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Trends in Socioeconomic Achievement Gap in Japan: Implications for Educational Inequality

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ABSTRACT

Japan underwent rapid economic expansion as well as economic development after the Second World War. However, since the 1990s, the country faced long recession and the increase in social and economic inequality. During such time, education policy also shifted toward favoring differentiated curriculum and choice-based system. The purpose of this paper is to reveal how the relationship between family background and students' academic achievement has changed over time in Japan in the recent decade. Using the Third International Mathematics and Science Study (TIMSS), we applied hierarchical linear modeling and examined the proportion of between-school variance in academic achievement as well as the effect of family background on achievement over time. As a result, we found evidence on increase educational inequality in Japan during this decade. This paper suggests that changes in educational policy, such as ensuring equal opportunity and providing adequate resources to schools may be necessary to reduce such growing educational inequality in Japan.

BACKGROUND

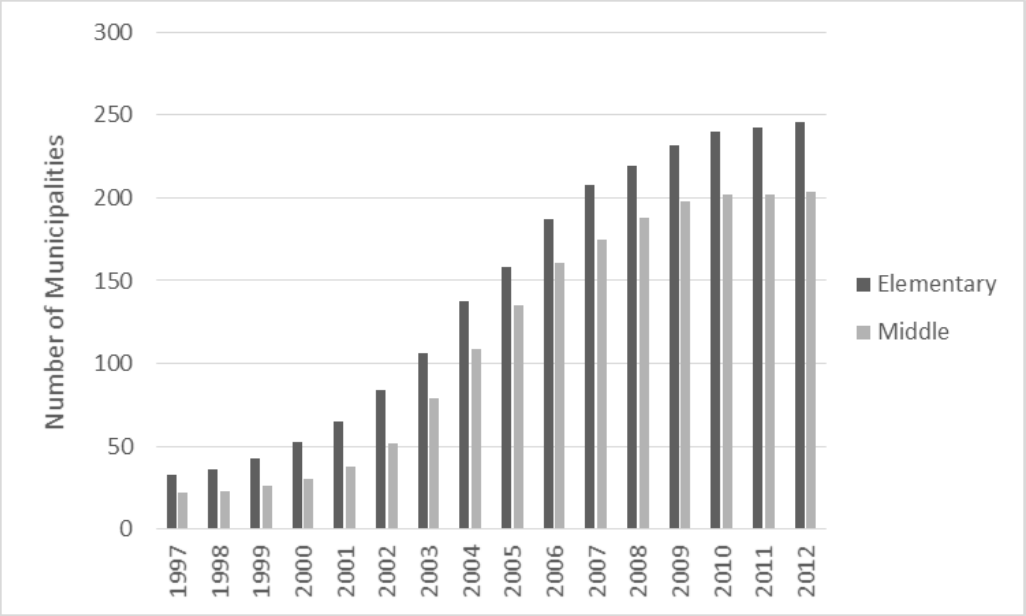
Japan underwent major economic development after the Second World War, with an average GDP growth of 10% during the 1960s and subsequent higher growth in GDP until the 1980s. During the postwar decades, Japan also experienced a dramatic educational expansion at all school levels. High school enrollment rate increased from 51.5% in 1955 to over 90% in the 1970s, and tertiary enrollment rate increased from around 50% in the 1980s to over 70% in 2000 (MEXT 2015).

More recently, since the late 1990s, Japan experienced a radical neoliberal restructuring of its social and economic systems due to changes in its political leadership. Amid such transformation, the country faced a long recession and rise in unemployment rate (MIC 2015). Moreover, a rising Gini coefficient over the period suggested growing income inequality (MHLW 2008). In terms of people's perceptions, recent survey showed that young Japanese adults identified themselves as being in a relatively low class within the whole Japanese society (Shirahase 2010).

These social and economic changes corresponded with changes in educational policy over time. The education system in Japan was once known for its egalitarian characteristics that provided equal opportunities for all students (Cummings 1982). In 1987, the U.S. Department of Education introduced the success of Japanese education in a book titled *Japanese Education Today* (Leestma & Dorfman 1987) to provide lessons for the United States. However, neoliberal and market-oriented educational reform in Japan since the late 1990s introduced school choice, ability grouping, and accountability in the mainstream school system, which seemed to have caused the breakdown of postwar egalitarianism in Japanese education (Fujita 1997). For example, Figure 1 shows that the number of municipalities introducing school choice in Japan dramatically

increased between 1997 and 2012, both for elementary schools and middle schools.

Figure 1. The Number of Municipalities that Introduced School Choice by Year



Source: MEXT (Ministry of Education, Japan), 2013

The Japanese government also changed the national curriculum standards towards more *yutori* (relaxation or latitude) over the past decades, aiming to address problem-solving skills and individuality as they reduced curriculum contents and school days. However, since the revision of national curriculum guidelines in 2008, there has been a quick return to a more emphasis on academically-focused curriculum.

Summarizing the recent key arguments on educational reforms in Japan, Takayama (2007) described the Japanese education system in the late 1990s to the 2000s as the collapse in "educational pipeline system," and indicated a widening socioeconomic gap in academic achievement and learning motivation based on previous studies (Honda 2005; Kariya 2001; Kariya et al. 2002; Yamada 2004).

Under such circumstances, a question arises as to what consequences result from these socioeconomic and educational changes with respect to social stratification and educational inequality. This paper addresses this question by examining whether and how the socioeconomic gap in academic achievement in Japan has changed over time during the past decade. To this end, we examined the trends in between-school differences in student achievement and the relationship between socioeconomic background and student achievement. We used data from the Trends in International Mathematics and Science Study (TIMSS) and focused on the most recent five cohorts (1995, 1999, 2003, 2007, and 2011) of eighth-grade students in Japan.

PREVIOUS STUDIES

There has been an increasing number of Japanese studies that revealed the relationship between family background (SES) and academic achievement. For example, Kariya and his colleagues (2002) compared the district achievement data in Western areas of Japan between 1989 and 2001 and showed that academic achievement of elementary and middle school students has not only declined but also widened its gap over the years. The authors showed that family background and use of private supplementary tutoring are among the possible reasons for such inequality in achievement. They also suggested that changes in the national curriculum standards toward *yutori* since 1998 caused wealthy families to rely on private tutoring, which consequently increased socioeconomic gap in achievement.

Mimizuka and his colleagues (2008) collected and analyzed data from students, parents, and school principals from three major areas in Japan (metropolitan area, suburban area, and rural area) from 2007 to 2008. Sponsored by the Ministry of

Education in Japan, their study analyzed whether parental education, occupation, household income, and expenditures on out-of-school tutoring had any influences on students' academic achievement. According to their analysis, they found substantial socioeconomic gap in academic achievement.

Although these studies offer important evidence on the relationship between SES and academic achievement in recent Japanese society, their findings are somewhat limited in that these studies relied on data that are not nationally representative, precluding generalization for a much larger population. In addition, neither of these studies documented the trend in the relationship between SES and academic achievement by including both the period before and after 2002, a year that introduced significant deduction in curriculum time. To better understand the trend in educational inequality over time in Japan, we should analyze nationally representative data with repeated cross-sectional design including cohorts from the most recent decade.

To summarize, this study seeks to offer empirical evidence on the growing educational inequality in Japan, as it seeks to understand the consequences of socioeconomic and educational changes in recent Japanese society.

METHODOLOGY

Data and Sample

In this study, we seek to examine the trends in between-school differences in student achievement and the relationship between socioeconomic background and student achievement. To this end, we used data from the Trends in International Mathematics and Science Study (TIMSS) and focused on the most recent five cohorts (1995, 1999, 2003, 2007, and 2011) of eighth grade students in Japan. TIMSS is

conducted every four years and measures student performance in mathematics and science among fourth and eighth grade students across societies [1]. As nationally-representative student achievement data is hardly available for public use in Japan, TIMSS is an important source of achievement data that provides a wealth of information on student and school characteristics. We focused on eighth graders because we regard the educational stage as crucial for observing educational inequality, located toward the end of compulsory education period. In addition, the assessment was not conducted for fourth graders in 1999. We focused on mathematics because some previous studies suggest that socioeconomic differences in academic achievement are stronger for math than for science (e.g., Sudo 2013). The number of samples was approximately 150 for schools and 4500 for students for each year.

Main Variable of Interest

Math achievement. TIMSS measures mathematics achievement by five plausible values with a scale having an international mean of 500 and an international standard deviation of 100. The five plausible values were simultaneously used to generate correct means and standard errors.

Socioeconomic background. TIMSS provides information that can be used as a proxy for family socioeconomic status (SES), including (1) father's education, (2) mother's education, (3) number of books in the home, and (4) home educational resources. These four items were integrated using principal component analysis to

[1] TIMSS is intended to measure whether students' academic learning ability is in line with the school curriculum, while PISA (Programme for International Student Assessment, targeting 15-year-old students) is intended to measure students' application of their academic knowledge and skills to real life.

construct a proxy for a family's socioeconomic status (SES). By aggregating the student-level SES measure at each school, school-mean SES measure was also created. Note that since data on parental education in Japan in 1999 are missing, for the multivariate trend analysis, we only used the number of books and the index of home educational resources to construct a proxy for SES[2]. The number of books is categorized as follows: (1) 1 = 0-10, (2) 2 = 11-25, (3) 3 = 26-100, (4) 4 = 101-200, and (5) 5 = more than 200 books. As for an index of home educational resources, a total of 8 items (computer, desk, internet connection, calculator, dictionary, telescope, terrestrial globe, and picture book) were summed up[3]. Missing values were deleted for the multivariate analysis, although supplementary analysis showed that the results were consistent when multiple imputation method was applied.

Analytic Strategies

To examine the trends in the relationship between SES and student achievement, we used a series of Hierarchical Linear Models (HLM). HLM was chosen over ordinary least squares (OLS) regression to address the nested nature of TIMSS data (Raudenbush & Bryk 2002). We first estimated the fully unconditional model for Japan, which contained only the dependent variable (math achievement) with no covariates. From this model, we obtained the proportion of between-school level variance out of total variance. The basic model was specified for each cohort year as follows:

[2] We also conducted analysis with SES including fathers' and mothers' education for 2003-2011, years which these parental education variables are available. The results were largely consistent with the results presented in this paper.

[3] The variable Internet was not available for 1999.

Level 1 model:

$$(\text{Math achievement})_{ij} = b_{0j} + b_{1j}\,(\text{SES})_{ij} + r_{ij}\ ,$$

where *j* refers to the school and *i* refers to the students sampled from school *j*; b_{0j} is the average math achievement in school *j*; b_{1j} is the effect of family SES on math achievement in school *j*; and $r_{1j} \sim N\ (0, \sigma^2)$ is the variability of students within school *j*. The SES variables was centered on the grand mean.

Level 2 model:

$$b_{0j} = \gamma_{00} + \mu_{0j}\ ,$$

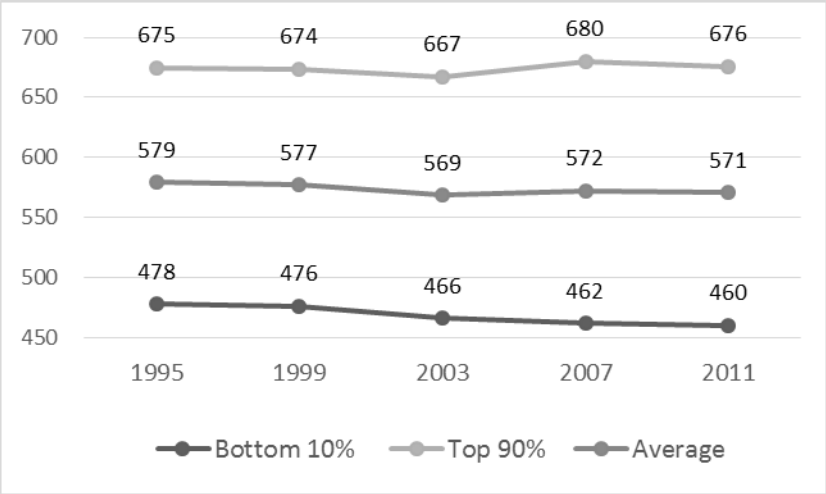
where γ_{00} is the grand mean of math achievement and $\mu_{0j} \sim N\ (0, \tau_{00})$ is the error term with τ representing the variance between schools.

RESULTS

Descriptive Results

We first examined the trends in mathematics achievement gap between 1995 and 2011. We used all five plausible values for this descriptive analysis. Between 1999 and 2003, there was a statistically significant drop in the average math achievement. Figure 2 shows a visual representation for this result. When we shed light on the top 10% and the bottom 10% of the distributions, its disparity seemed to have widened to some degree over the years.

Figure 2. Descriptive Statistics for Mathematics Achievement



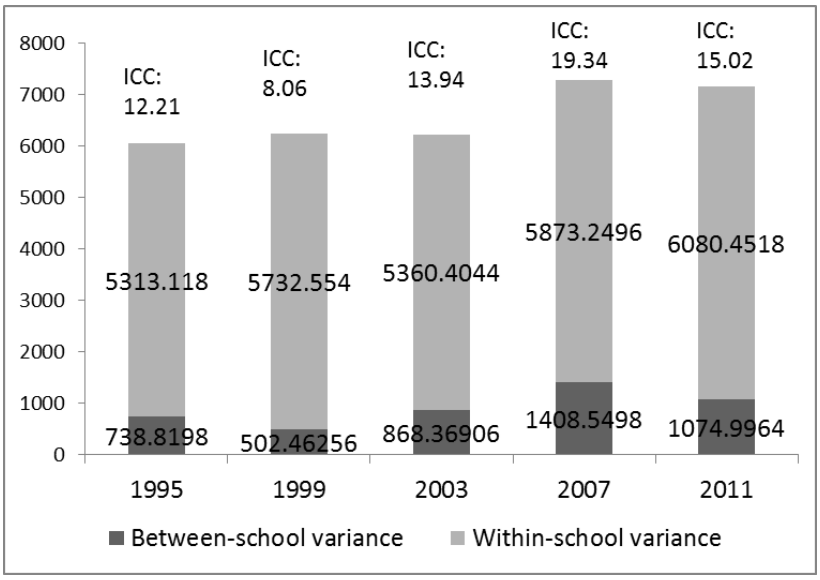
Variance among Schools

Table 1 shows the between-school variance in math achievement from 1995 to 2011. The results showed an increase in the proportion of between-school variance over the past decade. In 1999, approximately 8% of the variance in math achievement was attributable to the school level. In 2007, the corresponding proportion was approximately 19%. Figure 3 is the visual presentation of the result same as in Table 1.

Table 1. Proportion of Variance between Schools in Mathematics Achievement, 1995-2011

	1995	1999	2003	2007	2011
Between-school variance	738.82	502.46	868.37	1408.55	1075.00
Within-school variance	5313.12	5732.55	5360.40	5873.25	6080.45
Total variance	6051.94	6235.02	6228.77	7281.80	7155.45
ICC	**12.21**	**8.06**	**13.94**	**19.34**	**15.02**
Student N	5141	4745	4856	4312	4414
School N	151	140	146	146	138

Figure 3. Proportion of Variance between Schools in Mathematics Achievement, 1995-2011



Trends in the Relationship between SES and Student Achievement

Table 2 shows the trends in the relationship between socioeconomic background and math performance in Japan. We excluded year 1995 as there is no measures for SES for this year. The results showed that the magnitude of the impact of SES has increased over the years in Japan. For school-mean SES, a unit increase was associated with 31 score point increase in students' math achievement in 1999. In 2007, it has increased to 39 points, suggesting that between-school difference has widened over the period of 1999 and 2007. After 2007, the coefficient for school-mean SES has slightly dropped in 2011, which suggests a possible influence of recent counter-*yutori* reform movements. For student SES within each schools, a unit increase in student SES was associated with 17 score point increase in math achievement in 1999. Thereafter, it was associated with 24 score point increase in math achievement in 2003, 27 score point increase in 2007, and 28 score point increase in 2011. These trends suggest that the

impact of within-school SES on student achievement has grown over the recent decade in Japan, suggesting a growing educational inequality among students and their families.

Table 2. Trends in the Relationship between Socioeconomic Background and Math Performance, 1999-2011

	1999		2003		2007		2011	
Fixed Effect	Coef.		Coef.		Coef.		Coef.	
Intercept	576.97	***	573.28	***	572.40	***	573.64	***
School-mean SES	31.29	***	38.80	***	39.60	***	37.51	***
Urbanicity	1.91		0.84		1.73		7.69	
School environment	-1.55		5.92	***	9.47	***	4.04	
School resources	-0.19		3.67	*	-2.30		0.43	
Yearly lesson hour	1.25		1.80		0.28		6.63	*
Student SES	17.01	***	24.60	***	27.29	***	28.53	***
Female	-3.39		-2.67		-1.54		-5.26	+
Private school	50.59	***	-39.41	*	15.62		-13.93	
Private school*School-mean SES	19.38		111.55	***	52.95		54.87	*
Random Effect								
Uj	11.98		12.44		14.06		16.82	
Rj	72.74		68.53		69.27		71.44	

Table 3 examined the similar model by adding year as dummy variables and interaction terms with SES (both at student and school levels). It showed that the effects of school-SES as well as student-SES were indeed larger compared to the base year of 1999.

Table 3. Trends in the Relationship between Socioeconomic Background and Math Performance (Year added as dummy) , 1999-2011

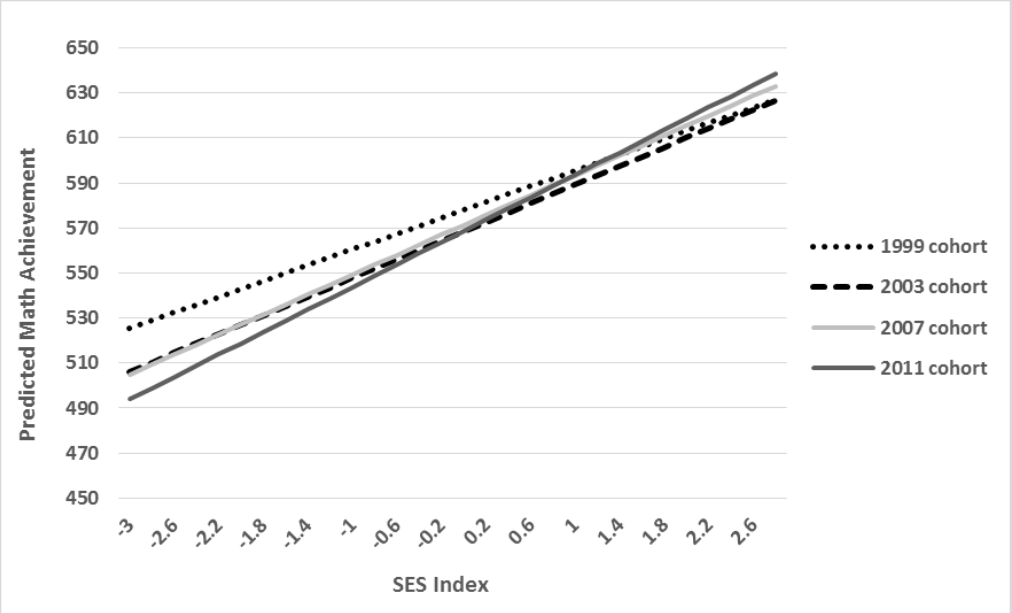
	Model 1		Model 2		Model 3	
School-mean SES	48.47	**	40.39	**	26.92	**
Private School			57.38	**	56.52	**
Student SES	21.08	**	21.08	**	17.38	**
Year 2003	-11.17	**	-11.40	**	-11.27	**
Year 2007	-8.16	**	-9.31	**	-9.06	**
Year 2011	-11.14	**	-12.90	**	-12.65	**
03*School-mean SES					12.40	*
07*School-mean SES					23.56	**
11*School-mean SES					14.26	*
03*Student SES					3.33	*
07*Student SES					4.49	**
11*Student SES					7.52	**
Intercept	580.37	**	577.43	**	577.57	**
School-level variance	392.04		177.69		176.79	
Student-level variance	5335.11		5336.04		5324.42	

** <.001, * <.05

Female and urbanicity are also controlled within each model.

To facilitate a more meaningful interpretation, Figure 4 graphically depicted the trend in the relationship between socioeconomic background and student achievement in Japan over the years. It shows that the absolute level of mathematics achievement was the highest in 1999 and subsequently declined, and that the slope for the effect of SES on achievement became steeper from 1999 to 2011.

Figure 4. Trends in the Relationship between Socioeconomic Background and Math Performance



DISCUSSION

Despite educational expansion in the postwar Japan and the role of education to support social mobility, concern on growing educational inequality is prevalent in contemporary Japanese society. To offer empirical evidence on the growing educational inequality in Japan, this study assessed the trends in the relationship between socioeconomic background and student achievement in Japan, using TIMSS data for eighth-grade students. The data showed increasing variance in student achievement among schools, as well as the increasing influence on socioeconomic background on student achievement. The evidence suggests that the achievement gap between students from advantageous and disadvantageous home backgrounds has indeed grown over time.

While this study does not examine the causal link between specific social and

educational reforms and the widening socioeconomic gap in student achievement, we speculate that various social and educational transformations in Japan since the late 1990s, including the neoliberal restructuring of social and economic systems, market-oriented educational reform in Japan, and reduced instructional hours and curricular contents, may be responsible for growing educational inequality that we found in our analysis. Based on the above empirical result, this paper suggests that changes in educational policy, such as ensuring equal opportunity and providing adequate resources to schools, may be necessary to reduce such growing educational inequality in Japan.

References

Cummings, William K. 1982. “The egalitarian transformation of postwar Japanese education.” *Comparative Education Review*, 26(1), 16-35.

Fujita, Hidenori. 1997. *Kyouiku kaikaku: Kyousei jidai no gakkou zukuri* [Education reform: Building schools in an era of coexistence]. Tokyo: Iwanami shoten.

Honda, Yuki. 2005. *Wakamono to shigoto: Gakko keiyu no shushoku wo koete* [Young adults and jobs: Beyond job placement via school]. Tokyo: University of Tokyo Press.]

Kariya, Takehiko. 2001. *Kaisoka nihon to kyoiku kiki: Fubyodo saiseisan kara kyoiku kakusa shakai he* [Japan’s class disparity and crisis of education]. Tokyo: Yushindo kobunsha.

Kariya, Takehiko, Shimizu, Mutsumi, Shimizu, Koukichi, and Morota, Yuko. 2002. *Chosa hokoku gakuryoku tekia no jittai* [Study report: Reality of academic decline]. Tokyo: Iwanami shoten.

Leestma, Robert. and Dorfman, Cynthia. H. 1987. *Japanese Education Today*.

MEXT (Japanese Ministry of Education, Culture, Sports, Science and Technology). 2013. *Shochu gakko ni okeru gakko sentakusei no jisshi jokyo nit suite* [Current state of introduction of school choice among elementary and middle schools]. http://www.mext.go.jp/component/a_menu/education/detail/__icsFiles/afieldfile/2013/09/18/1288472_01.pdf (Retrieved 3/6/2016).

MEXT (Japanese Ministry of Education, Culture, Sports, Science and Technology). 2015. *Gakko Kihon Chosa* [School basic survey]. http://www.mext.go.jp/b_menu/toukei/chousa01/kihon/1267995.htm (Retrieved 3/6/2016).

MHLO (Japanese Ministry of Health, Labour and Welfare). 2008. *Shotoku Saibunpai Chosa Houkokusho* [Report on income redistribution Survey]. http://www.mhlw.go.jp/stf/houdou/2r9852000000nmrn.html (Retrieved 3/6/2016).

MIC (Japanese Ministry of International Affairs and Communications). 2015. *Roudouryoku Chousa* [Labor force survey]. http://www.stat.go.jp/data/roudou/longtime/03roudou.htm (Retrieved 3/6/2016).

Mimizuka, Hiroaki. 2008. “Chosa kenkyu no gaiyo” [Overview of the research study] in

kyoiku kakusa no hassei, kaisho ni kansuru chosa kenkyu hokokusho [Research report on the generation and resolution of educational inequality]. Benesse Educational Research and Development Institute.

Raudenbush, Stephen W., & Bryk, Anthony S. 2002. Hierarchical Linear Models: Applications and Data Analysis Methods: Sage Publications, Inc.

Shirahase, Sawako. 2010. "Japan as a stratified society: With a focus on class identification." *Social Science Japan Journal*, 13(1), 31-52.

Sudo, Kosuke. 2013. *Gakko no kyoiku kouka to kaiso: Chugakusei no risukei gakuryoku no keiryo bunseki* [The effects of school education and social class]. Tokyo: Toyokan.

Takayama, Keita. 2007. "A Nation at Risk Crosses the Pacific: Transnational Borrowing of the U.S. Crisis Discourse in the Debate on Education Reform in Japan." *Comparative Education Review*, 51(4), 423-446.

Yamada, Masahiro. 2004. *Kibo kakusa shakai* [Aspiration divided society]. Tokyo: Chikumashobo.