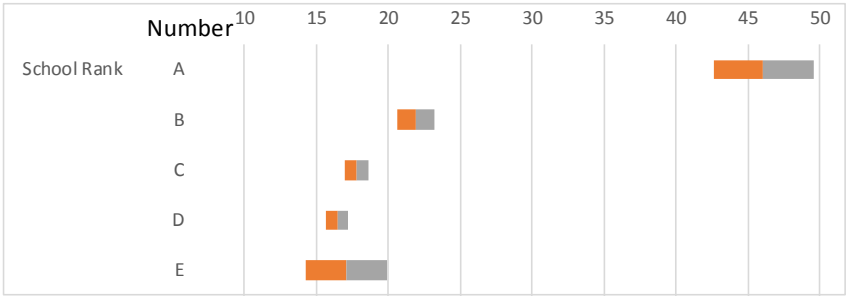


Figure 15 Number of Grade 5 Students per School by School Ranking

The same was also true in the case of school ranking. Figure 15 shows that there was a higher number of Grade 5 students if the ranking was "A" in contrast to schools with a lower ranking. An "A" ranking attracted many students.

Figure 16 shows the S/T ratio at the primary school level according to school ranking. The S/T ratio was lower when the school ranking was "C", "D", "E" rather than "A" and "B" maybe because of the recent increase in daily wage temporary teachers in these schools. In conclusion, a higher S/T ratio may have offset the advantage of schools ranked as "A".

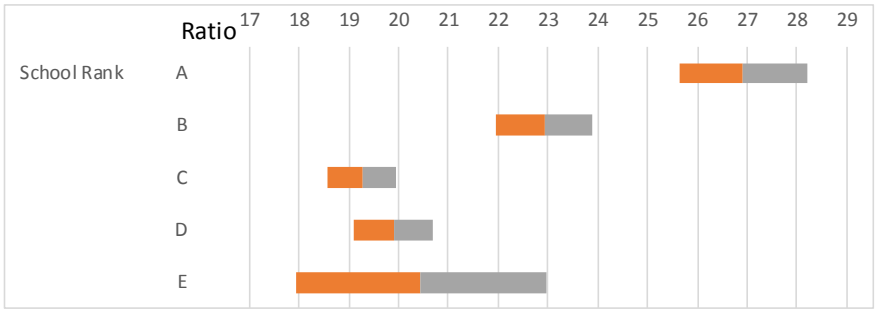


Figure 16 S/T Ratio of Primary School Level by School Ranking

As it was pointed out in previous research studies (Muta 2015a、2015b), and as shown in Figure 17, the quality of teachers and school ranking had a strong correlation. A school ranked as "A" had a higher quality of teachers. Although the school ranking was a good proxy for student SES, when several educational conditions were intricately combined, then it made the interpretation of Figure 3 difficult.

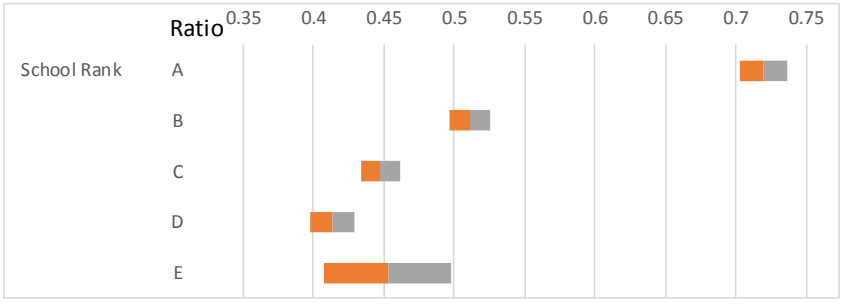


Figure 17 Quality of Teachers at Primary School Level by School Ranking

What about the case of Grade 9? When the number of Grade 9 students was calculated by type of school, it was found that the number was extremely high at high schools as shown in Figure 18. It seems that the high schools attracted many students from

neighboring areas because of its high reputation. When the S/T ratio was calculated by type of school, it was higher at the high school than at the middle school as shown in Figure 19, but it was not extreme such as in Chin State (Muta 2015c). The greatly increased S/T ratio did not contribute to a deterioration in the quality of the education. This may be the reason why the pass rate for Grade 9 was the highest even if the number of students per teacher was greater than 80 as shown in Figure 10. It seems there was an adequate number of teachers at the middle schools even though the number of students expanded greatly. In contrast, the number of teachers at the branch middle schools was still inadequate. The branch middle schools may have been established without the required number of teachers because of the strong demand by students.

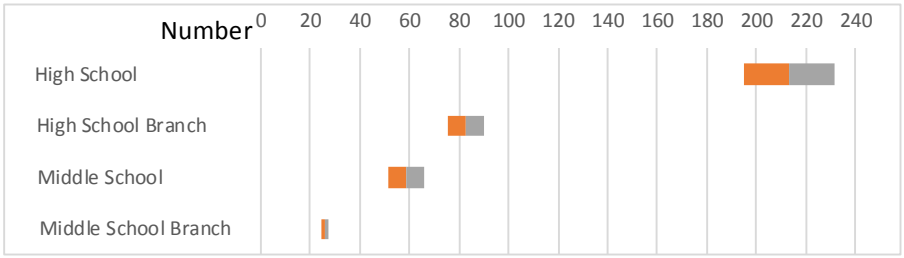


Figure 18 Number of Grade 9 Students per School by Type of school

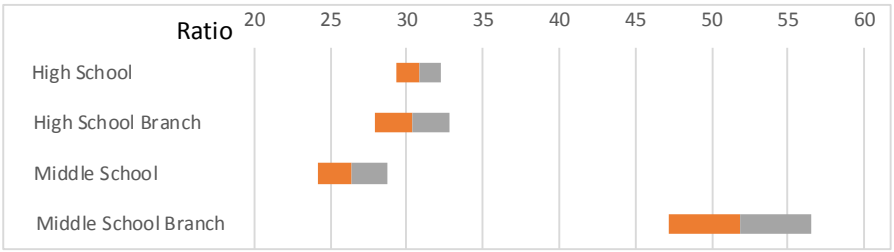


Figure 19 S/T Ratio at Middle School Level by Type of school

It is same for the school rankings. As shown in Figure 20, the number of Grade 9 students was very large in schools ranked "A." However, it didn't make S/T ratio high as shown in Figure 21. This is why the pass rate was high for schools ranked "A" as shown in Figure 4 different from the case in Chin State.

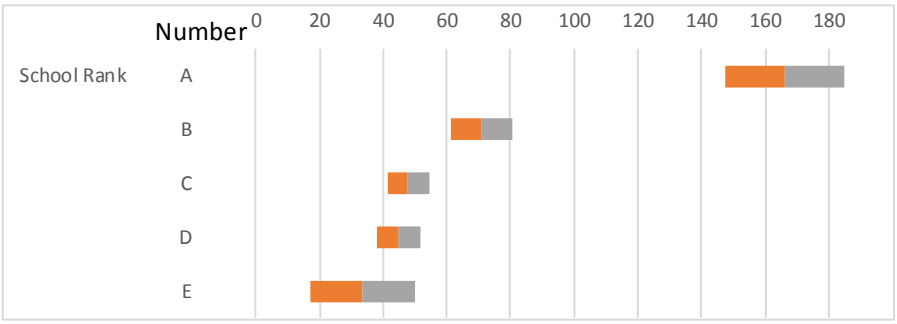


Figure 20 Number of Grade 9 Student per School by School Ranking

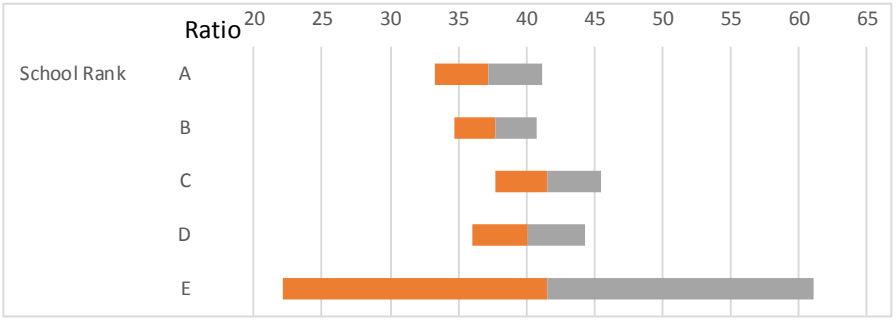


Figure 21 S/T ratio at Middle School Level by School Ranking

3.4 Contribution of Each Factor Variable Affecting the Pass Rate

As explained in the previous sections, factors that may have influenced the pass rate were correlated. Thus, the unique contribution of each factor could not be clearly identified when it was checked one by one. Regression analyses were conducted to find the unique contribution of each factor variable. The type of school, school ranking, and district were discrete variables from the start. The S/T ratio, number of students, quality of teachers were continuous variables. However, there was no guarantee that the relationship between the pass rate and these continuous variables were linear. These variables were then categorized into an almost equal number of schools. In this way, all of the explanatory variables were converted to dummy variables. The sample unit in the "Combined Dataset" was a school. As the size of the schools varied, the school was weighted by the number of students who took the examination, which was the base for calculating a pass rate when the regression analyses were conducted.

Table 3 shows the result of linear regression analysis for Grade 5. The explained variable was the pass rate for Grade 5, and the explanatory variables were the type of school, school ranking, district, and variables for educational conditions such as S/T ratio, number of students, and quality of teachers. Concerning the type of school, the High

School and Middle School showed a larger regression coefficient. Compared to the results in Figure 1, the general tendency, which was the higher the reputation, the stronger the influence, became clearer to some extent in Table 3. For school ranking, "A" showed the highest influence. The variables on educational conditions showed the expected results. If the S/T ratio was high, the pass rate was high; if the number of students was small, the pass rate was high; and if the quality of teachers was high, the pass rate was high.

Table 3 Factors Explaining the Pass Rate for Grade 5

Variables		Regression Coef.	Range (Max-Min)	t Value
School Type	High School	0.0815	0.0852	10.38
	High School Branch	0.0020		0.25
	Middle School	0.0590		7.32
	Middle School Branch	-0.0037		-0.47
	Post Primary School	0.0413		5.27
	Primary School	0.0519		6.80
	Primary School Branch	0.0000		-
School Rank	A	0.0576	0.0576	13.36
	B	0.0047		1.13
	C	0.0323		7.65
	D	0.0539		12.65
	E	0.0000		-
District	Mandalay	-0.0438	0.3354	-17.85
	Pyinoolwin	-0.0740		-31.19
	Kyaukse	-0.0844		-33.45
	Myingyan	0.0378		14.93
	Nyaung-U	-0.2976		-107.84
	Meiktila	-0.0610		-25.11
	Yamethin	0.0000		-
Average ST Ratio	0 < ST Ratio <=10	0.0949	0.0949	22.87
	10 < ST Ratio <=20	0.0658		25.09
	20 < ST Ratio <=30	0.0518		22.50
	30 < ST Ratio <=40	0.0329		14.01
	40 < ST Ratio <=50	0.0019		0.71
	50 < ST Ratio	0.0000		-
Number of Grade 5 Students	0 < Registered No <= 5	0.1153	0.1153	19.05
	5 < Registered No <=10	0.0932		28.07
	10 < Registered No <=15	0.0858		31.27
	15 < Registered No <=20	0.0623		25.27
	20 < Registered No <=25	0.0599		25.41
	25 < Registered No <=30	0.0502		20.61
	30 < Registered No <=35	0.0464		17.80
	35 < Registered No	0.0000		-
Quality of Teachers	0.0 =< PT Quality =< 0.2	-0.0802	0.0802	-32.69
	0.2 < PT Quality =< 0.4	-0.0631		-30.24
	0.4 < PT Quality =< 0.6	-0.0785		-40.35
	0.6 < PT Quality =< 0.8	-0.0497		-27.25
	0.8 < PT Quality =< 1.0	0.0000		-
	Constant	0.7200		80.06
	Adj R-squared = 0.2614	F=1059.82 (32, 95710)		
	Number of obs = 95743			

The most interesting finding in this table was the contribution of each factor variable. Since all of the categories for each factor were dummy variables, the regression coefficient showed the degree the pass rate changed if the case was "true." Thus, the range that was defined as the difference between the maximum and minimum coefficients among sub-categories of the same factor variable showed how much the factor contributed in changing the pass rate. It showed the relative contribution of the factor variable. For example, the coefficients of S/T ratio in Table 3 showed that the pass rate of “more than 40 students and equal to or less than 50” was 0.0019 point higher than “more than 50 students.” When the ratio was “more than 30 students and equal to or less than 40,” the pass rate increased 0.0310 point more. When the ratio was “more than 20 students and equal to or less than 30,” it increased 0.0189 point more. As a total, the difference in S/T ratio changed the pass rate 0.0949 point.

In Table 3, the District showed the greatest range. As the difficulty of the examination questions depended on the district, this was unavoidable. The second largest range was the number of students, which was 0.1153, followed by the S/T ratio, type of school, quality of teachers, and school ranking. As the District variable was special, it was not considered further. The sum of two factors, which were proxies for family-related variables, type of school and school ranking, was 0.1427, and the sum of three factors on educational conditions was 0.2904. This meant the educational conditions, which were school-related variables, were able to change the pass rate much more greatly. The maximum and the minimum figures of the estimated pass rate were easily calculated using the maximum or minimum coefficient of each factor variable, and these were 1.1070 and 0.3385. The maximum coefficient exceeded a range of 0 to 1.

Table 4 shows the result of linear regression analysis for Grade 9. The pass rate for middle school was the same as the high school shown in Figure 2, but the coefficient in Table 4 became smaller than that for the high school in Table 4, which indicated the influence was controlled by other variables. Because the examination questions were developed by the State/Region, the range of the district was thought to be small, but it was 0.1300 and the largest among other factor variables. Among the factors related to educational conditions, it was clear that the pass rate was highest when the S/T ratio was "more than 10 and equal to or less than 20." There was a tendency that the smaller the number of students, the higher the pass rate, but unlike Grade 5, the coefficient was the highest where the number of students was "more than 20 and equal to or less than 30." The order of the range was District, S/T ratio, school ranking, the number of students, and type of school from the largest to the smallest. The sum of two factors, type of school

and school ranking, was 0.1232, and the sum of two factors on educational conditions was 0.1542. The range of factors related to educational conditions was slightly exceeded if the range of the District was not counted. The estimated maximum pass rate was 0.6028 and the minimum was 0.1955. They fit into a range of 0 to 1.

Table 4 Factors Explaining the Pass Rate for Grade 9

Variables		Regression Coef.	Range (Max-Min)	t Value
School Type	High School	0.0498	0.0498	15.04
	High School Branch	0.0065		2.04
	Middle School	0.0349		11.27
	Middle School Branch	0.0000		-
School Rank	A	0.0734	0.0734	13.98
	B	0.0150		2.88
	C	0.0173		3.24
	D	0.0394		7.40
	E	0.0000		-
District	Mandalay	0.1148	0.1300	53.10
	Pyinoolwin	0.0384		17.53
	Kyaukse	0.0476		19.87
	Myingyan	0.0383		16.93
	Nyaung-U	-0.0151		-6.32
	Meiktila	0.0086		3.83
	Yamethin	0.0000		-
Average ST Ratio	0 < ST Ratio <=10	0.0193	0.0986	1.99
	10 < ST Ratio <=20	0.0877		30.12
	20 < ST Ratio <=30	0.0223		9.40
	30 < ST Ratio <=40	-0.0068		-2.92
	40 < ST Ratio <=50	-0.0109		-4.18
	50 < ST Ratio	0.0000		-
Number of Grade 9 Students	0 < Registered No <= 10	0.0224	0.0556	2.77
	10 < Registered No <=20	0.0323		7.20
	20 < Registered No <=30	0.0403		10.93
	30 < Registered No <=40	0.0290		8.34
	40 < Registered No <=50	0.0363		11.65
	50 < Registered No <=60	0.0117		3.55
	60 < Registered No <=70	-0.0153		-4.99
	70 < Registered No <=80	0.0137		4.75
	80 < Registered No	0.0000		-
	Constant	0.2368		37.62

Adj R-squared = 0.2173 F=707.05 (26, 66100)
Number of obs = 66127

The above estimates were calculated using linear regression analysis. When pass rates were estimated using the calculated coefficients, the figures were not in the 0 to 1 range in the case of Grade 5. An estimated pass rate value may be less than 0 or more than 1 because of the nature of the analysis. Suppose the pass rate shows the possibility of a student taking the test to pass. A pass rate can be transferred to a logit (log of odds) and this logit can be used to explain the variable in a linear regression analysis. An estimated figure can be easily transferred to a pass rate (probability to pass) and it will never exceed

the range from 0 to 1 theoretically. Figure 22 shows the different images of a linear regression and logit regression models.

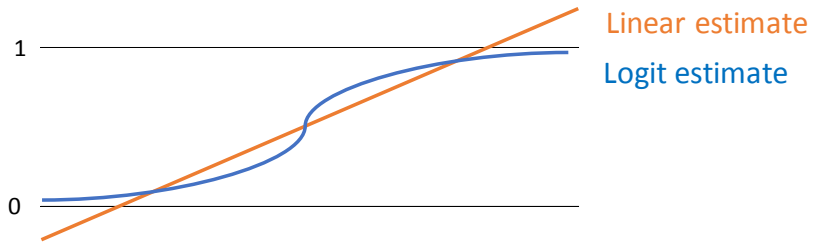


Figure 22 Different Images of Linear and Logit Regression Models

The logit is defined by the following formula:

Logit (p) = ln (p / (1-p)) where "p" shows the pass rate

According to this definition, the logit value cannot be calculated when "p" is either 0 or 1. In this research, the extreme pass rate based on a school such as 0 or 1 occurred when the number of students, who took the examination, was very small. In fact, there were 29 schools where the pass rate for Grade 5 was 0 and 1,195 schools where the pass rate was 1. If the original pass rate was used, a total of 1,224 schools, which was 30% of the sample, would be dropped. There were 13 schools where the pass rate for Grade 9 was 0, and 2 schools with a pass rate of 1. If the original pass rate was used, a total of 15 schools, which was 2% of the sampling, would also be dropped. To prevent them from being dropped, the value of 0 and 1 were modified as 0.01 and 0.99 after taking into account that the maximum number of students in such extreme cases appeared to be a maximum of two digits. The actual range of pass rates except 0 and 1 was 0.028 to 0.987 for Grade 5, and 0.023 to 0.869 for Grade 9. The order of the pass rate would not be reversed when 0 and 1 were modified as 0.01 and 0.99. In addition, if the modified values were very close to 0 or 1, the value of the logit became extremely small or large, which would distort the estimated coefficients.

Table 5 shows the regression analysis results for Grade 5 after the pass rates were converted to logits based on this idea. The tendency in the order of coefficients was almost the same as Table 3. The total range of variables related to type of school and ranking was 1.0032. In contrast, the total of range of variables related to educational conditions was 2.9053, and it excelled over the variables related to type of school and ranking. The maximum and the minimum values of logits were estimated as 4.9518 and -2.8841; these were equivalent to the pass rates of 0.9930 and 0.0529.

Table 5 Factors Explaining the Logit of the Grade 5 Pass Rate

Variables		Regression Coef.	Range (Max-Min)	t Value
School Type	High School	0.6129	0.6129	9.86
	High School Branch	0.1400		2.23
	Middle School	0.4874		7.64
	Middle School Branch	0.0779		1.25
	Post Primary School	0.4645		7.49
	Primary School	0.5387		8.91
	Primary School Branch	0.0000		-
School Rank	A	0.0869	0.3903	2.55
	B	-0.2492		-7.51
	C	-0.0395		-1.18
	D	0.1411		4.19
	E	0.0000		-
District	Mandalay	-0.2941	2.4763	-15.13
	Pyinoolwin	-0.4850		-25.83
	Kyaukse	-0.4487		-22.45
	Myingyan	0.5582		27.86
	Nyaung-U	-1.9181		-87.80
	Meiktila	-0.4313		-22.41
	Yamethin	0.0000		-
Average ST Ratio	0 < ST Ratio <=10	0.6699	0.7919	20.39
	10 < ST Ratio <=20	0.3747		18.06
	20 < ST Ratio <=30	0.2253		12.35
	30 < ST Ratio <=40	0.1619		8.71
	40 < ST Ratio <=50	-0.1221		-5.78
	50 < ST Ratio	0.0000		-
Number of Grade 5 Students	0 < Registered No <= 5	1.5186	1.5186	31.70
	5 < Registered No <=10	1.1637		44.27
	10 < Registered No <=15	0.8884		40.91
	15 < Registered No <=20	0.5935		30.38
	20 < Registered No <=25	0.5024		26.93
	25 < Registered No <=30	0.4181		21.69
	30 < Registered No <=35	0.4081		19.79
	35 < Registered No	0.0000		-
Quality of Teachers	0.0 =< PT Quality =< 0.2	-0.5948	0.5948	-30.61
	0.2 < PT Quality =< 0.4	-0.4634		-28.05
	0.4 < PT Quality =< 0.6	-0.5363		-34.81
	0.6 < PT Quality =< 0.8	-0.3452		-23.91
	0.8 < PT Quality =< 1.0	0.0000		-
	Constant	1.4511		20.38
	Adj R-squared = 0.2628	F=1067.62 (32, 95710)		
	Number of obs = 95743			

Table 6 shows the regression analysis results for Grade 9 using the same idea. The tendency in the order of coefficients was almost the same as Table 4. The total range of variables related to type of school and ranking was 0.7060. In contrast, the total of range of variables related to educational conditions was 0.8342, and it also excelled over the variables related to type of school and ranking if the District was not considered. The maximum and the minimum values of logits were estimated as 0.4878 and -1.5972; these were equivalent to the pass rates of 0.6196 and 0.1684.

Table 6 Factors Explaining the Logit of the Grade 9 Pass Rate

Variables		Regression Coef.	Range (Max-Min)	t Value
School Type	High School	0.3090	0.3090	18.49
	High School Branch	0.1111		6.91
	Middle School	0.2003		12.82
	Middle School Branch	0.0000		-
School Rank	A	0.3969	0.3969	14.99
	B	0.1245		4.73
	C	0.1149		4.27
	D	0.2249		8.38
	E	0.0000		-
District	Mandalay	0.5448	0.6259	49.94
	Pyinoolwin	0.1964		17.76
	Kyaukse	0.2293		18.97
	Myingyan	0.1938		17.00
	Nyaung-U	-0.0811		-6.72
	Meiktila	0.0479		4.25
	Yamethin	0.0000		-
Average ST Ratio	0 < ST Ratio <=10	0.2314	0.4440	4.72
	10 < ST Ratio <=20	0.4115		28.01
	20 < ST Ratio <=30	0.1410		11.76
	30 < ST Ratio <=40	0.0132		1.12
	40 < ST Ratio <=50	-0.0325		-2.47
	50 < ST Ratio	0.0000		-
Number of Grade 9 Students	0 < Registered No <= 10	-0.1951	0.3902	-4.78
	10 < Registered No <=20	0.1478		6.52
	20 < Registered No <=30	0.1951		10.48
	30 < Registered No <=40	0.1790		10.19
	40 < Registered No <=50	0.1752		11.15
	50 < Registered No <=60	0.0954		5.74
	60 < Registered No <=70	-0.0760		-4.92
	70 < Registered No <=80	0.0593		4.07
	80 < Registered No	0.0000		-
	Constant	-1.3695		-43.13
	Adj R-squared = 0.2046	F=655.26 (26, 66100)		
	Number of obs = 66127			

3.5 Simulation of the Effect of Daily Wage Temporary Teachers on the Pass Rate

The “Combined Dataset” includes the statistics of daily wage temporary teachers hired in 2014. There are several views concerning daily wage temporary teachers. The merit lies in providing the required number of government-funded teachers to local and small schools, where the number of teachers are insufficient. The demerit is the employment of unlicensed, inexperienced people as teachers even though they passed at minimum the Matriculation Examination. This vast number of newly employed teachers may decrease the quality of teaching as a whole. The following section will simulate what will happen to the pass rate if daily wage temporary teachers are omitted in Table 3 because the results can be easily interpreted.

There were 1,771 daily wage temporary teachers in the dataset, which was 7.6% of all teachers. The number of students per teacher was 22.61 and 24.47 if the daily wage temporary teachers were excluded, or a 1.86 increase. According to Table 3, the coefficient of S/T Ratio for "more than 20 students and equal to or less than 30" was 0.0518, and the coefficient for "more than 30 students and equal to or less than 40" was 0.0329. A difference of about 10 students made a 1.89% point difference. Thus, the difference of 1.86 students could make a 0.35% point difference in the pass rate.

In contrast, the quality of teachers can be calculated to 0.5536, if the daily wage temporary teachers were not included. But since it was 0.5990 if the daily wage temporary teachers were included, the difference was 0.0454. According to Table 3, the coefficient for the quality of teachers for "more than 0.4 students and equal to or less than 0.6" was -0.0785, and the coefficient for "more than 0.6 students and equal to or less than 0.8" was -0.0497. The difference of some 0.2 students made a 2.88% point difference, so the difference of 0.0454 would make a 0.66% point difference in the pass rate.

As a whole, the positive effect of daily wage temporary teachers on the pass rate by reducing the S/T ratio, may be cancelled by the negative effect of reducing the quality of teachers, although both effects are small. Of course, this is a general overall picture and it may differ if specific conditions are included.

The daily wage temporary teachers were mostly deployed at local and small schools (Muta 2015a; 2015b). A branch primary school is a typical case. Among the branch primary schools, the S/T ratio was 32.20, but it jumped to 43.91, or 11.71 more if the daily wage temporary teachers were excluded. According to Table 3, the S/T Ratio coefficient for "more than 30 students and equal to or less than 40" was 0.0329, and the coefficient for "more than 40 students and equal to or less than 50" was 0.0019. The difference of about 10 students created a 3.10% point difference. Therefore, the difference of 11.71 students could make a 3.63% point difference in the pass rate.

In contrast, the quality of teachers was low from the first regardless of the daily wage temporary teachers. It was 0.0074 if the daily wage temporary teachers were included, and 0.0101 if they were not included. The difference was 0.0027. According to Table 3, the coefficient for the quality of teachers for "more than 0.0 and equal to or less than 0.2" was -0.0802, and the coefficient for "more than 0.2 and equal to or less than 0.4" was -0.0631. The difference of about 0.2 point in the quality of teachers created a 1.71% point difference in the pass rate. In summary, it is clear that the introduction of daily

wage temporary teachers to branch primary schools increased the pass rate of these schools.

The above simulation is a story of branch primary schools as a whole. If we look at individual schools, the reality is rather stringent. In the dataset, there were 98 branch primary schools with students. Among them, there were 34 schools where all the teachers were daily wage temporary teachers; and there was only one daily wage temporary teacher at 31 schools. If the daily wage temporary teachers were excluded, there were no government-funded teachers at all in these schools. In fact, there are currently 13 branch primary schools where there are no government-funded teachers, and these schools were excluded from the previous calculation for Table 3 and Table 5 because the indicator on the quality of teachers could not be calculated. The effect of daily wage temporary teachers for these kind of local and small schools must be much more than the result of this simple simulation. The government has established many small schools in local areas to ensure access to primary education. It is necessary for EFA (Education for All), but the issue is also to ensure an appropriate number of teachers there. The introduction of daily wage temporary teachers was a solution, but its effects were transient. Any permanent means of deploying an adequate number of teachers have to be considered from the viewpoint of equal educational opportunity for all children.

3.6 Difference between the Results of Mandalay Region and Chin State

The data for Mandalay Region was analyzed in this study. Thus far, the data for Chin State has been analyzed (Muta 2015c). The two results were compared here based on Table 3 and Table 4, which are easy to interpret.

Table 3 shows the contribution of factor variables to the Grade 5 pass rate. The District showed the highest range of coefficients in both cases among factor variables. This was unavoidable as the examination questionnaires were made by the District level, and the difficulty of the examination questions depended on the district.

The second largest range was the factor variables on educational conditions such as the number of students, S/T ratio, and the quality of teachers; and the tendency of subcategory of variable were same in both Chin State and Mandalay Region. The tendency of the sub-categories of the factor variables were exactly the same in both cases. It was clear that the pass rate was high when the number of students was small, the S/T ratio was small, and the quality of teachers was high. Proxies for family-related variables, type of school

and school ranking followed. The pass rate for school ranking “A” was large in both Chin State and Mandalay Region, but the tendency of other subcategories varied. When the range of same factor variable in Chin State and Mandalay Region were compared, the ranges of all factor variables were larger in Chin State than in Mandalay Region.

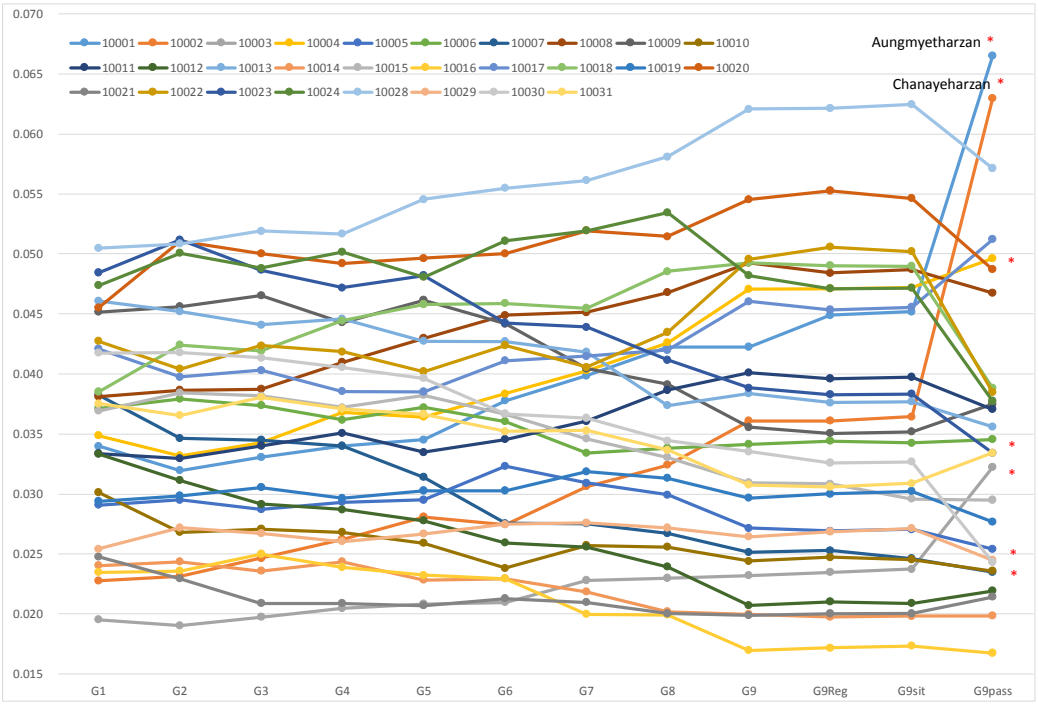
Concerning Table 4, factors explaining the pass rate for Grade 9 in Chin State, the sum of the range of variables on educational conditions and the sum of the range of school type and school ranking were almost the same; and the range of the district was small. In contrast, in Mandalay Region, the range of the district was large and the sum of the range of variables on educational conditions and the sum of the range on school type and school ranking followed.

Concerning the S/T ratio, the smaller the S/T ratio, the higher the pass rate in Chin State, but the pass rate was highest when the S/T ratio was "more than 10 students and equal to or less than 20" in Mandalay Region. The pass rate was the highest when the number of students was "more than 20 and equal to or less than 30" for both Chin State and Mandalay Region. Regarding the type of school and rank, only the tendency for the pass rate for schools ranked “A” was large. This was the same in both cases.

There was a question as to why the range of the District was large in Mandalay Region as the examination questionnaires were made by State/ Region level. According to Table 4, Mandalay District showed the highest coefficient. Since a District consists of several Townships, the following analysis was conducted by township. Figure 23 showed the distribution of students from Grade 1 to Grade 9 in October 2014, the registered number at the time of examination, the number of students who took the examination, and the number of students who passed among the townships in Mandalay Region.

Suppose the distribution of Grade 1 in each township is the same every year. If the dropout rate is the same among townships, and there are no transfers between townships, then the lines in the Figure 23 should be parallel. In actuality, some lines show an increase and other lines show a decrease because the dropout and transfer rates are different among townships. Two townships, which belonged to Mandalay District, namely Chanayeharzan (10002) and Aungmyetharzan (10001) were remarkable. The lines especially jumped between the ratios of students who took examination and those who passed. The pass rates of these townships were 65.75% and 56.04%, where the average pass rate was 38.05% in Mandalay Region. These two townships increased the

average pass rate of Mandalay District to 47.05%.



Note: Mandalay District consists of 7 Townships (10001 – 10007) shown ＊.

Figure 23 Distribution of Students for Each Grade among Townships in Mandalay Region

The ratio of "the number of students registered at the time the examination was taken" and "the number of Grade 1 students" was 0.5978 in total. But 0.9486 and 0.7902 were very high for the above two Townships. That signified there were not only a smaller number of dropout in these townships, but there were also a large number of superior students, who transferred from other townships. Furthermore, they contributed to the high pass rates in two townships. This may be proven by the fact that the correlation coefficient of the "pass rate" and the "ratio of the number of registered students at the time of the examination and the Grade 1 students" based on townships was 0.4149 and statistically significant at a 5% level.

In contrast, the situation in Chin State is shown in Figure 24. Paletwa (4009) showed a downward trend and Hakha (4002) and Tiddim (4004) showed an upward trend, but the trends were not so large compared to Figure 23. It was not likely that many students transferred from one township looking for a better educational environment. The trend simply came from the different dropout rates. Unlike Mandalay Region, Chin State is a mountainous region, and it is not geographically easy to transfer to other schools in

different townships simply for the reason of a better educational environment. The correlation coefficient between the "pass rate" and the "ratio on the number of registered students at the time of examination and Grade 1 students" based on townships was -0.2134 and statistically not significant.

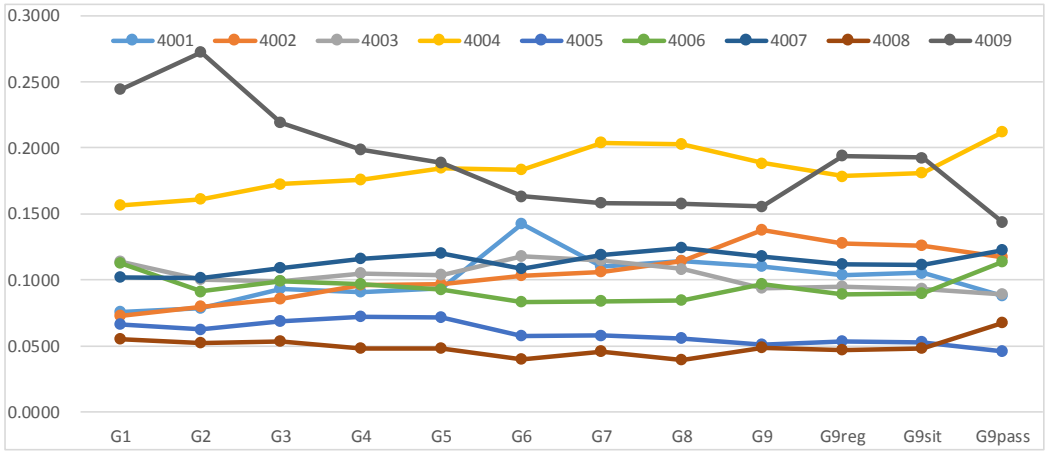


Figure 24 Distribution of Students of Each Grade among Townships in Chin State

It may be better to consider the range of the district within the same group on the type of school and rank for Grade 9. If so, the contribution of the variables on educational conditions to the pass rate was relatively lower in Mandalay Region. According to the previous study (Heyneman and Loxley 1983), the contribution of educational conditions to the pass rate would be lower if the economic condition of the region was high. Either way more studies on other States/ Regions are necessary for generalizations.

4. Conclusion and Policy Implications

The scholastic achievement examination for Grade 5 and Grade 9 students held in February 2015 was a nationwide examination that was a first-time experience for the students. The examination questions were developed for all major subjects by the district for Grade 5, and by the State/Region for Grade 9. This examination did not aim to investigate whether the scholastic ability, which the national curriculum targeted, had been achieved or not. It was designed to confirm if individual students had the scholastic ability to graduate from primary school or middle school levels. That was why the students, who failed the examination, had to take supplementary classes and a supplementary examination to move on to the next grade.

The examination questions were not standardized to make a comparison possible between

regions or academic years, and the only available variable on the scholastic achievement results was in actuality the pass rate of each school. The information about factors that may have influenced scholastic achievement such as student motivation, time to study, and family background of the students were not collected. In this regard, the data on examination results were not the most suited to analyzing the factors influencing scholastic achievement. However, this kind of large-scale data was rare; and it was possible that a careful analysis would draw some useful implications despite the limitations.

As information exists about schools where students study, the "Pass Rate Dataset" was combined with the "School Basic Dataset," after which the relationship between the pass rate and the information on schools was analyzed. The basic data on school characteristics was the State/Region, district, type of school and school ranking. As the examination questions were developed and managed by the district for Grade 5 and the State/Region for Grade 9, the interpretation of the results should be the difference in the difficulties encountered between districts or States/Regions. Other variables related to type of school and school ranking were considered to be strong proxies for student motivation and the SES of the family. Other variables representing the educational conditions that greatly affect scholastic achievement were S/T ratio, number of students, and quality of teachers.

According to an analysis of Mandalay Region data, the following conclusions were reached.

1) The type of school or school ranking that were considered to be proxies of student motivation and SES showed significant influence, which explained the pass rates, but the variables on educational conditions explained the pass rates further.
2) The smaller the S/T ratio, the higher the pass rate both for Grade 5 and Grade 9.
3) The higher the quality of teachers, the higher the pass rate for Grade 5.
4) The smaller the number of students, the higher the pass rate for Grade 5. The pass rate was the highest when the number of Grade 9 students was "more than 20 and equal to or less than 30."
5) It was estimated that the pass rate of local and small schools may have been lower to some extent if there were no daily wage temporary teachers.
6) Unlike Chin State, the District greatly contributed to the pass rate of Grade 9 in Mandalay Region, maybe because of a greater number of student transfers seeking a better educational environment among the districts.

The above conclusions from 1) to 4) were the same in Chin State; and it seems they can be considerably generalized. As the results indicate, educational conditions that are changeable policy variables such as S/T ratio, educational quality, manageable and appropriate number of students affected the pass rate significantly, and the effect was greater than the effects caused by type of school and ranking, which were the proxies for family-related variables. This implied that scholastic achievement could be improved by improving these educational conditions. These implications supported the current educational policies to establish small schools in local areas to boost the enrollment rate and to employ daily wage temporary teachers for deployment to local and small schools as needed.

The examination for Grade 5 and Grade 9 conducted in February 2015 did not aim to analyze the effect of factors contributing to scholastic achievement. Despite this, as this paper showed, useful implications can be obtained based on appropriate analyses. It was possible to make the analysis results more in depth if additional data were added to this dataset.

The following policy implications were drawn from the previous study in Chin State (Muta 2015c).

1) The school code is necessary for effective and efficient analyses in future.
As shown in this study, different datasets can be combined if they have a common variable. If the datasets have more variables, several more interesting analyses become possible. To create a meta-dataset, a simple and non-changeable variable common to all datasets is necessary. The name of the school was used as the common variable in this study, but it was difficult to combine the two datasets as described based on the name of the school. The school code should be decided in the near future by the Ministry of Education and it should be used in all school statistics from now on. This simple practice can help to greatly utilize the accumulated educational data appropriately and thoroughly.

2) A nationwide standardized scholastic achievement examination is necessary.
Scholastic achievement is the most basic outcome of an educational system in any country, and an analysis of the current status and factors affecting scholastic achievement is required to find effective and efficient ways to improve the situation, and to make appropriate educational plans for the future. Thus, it is necessary to develop an assessment system on scholastic achievement and to collect related variables with the goal of contributing to an international comparative survey in the near future.

3) Similar comparative analyses of other States/Regions are necessary.
This study analyzed Mandalay Region followed by Chin State. Some conclusions were the same, but not all. It is still not known to what extent the results can be generalized for the entire nation.

In addition to these policy implications, the following issues should be added.

4) The information on community-funded teachers should be collected along with government-funded teachers.
As also shown in this study, the teachers are essential to increase the scholastic achievement of students. The current statistics collected information only on government-funded teachers. If information on all kinds of teachers is available, the relationship between teachers and scholastic achievement will become clearer.

5) Appropriate deployment of teachers should be seriously considered.
The role of daily wage temporary teachers on academic achievement at local and small schools is clear. However, this policy cannot continue for an extended period because of budgetary constraints. It is necessary to consider a permanent solution on how to secure the needed number of teachers at local and small schools.

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