【論文】

Myth of Japanese Meritocracy: Monographic Research Using Panel Data on Academic Achievement

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Abstract

The Japanese meritocracy ideology states that any educational inequality resulting from children's SES can be overcome through their individual effort at studying hard. However, it hasn't empirically been clear whether inequality in academic achievement can be overcome through studying hard. Using data from the *Japan Education Longitudinal Study* (N = 1,085), this article examines students' math achievement trajectories with respect to their SES. This study especially focuses on the changes in students' self-learning time by different levels of SES. Although children of low SES initially showed less achievement, their learning time had a positive effect; however, when compared with children of high SES, it showed a negative effect. Therefore, the inequality among children of low SES occurs in two steps: at the initial level and during their grade progression. Thus, the results suggest the Japanese meritocracy ideology.

Key words: Academic Achievement, Meritocracy, Longitudinal studies of education, Japanese Education, Cultural capital

1. INTRODUCTION

Since 2000, data to illuminate understanding about the academic achievement gap in Japanese children by SES have gradually been made available. However, most existing research has been cross-sectional, showing the academic achievement gap at only a single point in a student's school career. For example, Yamada (2014) only analyzed limited cross-sectional data from 6th grade and 9th grade, and the data from Akabayashi *et al.* (2016) was unable to capture the long-term individual trajectory for student achievement as they only analyzed two year, short-term panel data. As education is a process in children's growth, there is a need for continuous observational tracking. Namely, there is a need for longitudinal data analyzes; however, few educational sociologists have published longitudinal studies, as such assessments are very expensive.

This paper uses rare panel data on academic achievement in Japan to investigate the level of Japanese meritocracy through an examination of the longitudinal change in the inequalities in children's academic achievement by SES and by analyzing the effects of individual effort in Japan.

2. LITERATURE REVIEW

2.1. Relationship between Family Background and Student Achievement

Social mobility through education has been a traditional topic in educational sociology. The idea is that individuals are able to gain wealth through education, thereby reducing the gap between the rich and the poor and stimulating economic development in the society as a whole. Education has been expected to balance both economic efficiency and social justice (Lauder *et al.* 2006). The possibilities for social mobility increased as society industrialized, with education being the important inter-medial factor (Treiman 1970). As industrialization led to societal modernization, people's status attainment was expected to gradually become meritocratic/performance-based as social classes weakened; therefore, higher educational levels were expected to be related to higher social status (Young 1958; Collins 1971, 1979).

In reality, however, as a parents' SES has often determined their children's educational achievements, even if the relationship between social status and education was strong, in the end, the relationship between the original social class and the destination social class was not always weakened (Halsey 1977). Inequalities in educational achievement have been explained as a combination of the cultural values and school culture in relation to each child's SES (Bourdieu and Passeron 1964, 1977; Bourdieu 1984; Bernstein 1978). Lareau (2003), in a study in the USA, found that middle-class and working class mothers' parenting styles were different, which were distinguished and named "concerted cultivation" for the middle-class and "accomplishment of natural growth" for the working-class. For example, middle-class mothers tended to encourage the logical use of language and autonomy from authority while working class mothers tended to use a command tone and tried to avoid clashes with authorities. These strategic parenting differences between social classes were seen to cause differences in the development of children's learning habits, their adaptation to school, and their academic achievements. Therefore, the children of parents from higher social classes were found to be more advantaged, resulting in educational achievement inequality. Several empirical analyzes have attempted to explain educational achievement inequalities by focusing on the differences in family cultural backgrounds and parenting styles (De Graaf *et al.* 2000; Jæger 2011; Cheadle 2008; Cheadle and Amato 2011). In Japan, however, historically, as there is limited social data, Japanese researchers have not been able to directly measure or explain the Japanese case, even though there was a general acknowledgment of foreign studies. As a result, even though the measurement and explanation of inequality in academic achievement has been a central topic in educational sociology, little empirical knowledge on the Japanese situation has been gathered (Mimizuka 2008).

Following "the era of the achievement test" in the 2000s, several empirical studies that investigated the academic achievement gap in Japan found that the academic achievement inequality by SES in Japanese children had widened (Kariya and Shimizu 2004), and that there were significant regional differences (Mimizuka 2008). Yamada (2014) analyzed the NSAPLC 2013 using a multiple regression analysis that set household income and father/mother's academic background as the independent

variables, from which it was found that the father's academic background had the strongest effect on a child's academic achievement. Tarumi (2014) used the same data to analyze the relationship between parental involvement and academic achievement based on Lareau's (2003) theoretical framework, and found that a family's cultural capital, such as book reading at home, approaches to living, parent-child communication, and cultural activities, had positive effects on a child's academic achievement.

2.2. Japanese Meritocracy: Effects of Self-Learning Time

In a meritocratic society, an individual's educational attainment is determined from a combination of ability and effort (Young 1958), but it also considers barriers such as social class (Bourdieu and Passeron 1964; Boudon 1974; Lareau 2003). The characteristics of children who overcome these disadvantages and achieve high academic success include daily efforts toward self-learning (OECD 2011). Therefore, there has been a general understanding that to overcome the disadvantages of a low SES, individual effort is important; however, in East Asia, including Japan, the importance of student effort (*gambaru* in Japanese), in terms of educational achievement, has been particularly stressed (Duke 1986; Shingleton 1989). In a survey by Takeuchi (1995), middle-school students were asked, "What factor is important for passing the high school entrance exam?," with answers given from a choice of two out of five possible answers: effort, innate ability, exam-taking skills, luck, and other; with "Effort" being selected by 89.2% of the students, indicating that Japanese students have strongly internalized the importance of effort for educational achievement.

Japanese educational sociologists have also often used self-learning at home as an analytical measure. The first such study by Kariya (2000) has had a significant influence on Japanese meritocracy studies. Kariya (2000) argued that in Japanese society, even though self-learning time could be used as a sociological index for effort, it is also determined by SES and therefore, the effort defined as the basis for Japanese meritocracy is also essentially unequal. As the Japanese meritocracy ideology believes that people who have failed to attain high academic achievement have not put enough effort into studying (i.e., individual failure is a result of lack of effort), there is an assumption that effort is equally accessible to all.

However, there has been some suspicion regarding this myth of equal effort. After "the era of the achievement test," Japanese educational sociologists gained access to data on academic achievement and verified how "meritocratic" it was for children to achieve academic success.[1)] Common methodologies have set self-learning time as the index for effort, which was then tested to determine whether it had a significantly positive effect on achievement, with the SES variables examined in multiple regression analyzes, from which it was found that the academic achievement variance was largely explained by the SES variables, and that self-learning time had a constant effect on "improvement" in academic achievement (Mimizuka and Nakanishi 2014).

On the academic achievement gained through self-learning by children from disadvantaged SES, the NSAPLC2013 revealed a shocking finding. Researchers conducted a principal component analysis on the parents' educational background and household income and analyzed the

relationship with academic achievement by classifying the SES into four groups: lowest SES, lower-middle SES, upper-middle SES, and highest SES. Mimizuka and Nakanishi's (2014) report, which was included in the research report, contained the research question "How much would children from other SESs have to study to perform better than children from the highest SES who do not study at all?" Taking Math A in 9th grade as an example, the correct answer rate (gained score) for children from the highest SES who did not study at all was 62.5%. To achieve the same rate, it was estimated that children from the upper-middle SES needed to "study more than 30 min, less than 1 h," and those from the lower-middle SES needed to "study more than 2 h, less than 3 h." However, for children from the lowest SES, even if they studied more than the maximum; i.e., "more than 3 h;" they could not achieve greater than 62.5%.[2] Note that even though these findings were simply a comparison of average values, it had a significant impact on Japanese society, which had firmly believed that inequality could be overcome by individual effort.[3]

Therefore, several research findings in recent decades have revealed that the postwar Japanese meritocracy belief that effort can overcome educational inequality is a myth.

2.3. Rationale for this Study

The rationale for Japanese meritocracy has been that any educational inequality resulting from children's SES can be overcome through individual effort. However, after analyzing the data collected in "the era of the achievement test," research has revealed that Japanese children have extremely deep-rooted educational inequalities, and therefore, the meritocracy of personal effort is a myth (Kariya 2000; Yamada 2014; Mimizuka and Nakanishi 2014).

However, there have been two major barriers to attempts to verify meritocracy. One of these has been that the self-learning time analyzes by Kariya (2000) and others have been insufficient as no data on educational achievement were included.[4] If only self-learning time was used as the effort index to verify the truth of Japanese meritocracy, the effect of this self-learning time on educational achievement needed to be better clarified.

Another problem was that the data and methods used in the Japanese meritocracy studies had three limitations because of the cross-sectional data. First, they did not assess the educational inequality trajectory by SES. In other words, they did not answer simple questions such as at what age educational inequality appeared or how the situation changed as the children grew up; that is, when making causal inferences on the background mechanism behind changes in educational achievement, it is necessary to have longitudinal data on specific students. The latest studies in Japan suggested that the SES educational achievement gap appeared in early childhood and existed at every stage in school (Yamada 2014; Akabayashi *et al.* 2016). However, these "conclusions" were only deduced from a combination of cross-sectional data or from short-term panel data on some students in some grades. Long-term educational achievement changes have been studied in other countries; for example, Seltzer *et al.* (2003) used data from the Longitudinal Study of American Youth (LSAY) to clarify the supposition that the higher the initial score, the greater the educational achievements. Heckman (2006) ana-

lyzed changes in math scores on the Peabody Individual Achievement Test (PIAT) by dividing students by household income, and found that the home economic situation influenced the educational achievement of children as young as six years old, and that the gap increased as they grew up. Using Early Childhood Longitudinal Study (ECLS) data, Cheadle (2008) elucidated the heterogeneity of the trajectory of the educational gap that was affected by SES or ethnicity. Based on these preceding studies, this paper examined panel data on the educational achievements of Japanese students to determine the academic gap trajectory of students from different SES. Therefore, the first research question was focused on whether the differences in student achievements were associated with differences in their individual SES.

Second, existing research has not kept pace with the recent changes in student self-learning times. Researchers have only shown that self-learning time was positively related to educational achievement in limited situations; primarily because they used cross-sectional data from only one study. Likewise, Nakanishi's study (2017), which analyzed panel data to solve the above problem, did not use a model combining both invariant variables and variable variables either. This paper, on the other hand, used panel data to determine whether educational achievement was based on self-learning attitude. The previously mentioned study (Seltzer *et al.* 2003; Heckman 2006; Cheadle 2008) not only found heterogeneity in the math achievement trajectory based on SES, but it also examined whether this inequality could be overcome by the school program, pre-school education, or parenting styles. This paper examined Japanese meritocracy to elucidate how student achievement could be promoted through self-learning activities. The second research question, therefore, was focused on whether math achievement improved in relation to self-learning time.

Third, the analysis methods used to assess the effect of self-learning time need to be reconsidered. Previous studies have not clarified the differences in the recent changes in student self-learning time between different SES levels, which is also related to the second research question. The Japanese meritocracy ideology believes that the more a student studies, the higher the score they can achieve; however, it is also assumed that the effect of this personal effort is equal for everyone. However, as Mimizuka and Nakanishi (2014) found, the most diligent low-SES students were unable to obtain higher scores than the laziest high-SES students. A two-step mechanism was estimated to explain this contradiction: 1) there was a large inequality in the initial scores between SES groups, and 2) lower SES students did not benefit from self-learning effects as efficiently as higher SES students. The first inequality was based on family background and the second one was raised by the students' personal activities. Bourdieu and Passeron found that every student had a different level of initial knowledge from home, and for that reason, the effects of self-learning activities were not equal for everyone (Bourdieu and Passeron 1964, 1977). These findings suggested that higher SES students could achieve greater effects from self-learning because their learning styles were more effective than lower SES students, indicating that math achievement inequality could not be overcome by student individual effort, which was the answer to the third research question. Concretely, this paper calculated and compared the

amount of self-learning time by higher and lower SES groups. If the self-learning affect in the lower SES group showed greater or at least the same efficiency as the higher SES group, then the math achievement inequality was because of SES as the effect of effort was equal for everyone.

3. METHODS

3.1. Data

The data used in this paper were partly obtained from the Japan Education Longitudinal Study (JELS). This research was designed using references such as the National Education Longitudinal Study (NELS) and was a part of a six-year panel survey carried out in the Kanto (urban area) and Tohoku areas (rural area). The population size in the urban area was around a quarter of a million people, and in the rural area, it was around 90,000 people at the beginning of this research.

Research in the urban area was conducted in 2003 (Wave 1), 2006 (Wave 2), and 2009 (Wave 3), and in the rural area, in 2004 (Wave 1), 2007 (Wave 2), and 2010. In the rural area, Wave 1 focused on 3rd graders, Wave 2 on 6th graders, and Wave 3 on 9th graders. The data were based on the questionnaire responses from students as well as mathematics academic assessment scores.

The data were collected by asking each prefecture and city's education committee to send a request to participate with around half of the public elementary and middle schools in the urban area and all of the public elementary and middle schools in the rural area. Fourteen elementary schools and eight middle schools from the urban area and twenty-one elementary schools and ten middle schools from the rural area participated. The surveys were conducted in class and distributed and collected by the teachers at each school.[5)]

3.2. Measures

Dependent variables

Student achievement. Data were derived from unique mathematics assessments, with the percentage of correct answers being assessed as student achievement. The assessments had 18 questions in 7 sections (assessment time: 30 min) in 3rd grade, 23 questions in 14 sections (assessment time: 40 min) in 6th grade, and 22 questions in 11 sections (assessment time: 45 min) in 9th grade. The assessments were based on the Japanese standard math course and included 1-4 questions from four categories; "number and calculations (*kazu to keisan*)," "amount and measurement (*ryo to sokutei*)," "quantity relationship (*suryo kankei*)," and "shape (*zukei*);" though there were some differences between the grades, with the "number and calculation" category having relatively more questions than the other three categories (Ochanomizu University 2004-2015).

To compare the test scores over time, the scores in each grade were standardized, after which they were multiplied by 10 and 50 added because Japanese studies on academic achievement usually set the mean at 50 and the standard deviation at 10.

Independent variables

SES. The student SES variable was based on the parents' educational levels from the 9th-grade student survey, for which "Yes" or "No" was given for questions about both parents; such as "My father has a university degree"

and "My mother has a university degree." This was because parental education was believed to have the strongest relationship with social-class-related practices such as concerted cultivation, while other aspects of social class have been found to have weaker ties (Cheadle and Amato 2012). These variables were combined and described as follows: High SES—both parents had a university degree; Middle SES—one parent had a university degree; Low SES—neither parent had a university degree; and Don't know—both questions were unanswered.[6)]

Self-learning time. In this paper, self-learning time was determined from the student answers to the question "How much time do you usually spend each week and each day studying at home?" in the 3rd, 6th, and 9th grade surveys. These answers were recorded as one of the following: No time—Almost never; Less than 60 min—About 30 min/day; About 1 hr./day, Less than 120 min—About 1.5 or 2 hrs./day; More than 150 min—About 2.5 or more hrs./day.

Control variables. In addition to the explained variables, the students' sex, settled area, and shadow education were also added as control variables. Sex was recorded by a male dummy (male = 1/female = 0) and settled area was recorded by an urban area dummy (urban area = 1/rural area = 0). Shadow education was also included in the analysis, as cram schools have often been found to have a significant effect on student academic achievement in Japan (Nabeshima 2003), and whether a student attended cram schools has been found to be related to their domestic economic/cultural environment to a certain degree. To obtain the variable for shadow education, the questionnaire asked, "Which of the following out-of-school classes do you attend? (Multiple answers allowed)," followed by four answer choices: "Have a private tutor," "Go to tutorial centers to review school lessons," "Go to tutorial centers for exam preparation," and "Take a correspondence course (i.e., distance learning)." The students who selected at least one of these options were recorded as 1, while those selecting none of these were recorded as 0, allowing for a generalization of the shadow education variable. However, as there was no variable for actual time spent in shadow education, only attendance was reflected by this variable.

Table 1 presents the means, standard deviations, minimums, and maximums for all variables.

3.3. Analyses

Because this paper was focused on capturing the dynamic aspects of the student learning attitude changes on math achievements, latent growth curve modeling was used with time-invariant and time-variant covariates (Wang and Wang 2012). This strategy assumed that the SES differed in the initial achievement ratings and that any variance in subsequent achievement growth (or decay) also varied by SES. A unique intercept (a), linear, time-dependent slope (β), and some measurement errors (ε) characterized each individual. Therefore, the level one equation used was as in Equation 1:

$$y_{it} = a_i + \beta_{it} + \varepsilon_{it} \quad (1)$$

which represented the within-individual (i) change over time (t). To incorporate the time-varying covariates that represented SES changes into the model, Equation 1 was modified to Equation 2:

Table 1. presents the means, standard deviations, minimums, and maximums for all variables (N = 1,085).

	Mean	S.D.	Min.	Max.
Time-variant variables				
3rd grade				
Math Achievement	50.00	10.00	14.58	67.67
Self-learning time				
No time	0.16	0.37	0.00	1.00
Less than 60 min	0.66	0.47	0.00	1.00
Less than 120 min	0.12	0.33	0.00	1.00
More than 150 min	0.05	0.22	0.00	1.00
Taking shadow education	0.25	0.43	0.00	1.00
6th grade				
Math Achievements	50.00	10.00	25.27	78.11
Self-learning time				
No time	0.09	0.28	0.00	1.00
Less than 60 min	0.67	0.47	0.00	1.00
Less than 120 min	0.19	0.40	0.00	1.00
More than 150 min	0.05	0.22	0.00	1.00
Taking shadow education	0.31	0.46	0.00	1.00
9th grade				
Math Achievements	50.00	10.00	19.49	66.10
Self-learning time				
No time	0.11	0.31	0.00	1.00
Less than 60 min	0.26	0.44	0.00	1.00
Less than 120 min	0.36	0.48	0.00	1.00
More than 150 min	0.27	0.45	0.00	1.00
Taking shadow education	0.70	0.46	0.00	1.00
Time-invariant variables				
SES (Parents' education)				
Low SES	0.46	0.50	0.00	1.00
Middle SES	0.22	0.42	0.00	1.00
High SES	0.25	0.43	0.00	1.00
Don't know	0.07	0.25	0.00	1.00
Sex				
Male	0.52	0.50	0.00	1.00
Region				
Urban area	0.53	0.50	0.00	1.00

(JELS)

$$y_{it} = a_i + \beta_i + \Upsilon_t w_{it} + \varepsilon_{it} \quad (2)$$

in which $\Upsilon_t w_{it}$ represented the effect of each of the time (t) variables for shadow education and self-learning time on achievements at time (t) for each ith individual. By regressing each $\Upsilon_t w_{it}$ on subsequent achievement, the effect of the time-specific transitions at multiple time points could be assessed.

The second level of the growth model allowed the random intercepts (a_i) and slopes (β_i) to be functions of the variables that differed across individuals (i) but did not change over time (t). This level represented the between-individual changes over time. The level two equations are shown as Equations 3 and 4:

$$a_i = a_0 + a_1 x_{i1} + a_2 x_{i2} + \cdots a_k x_{ik} + u_i \quad (3)$$
$$\beta_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots \beta_k x_{ik} + v_i \quad (4)$$

in which xs indicated the controls and the time-invariant SES variables. The intercepts and slopes for each achievement were directly regressed on these characteristics to assess potential group differences in the means for the growth factors. In Equations 3 and 4, (k) was the number of variables, while (u) and (v) were the mean disturbance terms.

In this analytic model, the potential confounding factors included error terms. For example, even for students who had much higher self-learning times associated with their higher academic achievement, there were still several possibilities that there was "unobserved heterogeneity," such as innate intelligence or personalities that reflected self-learning time, with such factors expected to enhance the academic achievement derived from the self-learning time. However, as there were no data on innate intelligence or personalities gathered in this study, the effects of this unobserved heterogeneity were included as error terms.

Models were estimated using Mplus, Version 7.31 (Muthén and Muthén 2012). The model fit was evaluated using the maximum likelihood ratio test statistic (chi-square), which, if significant, indicated a poor fit. Because models with sample sizes over 200 are frequently significant, three supplemental model fit measures were used; the root mean square error of approximation (RMSEA), the Tucker Lewis Index (TLI), and the Comparative Fit Index (CFI). Convention dictates an RMSEA below .05 and a TLI and CFI close to 1.0 (Bollen and Curran 2005). All statistical tests referenced in the text were two-tailed.

4. RESULTS

4.1. SES Effects: Group Differences

The first research question in this paper was focused on whether the math achievement differences were associated with SES differences. Model 1 in Table 2 presents the results for math achievement based on Equations 3 and 4 in the abovementioned growth model.

First, the differences in the math achievement trajectory between the SES groups are described. Model 1 shows the SES effect. Significant variables existed in the intercept (α) estimates for the middle SES ($p < .01$) and high SES ($p < .001$) compared to the low SES, which indicated that students from high/middle SES had a higher initial status than those from low SES. In addition, the significant variable in the slope (β) estimate for high SES ($p < .01$) indicated that high-SES students had higher math achievements than low-SES students.

Table 2. Results of Math Achievement with Growth Curve Models

N			1085	
Chi-Squar			12.461	
Degree of Freedom			6	
Probability			0.052	
	Intercept (α)		*Slope* (β)	
Level 2	*Estimate*	*S.E.*	*Estimate*	*S.E.*
Intercept	48.335	0.584 ***	0.371	0.291
SES				
Low SES (Fixed at 0)	0.000	-	0.000	-
Middle SES	2.039	0.752 **	0.319	0.375
High SES	4.640	0.735 ***	0.983	0.367 **
Don't know	-1.104	1.191	0.466	0.594
Male	-0.539	0.579	0.043	0.289
Urban area	0.787	0.595	-1.383	0.297 ***
Model Fit Infomartion				
RMSEA			0.032	
CFI			0.995	
TLI			0.984	

Note: *$p<.05$ **$p<.01$ ***$p<.001$ (two-tailed tests)
(JELS)

Therefore, for the first research question, the analysis clarified that as early as 3rd grade, children showed heterogeneity in the math achievement trajectory in Japan and that high SES students achieved higher scores in each school stage.

4.2. Interactive Effects of SES and Time-Varying Self-Learning Time Attitudes: Individual Changes

The second research question focused on whether math achievements improved with an increase in self-learning time.

The model total shown in Table 3, which used additional time-varying measures for the student self-learning time changes in the latent growth models, shows the results for math achievements based on Equations 1 to 4.

In addition, the effect of the invariant variables in the model is also shown. The significant variables in the intercept (α) estimates were middle SES and high SES, indicating that the middle- and high-SES students had a higher initial status compared to the low-SES students. The effect of high SES on slope (β) had no significance compared to Table 3, which may have indicated that students could improve academic achievement through effort.

The variant variables in the overall model were also examined. The impact of self-learning time on math achievement was observed to increase as the students' progressed to the higher grades, though there was no significant difference for 3rd-grade students. In 6th grade, students who had 60 to 120 minutes of self-learning time a day scored 2.698 more points ($p <$

.001), and those who had more than 150 minutes of self-learning time a day scored 4.637 more points ($p < .01$). In 9th grade, the 60-120-minute group scored 3.451 more points ($p < .001$), and the 150 or more-minute group scored 4.238 more points ($p < .001$). In other words, the more self-learning time the students had, the greater the math achievement they achieved, thereby verifying the second research question as to whether math achievement improved in correlation with self-learning time.

The third research question focused on whether student self-learning effort equally effected achievement regardless of SES. To examine this question, the students were categorized into high- and low-SES groups, as shown in Table 3. A comparison of the two models found that the self-learning time had a positive correlation with math achievement for the 6th- and 9th-grade students. However, there were three significant differences between the high- and low-SES models. First, the gap in the intercept of means indicated that high-SES students had an initial math achievement advantage. Second, the linear slope of means had a significant variable in the high-SES model at a 1% level, which was not found in the low-SES model. In other words, the self-learning time of the low-SES students did not seem to be related to their math achievement; however, the math score for high-SES students, as well as for the total model, decreased as less time was spent on self-learning. Third, there was a strongly significant difference between the estimates for self-learning time in each SES model. Table 3 shows the self-learning time estimates for the three groups: less than 60 minutes, less than 120 minutes, and more than 150 minutes. In 9th grade, the values for these three groups were 5.861, 7.125, and 8.646 for the high-SES students, but only 2.264, 2.719, and 3.588 for the low-SES students, indicating that self-learning had a lower effect on low-SES student achievement.[7)]

These results indicated that high-SES students had an initial advantage in math achievement and gained more of an effect from their learning efforts than low-SES students, who had a lower initial status and tended to have less achievement gains even if they had spent considerably more time on self-learning.[8)]

5. DISCUSSION

Three main findings emerged from the analysis. First, inequality in academic achievement by SES was found to be significant at the initial status (in this paper, 3rd graders). Moreover, it was clarified through statistical analysis that compared to low SES children, those from a high SES improved their academic achievement as they grew older. Akabayashi *et al.* (2016) conducted a short-term panel data analysis and clarified that inequality in academic achievement by household income existed from the lower level of elementary school. Further, Yamada (2014), who analyzed NSAPLC2013, found that inequality in academic achievement by household income and parents' educational backgrounds was evident in both 6th and 9th graders. Therefore, while previous research had found academic achievement inequality based on cross-sectional data and short-term panel data, this paper found this evidence from the study of a long-term trajectory, which clearly indicated that the academic achievement inequality was formulated at an early stage, and that the gap widened as the child grew up.

Second, this paper clarified that self-learning

Table 3. Growth Model for Math Achievement and Time-Varying Learning Changes

	Total	Low SES	High SES
N	1085	502	268
Chi-Squar	66.744	40.579	29.395
Degree of Freedom	30	27	27
Probability	0.000	0.045	0.342
	Estimate	Estimate	Estimate
Means			
Intercept	47.694 ***	48.260 ***	50.958 ***
	(0.813)	(1.092)	(1.881)
Slope of intercept	−1.670 **	−1.164	−3.165 **
	(0.535)	(0.778)	(1.215)
Level 2			
Predicting Intercept (*a*)			
SES (Parents' education)			
Low SES (Fixed at 0)	0.000	−	−
Middle SES	2.012 **	−	−
	(0.751)		
High SES	4.506 ***	−	−
	(0.738)		
Don't know	−1.198	−	−
	(1.190)		
Male	−0.519	−0.717	−1.099
	(0.579)	(0.829)	(1.148)
Urban area	0.688	0.025	2.612
	(0.606)	(0.868)	(1.226)
Predicting Linear Slope (β)			
SES (Parents' education)			
Low SES (Fixed at 0)	0.000	−	−
Middle SES	0.137	−	−
	(0.372)		
High SES	0.649	−	−
	(0.369)		
Don't know	0.584	−	−
	(0.587)		
Male	0.202	0.126	0.573
	(0.286)	(0.436)	(0.545)
Urban area	−1.273 ***	−1.601 **	−1.148
	(0.313)	(0.482)	(0.598)

(continued)

Table 3.（continued）

	Total	Low SES	High SES
	Estimate	Estimate	Estimate
Level 1			
Self-learning time at 3rd grade			
No time（Fixed at 0）	0.000	0.000	0.000
Less than 60 min	0.437	0.160	0.738
	(0.640)	(0.914)	(1.502)
Less than 120 min	0.726	0.930	−0.965
	(0.888)	(1.307)	(1.887)
More than 150 min	0.824	1.806	−0.150
	(1.172)	(1.763)	(2.353)
Taking shadow education at 3rd grade	1.308	1.170	1.575
	(0.550)	(0.852)	(1.053)
Self-learning time at 6th grade			
No time（Fixed at 0）	0.000	0.000	0.000
Less than 60 min	2.178 ***	1.487 *	4.780 ***
	(0.491)	(0.699)	(1.127)
Less than 120 min	2.698 ***	2.886 **	5.342 ***
	(0.656)	(0.944)	(1.367)
More than 150 min	4.637 ***	5.874 ***	8.181 **
	(1.068)	(1.479)	(2.714)
Taking shadow education at 6th grade	1.594 **	0.658	2.184 *
	(0.480)	(0.755)	(0.916)
Self-learning time at 9th grade			
No time（Fixed at 0）	0.000	0.000	0.000
Less than 60 min	2.417 **	2.264	5.861 ***
	(0.783)	(1.212)	(1.619)
Less than 120 min	3.451 ***	2.719 *	7.125 ***
	(0.786)	(1.198)	(1.667)
More than 150 min	4.238 ***	3.588 **	8.646 ***
	(0.826)	(1.287)	(1.659)
Taking shadow education at 9th grade	2.511 ***	2.003 *	2.655 *
	(0.521)	(0.775)	(1.139)
Model Fit Infomartion			
RMSEA	0.034	0.032	0.018
CFI	0.972	0.972	0.992
TLI	0.950	0.954	0.986

Note: *$p<.05$ **$p<.01$ ***$p<.001$（two-tailed tests）

Note 2: Standard Error in Parentheses

time as a measure of effort affected academic achievement. Previous studies found a covalence between self-learning time and academic achievement in cross-sectional data (Mimizuka *et al*. 2002; Mimizuka and Nakanishi 2014), which was confirmed from the panel data analyses in this study, in which it was found that there was a within subject correlation between academic achievement improvements and learning commitment. However, the initial academic achievement inequality was not found to change even if learning time was controlled; therefore, it could be concluded that the effort effect in overcoming academic achievement inequality during school years was limited.

Third, this paper clarified that the effects of learning time differed by SES level. As Mimizuka and Nakanishi (2014) indicated using cross-sectional data, even the hardest-working children from the lowest SES attained lower academic achievement than the least hard-working children from the highest SES. It was unclear whether the effect of SES was so great that the inequality could not be overcome by self-learning or whether the effect of self-learning differed by SES level. It was found in this paper that learning time had a positive effect on low SES children who initially had low academic achievement; however, compared to high SES children, learning time had only a relatively negative effect. Therefore, low SES children were found to experience inequality on two levels: the initial level, and as they rose through the grades. From these results, it can be concluded that Japanese meritocracy is a myth, as individual effort was not found to significantly affect academic achievement inequalities.

Ability and effort result in individual educational achievements in a meritocratic society (Young 1958). The belief behind Japanese meritocracy is that effort reduces any inequalities resulting from SES (Kariya 2000, 2013; Takeuchi 1995). Since the 2000s, however, cross-sectional research on academic achievement inequality in Japan has proven that Japanese meritocracy is a myth. Unlike previous research, this paper used panel data to assess three key research questions: (1) whether differences in student achievements were associated with differences in SES, (2) whether math achievement improved with greater self-learning time, (3) and whether student self-learning efforts affected achievement equally regardless of SES. It was found that an academic achievement gap already existed in 3rd grade, which was difficult to overcome through individual effort.

In recent years, several researchers have stated that school education could not be expected to close the inequality gap between children but that a focus on preschool education could possibly be more effective (Heckman 2006; Esping-Andersen 2006). Preschool education has been recently emphasized in Japan (Akabayashi *et al.*) ; however, it is still unclear whether the effect lasts as the current validation of this effect was only investigated using one-point surveys or retrospective data. Therefore, a survey on Japanese preschool education that includes panel data is necessary before any firm conclusions can be made.

NOTES

1) Japanese educational culture has tended to emphasize the importance of effort. Further, during this period, there was finally an opportunity to analyze academic achievement data. Following Kariya (2000), a method for measuring effort was established and spread in Japan.

2) Likewise, for language ability, it was found that if children from the lowest SES studied hard, they did not perform as well as the children from the highest SES who had not studied at all.
3) For example, on March 30, 2014, several mass media sources including *Asahi Newspaper* reported this fact.
4) For example, Tobishima (2012) analyzed the gap in the amount of self-learning time as a factor of academic achievement inequality.
5) As mentioned, there was a possibility that there were deviations in student scores between schools; however, the survey in this paper was conducted in schools and with students from similar social classes who tended to live in the same area. Because of this, the reported standard error in the results table may be too small.
   However, according to Kawaguchi (2009) and Tarumi (2014), the ICC (Intra-class Correlation Coefficient) for Japanese compulsory education (elementary and junior high school) was lower than in other countries, indicating there was little inequality between schools. In fact, the ICC for the achievement score of Wave 1 (3rd grade students) was calculated and the value was as little as 0.08 (about 8%) ; small enough that the effect on the standard error was assumed to be also small.
6) Both parents' educational attainments were combined to avoid multicollinearity.
7) To better compare the coefficients in Table 3, standard coefficients were calculated. As a result, in 9th grade, the standard coefficients for the learning time values were 0.293, 0.362, and 0.464 for the high-SES student and only 0.098, 0.133, and 0.158 for the low-SES students. In addition, the effects of learning time were confirmed as different between the SES groups using a t-test.
8) Though it was only a control variable, shadow education appeared to have a different effect on the SES groups, with a significant positive effect only being found for the high-SES students in 6th grade. The impact of considering shadow education on math achievement was slightly stronger for the high-SES students (estimates = 2.655) than for the low-SES students (estimates = 2.003) in 9th grade.

ACKOWLEDGEMENTS: This work was supported by JSPS KAKENHI [Grant-in-Aid for Scientific Research (B) Number 16330164, 19330185, 21330190 (Research Representative: Hiroaki Mimizuka), 16300230 18300245 (Research Representative: Katsuko Makino)], Ochanomizu University COE program "Studies of Human-Development from Birth to Death," and Ochanomizu University Global COE program "Science of Human Development for Restructuring the 'Gap-Widening Society'." The authors would like to thank Dr. Kentaro Nakamura (The Japan Foundation) for analysis and Dr. Wataru Hanai (Assistant Professor of National Center for University Entrance Examinations), Ms. Ayaka Yunoki, Ms. Sayaka Fukuda (Graduate School of Kyushu University) and Enago (www.enago.jp) for the English language review.

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