Tracking Effect on Tenth Grade Students’ Self-learning Hours in Japan

Ryoji Matsuoka
Tohoku University

Abstract

A number of tracking studies have revealed that inequities in schools’ structures and practices perpetuate societal inequities by negatively affecting the quality of education experienced by certain groups of students. However, how the structure of the school system influences students’ behavior has not been well studied. To investigate whether the tracking structure shapes high school students’ self-learning hours, a multilevel ordinal regression analysis was carried out with a nationally representative Japanese dataset from the Programme for International Student Assessment (PISA) 2006 conducted by the Organisation for Economic Co-operation and Development (OECD). Findings of this study show that one’s tracking location represented as school rank, school socioeconomic composition and curriculum tracking (general/vocational education) shape how long students study mathematics by themselves. Also, all student-level variables including students’ socioeconomic status and academic disposition affect their practice of self-studying, while other variables are held constant. These results highlight the importance of understanding how one’s effort is structured not only by students’ background but also by the school system; how the formal education is organized facilitates socioeconomically advantaged students to study longer by themselves outside of any instructional lessons, intensifying the inequality of effort.

Keywords and Phrases: Tracking, inequality, effort, PISA, Japan

1 Introduction: Tracking and self-learning

There have been a number of tracking studies that reveal differences of quality and quantity of regular lessons between tracks. However, as Carbonaro (2005) argues, previous tracking studies mainly investigate mechanisms within schools that enhance or limit students’ access to quality curriculum and teaching. He suggests that sociologists in education heavily focus on “the importance of social structure” (27), such as curriculum tracking that provides learning opportunities differently across tracks, but generally do not pay sufficient attention to “the importance of human agency in shaping students’ outcomes” (27). Carbonaro (2005) therefore contends that “few studies have successfully accounted for the role that both structure and agency play in determining students’ outcomes” (28). His study using the NELS:88 data set revealed that higher track students exerted more effort than their lower track counterparts, and these track-related differences in effort partially explained between-track differences in students’ learning outcomes.

“A Study of Study Hours” by Kariya (2000b) could be considered as one of the few studies to investigate tracking effects on “human agency”; he argues that although the individual’s self-learning
time can be used as a sociological index to show individual effort, there had been no previous studies that had assessed the relationship between students’ family background and their learning effort. Kariya’s study on students’ self-learning hours outside of their formal schooling reveal considerable differences in the length of self-learning hours (i.e., the index of effort) among students, depending on one’s family background and high school ranking. Moreover, these differences among schools became greater between 1979 and 1997 (Kariya 2000a; 2000b; Kariya and Rosenbaum 2003). Other than Kariya’s study (2000b), there are a few studies on students’ study habits or effort; differences among sixth graders in the amount of student effort due to socioeconomic status were reported (Kaneko 2004; Otawa 2008) and similar differences were found among middle school students (Origuchi 2008). Additionally, Aramaki (2002) finds that father’s education and high school rank shape high school seniors’ learning hours.

These studies uncover tracking effects on students’ learning behavior. However, their models are best considered as preliminary. For example, Kariya (2000b) includes only father’s job, mother’s educational background, gender, and four broad categories defining high school academic rank. To investigate how long students study under the influence of the tracking system, it is important to control if students take additional instructional lessons in addition to regular lessons in high school, as taking these extra learning opportunities likely shapes the length of the self-studying time (e.g., students need to work on homework assigned by instructors of these extra lessons). In Kariya’s study, taking additional lessons is likely to be correlated to the included variables, and the results may be overestimated. In addition, all of the studies on students’ learning hours use regional data; their findings cannot be generalized. Moreover, in the previous studies, only single-level analyses were carried out, even though characteristics of students in the same school are likely to be similar, leading to have spurious significant results (e.g., Hox, 2010). To overcome these issues, this study is intended to reveal tracking effects on students’ self-learning hours outside of any type of instructional lessons with a nationally representative data consisted of tenth grade students in Japan with detailed tracking locations and multilevel regression techniques, enriching the literature on the relationship between formal schooling (i.e., tracking), students’ socioeconomic background and their effort.

2 Background: Tracking in Japan

Japan has a different type of upper secondary schooling system from the typical comprehensive high school model in other countries (e.g., the United States). Upper secondary schools in Japan are differentiated according to students’ performance on high school entrance examinations. This differentiation has been mentioned as a type of hierarchical academic ranking system similar to a tracking system (Kariya and Rosenbaum 1999; LeTendre, Hofer and Shimizu 2003; Rohlen 1983). Kariya and Rosenbaum (1999:211) summarize this type of tracking system as follows:

While Japanese schools rarely had ability grouping within schools, their school hierarchy is regarded as tracking in Japan as it would be in the United States (Iwaki and Mimizuka 1983).
Sociologists note that both forms of tracking have similar social properties (Rosenbaum 1976; Sorensen 1970).

Even though a specific word for “tracking” in Japanese does not exist, upper secondary schools are ranked on a single continuum (LeTendre, Hofer and Shimizu 2003). At the last year of compulsory education, Japanese middle school students (ninth grade students) take an entrance examination and subsequently attend high schools that match their demonstrated level of academic performance (Rohlen 1983). Even in small school districts and rural regions that intend to diminish the academic ranking, public high schools are often included somewhere in the hierarchal ranking system of private schools (Takeuchi 1995). A recent study by Kariya (2011) confirms that this system still exists.

Tracking effects which result from this academic ranking system are consistently found in Japan. Studies reveals that (1) students’ SES (socioeconomic status) is related to their schools’ tracking location; higher SES students tend to be in top ranked schools (Iwaki and Mimizuka 1983; Nakanishi, Nakamura and Ouchi 1997; Ono 2001; Rohlen 1983; Tsukada 2010; Yamamoto and Brinton 2010), especially in top-private schools (Kariya 2011); (2) one’s tracking location influences postsecondary aspirations (Arakawa (Tanaka) 2001; Hata 1977; Honda 2009; Takeuchi 1981; Taki 2011; Yoshimoto 1984), even before entering into high school once students decide which school to attend (Kariya and Rosenbaum 1987); (3) the content of academic lessons students receive varies according to school rank among general-education schools (Kikuchi 1986); (4) school rank is related to student culture, morale and discipline (Knipprath 2010; Rohlen 1983); and (5) students at low-ranked schools rarely enter competitive universities (Nakanishi 2000; Ono 2001). In short, students who attend low-ranked general high schools and vocational high schools “are virtually eliminated from further competition for higher education” (Kariya and Rosenbaum 1987:178), while “[a]ttending higher ranking high schools significantly improves the probability of advancing to higher ranking colleges” (Ono 2001:182); Onai (1998) contends that the high school tracking system therefore functions to reproduce the existing social stratification, helping social reproduction occur. It should also be noted that the structure of the system and its effects have not been significantly changed, according to two studies that assess changes over two points of time (Hida et al. 2000; Ojima 2001). As a recent trend, Kariya (2011) contends that students attending top-private schools are likely to attend selective universities, compared to counterparts in the public sector, while high SES students tend to be in these competitive private schools.

3 Theoretical background: Habitus, Capital and Field

To understand who spends more time engaged in self-study and how such practice is generated as a strategy to advantage him/her in the academic competition under the influence of the tracking system, this study applies Bourdieu’s (1977) theory of practice referred to in his Outline of a Theory of Practice and in his work, Distinction (Bourdieu 1984). The component relationships are referred to
as follows: \((\text{Habitus} \times \text{Capital}) + \text{Field} = \text{Practice}\) (Bourdieu 1984:101)

_Habitus_. Maton (2008) summarizes this complex concept based on Bourdieu’s numerous writings. He explains that _habitus_ is a system of dispositions, which is a structure that structures itself (a structuring and structured structure); it is shaped by his/her past experience and present circumstances, and it also shapes one’s current and future perceptions/practices.

_Capital_. Bourdieu (1986) defines three forms of capitals: economic (e.g., money and property rights), cultural (i.e., _embodied cultural capital_: one’s awareness towards cultural matters/goods; _objectified cultural capital_: cultural goods like books and pictures; and _institutionalized cultural capital_: educational qualifications), and social (i.e., resources gained in social networks with group membership and titles), while pointing out that economic capital is at the root of every form of capital. There is a difference noted between the embodied form of cultural capital and _habitus_. The embodied form of cultural capital includes a taste for “high art,” general cultural awareness and verbal skills (Swartz 1997), while _habitus_ is “a set of deeply internalized master dispositions that generate action” (Swartz 1997:101).

_Field_. According to Bourdieu and Wacquant (1992), a field can be defined “as a network, or a configuration, of objective relations between positions” (Bourdieu & Wacquant 1992: 97). It consists “of positions occupied by social agents (people or institutions) and what happens on/in the field is consequently boundaried” (Thomson 2008:69). Drawing on Bourdieu’s writings, Thomson (2008) argues that games played in social spaces or fields are competitive, and social agents with certain capitals use various strategies to improve or maintain their social position; an example of such strategies is financial investment, which is an economic strategy. In social fields, some players possessing certain volumes of capitals are advantaged, and these players can use their advantages to improve their position, while fields are differently shaped based on the game which is played on those fields.

_Interrelated concepts_. It is necessary to use these three concepts together in order to understand how individuals (students and families) strategically use education to maintain and improve their social position. According to Maton (2008) and Reay (2004), Bourdieu’s (1984) equation, which demonstrates the relationship among the three concepts, could be understood as follows; Practices are “not simply the result of one’s habitus but rather of _relations between_ one’s habitus and one’s current circumstances “ (Maton 2008:52). Reay (2004) also articulates Bourdieu’s (1990:116) argument, suggesting “habitus becomes active in relation to a field, and the same habitus can lead to very different practices and stances depending on the state of the field” (Reay 2004:432).

## 4 Research Question

As the study investigates tracking effects on students’ study habits (defined as their self-learning hours), the research question is; _Do school-level tracking factors affect students’ study habits (i.e., self-study time)?_
Tracking Effect on Tenth Grade Students’ Self-learning Hours in Japan

To empirically test who exerts efforts in the form of self-learning time under the influence of the tracking system, the previously mentioned Bourdieu’s theoretical model should be modified with multilevel nature of its reality (nested field) as follows: \((\text{Habitus} \times \text{Capital}) + \text{Sub-Field} + \text{Field}) = \text{Practice} \)

The main “field” is the academic competition in which students are embedded and a sub-field is each school where formal instructional lessons are offered in the hierarchical ranking system. “Practice” here means how many hours students study an academic subject (i.e., mathematics) by themselves outside of any instructional lessons: a proxy of effort. The research hypothesis is that one’s sub-field (i.e., tracking location represented as school rank, school SES composition and curriculum tracking) shapes the amount of efforts one exerts (practice) in relation to his/her \textit{habitus} and capital. More specifically, students in higher-ranked schools (sub-field) are more likely to engage in longer-self-studying, while other factors including individual \textit{habitus} and capital are controlled. This means that the academic race for college admission (field) facilitates students in high tracks being in positions to study longer by themselves along with effects of students’ \textit{habitus} and capital. As this connection between the tracking structure, students’ family background and self-learning has not been studied with a rigor nationally representative data and the theoretical understanding of students’ practice, the current study fills its gap.

5 Method

5.1 Data

Data is the Programme for International Student Assessment (PISA) 2006 which was conducted by the Organisation for Economic Co-operation and Development (OECD). PISA 2006 includes academic tests on a randomly drawn sample of 15-year-old students in fifty-six participating countries/regions. It also collected family and school-contextual information from student and principal questionnaires.

PISA 2006 was conducted at randomly sampled high schools in the third or fourth month of the three year upper secondary education in Japan. The size of Japanese sample is 5,952 tenth grade students in 185 high schools. The report on PISA 2006 by National Institute for Educational Policy Research (2007) notes that their research team conducted a two-stage cluster sampling method to choose sampled schools. First, upper secondary schools were divided into four categories: academic public schools, vocational public schools, academic national/private schools, and vocational national/private schools. Second, the team randomly selected schools so as to have a specific number of students that would proportionally reflect the population (age cohort nationwide) in each category: “PPS: Probability Proportional to Size” (21). Third, tenth grade students (high school freshmen) were randomly selected from the chosen schools. As a result, each school includes an average of 32 students. A final student weight and replicated weights were used for the analysis of this study.

It is important to highlight that some school characteristics should not be associated with student
performance. Since PISA 2006 was conducted among tenth grade students of high schools in the third or fourth month of the Japanese academic year, there was limited time for school characteristics to have effects on student performance. As Knipprath (2010) contends in her correlational study employing Japanese data of PISA 2000, 2003 and 2006, because “students had been sliced into rather homogeneous groups based on entrance examinations just a few months before the PISA data were gathered (Knipprath 2010:403),” the “PISA data in Japan are more suitable to study the issue of tracking than of school effectiveness” (403). This means that PISA2006 is appropriate for this study to investigate tracking effects on students’ behavior (i.e., self-learning hours). As (1) students’ testing score cannot be drastically changed during three or four months, while (2) students’ behavior (i.e., self-learning hours) could be shaped because of field where they are located, it is reasonable to assume the proposed causal direction to test the research question (i.e., students engage in self-learning due to their tracking location).

5.2 Dependent Variable

This study examines self-studying hours in mathematics as a dependent variable. It is because mathematics is (1) one of the required subjects at tenth grade and (2) the most self-studied subject among the sampled students of PISA 2006, according to a preliminary analysis. The dependent variable was constructed based on the following PISA student questionnaire item by OECD (2005b) and students’ responses to it.

Self-learning hours. The item “the time spent studying or doing homework by yourself” was used to define students’ “self-learning hours” in mathematics. The item is as follows:

Q31 How much time do you typically spend per week studying the following subjects? For each subject, please indicate separately: the time spent attending regular lessons at your school; the time spent attending out-of-school-time lessons (at school, at home or somewhere else); the time spent studying or doing homework by yourself. <An hour here refers to 60 minutes, not to a class period> (p. 24)

Self-learning hours was coded from 0 to 3 to indicate how long students study mathematics by themselves (i.e., coded 0 = no time; 1 = less than two hours a week; 2 = two or more but less than four hours a week; 3 = four or more a week).  

5.3 Independent Variables

At the student level of a model, there are six explanatory variables that are Student SES (socioeconomic status), Academic Attitude (as a proxy variable of habitus), Female (Gender), Student Math Score, Shadow Education Participation and Free Lesson (hosyu) participation. At the school level, six variables were included: School SES, School Rank (tracking location), city size (two dummy coded variables: City and Large city), Public/Private and General/Vocational Education at the school level. Among them, School SES, School Rank and General/Vocational Education (curriculum tracking) are considered as consequences of sorting students into school-based tracks based on high
school entrance examinations; these three variables are tracking factors.\(^2\)

**Student Level Variables**

**Student Socioeconomic Status (Student SES).** The PISA index of economic, social and cultural status was used as an individual SES indicator. OECD (2007) notes that the index "was derived from the following variables: the international socioeconomic index of occupational status of the father or mother whichever is higher; the level of education of the father or mother whichever is higher converted into years of schooling" (211) along with the index of home possessions.\(^3\) This index which covers a wide range of socioeconomic factors could be understood as “capital” in the theoretical model: \(((\text{Habitus} \times \text{Capital}) + \text{Sub-Field}) + \text{Field}) = \text{Practice}\)

**Academic Attitude.** As a proxy variable of students’ \textit{habitus} in the above theoretical equation, I created this dichotomous variable by using students’ responses to the following item in the PISA student questionnaire by OECD (2005b).

\textit{Q36 In general, how important do you think it is for you to do well in the subjects below?}

\begin{enumerate}
\item \textit{School science} subjects
\item Mathematics subjects
\item \textit{Test language} subjects (30)
\end{enumerate}

The sampled students were asked to select one of the four levels of importance for each subject: “Not important at all,” “Of little importance,” “Important” and “Very important.”

The National Institute for Educational Policy Research (2007) published the translated version of this item. The item’s meaning slightly differ in Japanese. A re-translated version of the item is; how important do you think it is for you to receive a good grade in the subject below: 1) Science, 2) Mathematics and 3) National Language. This means that the Japanese students were asked if they believe that it is important for them to "receive a good grade (in school)" instead of "do well." Therefore, the “Academic Attitude” variable composed of responses of the students to the item should mean how strongly they care about their grades in high school, representing their attitudes/dispositions (\textit{habitus}) towards the academic subjects/performance in school.

To clarify tenth grade students who perceive that studying the academic subjects is “very important,” those who selected “very important” for both mathematics and languages were coded 1, as the “academically oriented \textit{habitus} group.” Then, all other students were coded 0, as the “less academically oriented \textit{habitus} group”.\(^4\) Both mathematics and “national language” (equivalent to “English” in the United States) were put together to have a balanced “academic attitude” in terms of neither just mathematics/science nor the arts/humanities. This variable should be included in the analysis, since this represents students’ academic dispositions, while individual (student) SES was composed of parental occupations/educational backgrounds and home possessions including the number of books at home, reflecting family-SES, as opposed to students’ dispositions.

**Female (Gender).** Female was coded as 1. Male students were indicated as 0.

**Student Math Score (Performance).** Five plausible values in mathematic were provided for analyses and should be simultaneously used. These values represent academic performance on
mathematics that tenth grade students demonstrated in the third or fourth month of the three-year upper secondary education.

Two Types of Additional Instructional Lessons. There are two types of additional instructional lessons outside of regular lessons in Japan: shadow education and supplemental lessons (hosyu). Additional instructional lessons are provided through a private educational market, and they are referred to as shadow education (Baker et al. 2001; Stevenson and Baker 1992). These extra organized learning activities are similar to those instructional activities found within formal high schools; that is, their lessons are intended to enhance students’ academic performance within formal school settings (Baker et al. 2001). In contrast to paid lessons in the shadow education industry, supplemental free lessons (hosyu) are oftentimes available in public/private schools. In theory, this provides a free opportunity for students to gain extra learning opportunities regardless of their socioeconomic background. There is no study that specifically assesses who attends these lessons with rigor, empirical data, even though a number of high schools are known to offer such supplemental lessons. Two dichotomous variables, “Shadow Education Participation” and “Free Lesson Participation” were created: 1 = participation, 0 = non-participation.  

School Level Variables

School Rank. This variable represents the student’s tracking location; that is, each school’s aggregate mean score of individuals’ math performance (i.e., consisting of five plausible values ranging from 200 to 800) was standardized (OECD mean = 500; standard deviation = 100). The average score for each school is intended to show its academic rank in the hierarchal academic ranking system. Because the students in the sample had been at high schools for only three or four months at the time of the PISA test, it is reasonable to assume that there was virtually no, or very little, high school effect on their academic performance in mathematics. This variable seems to depict the well-defined hierarchal academic ranking system (e.g., skewness of 0.03 and kurtosis of -0.44 suggest that it is normally distributed).

General/Vocational Education School. As for PISA 2006, schools were sampled for each general/vocational category (National Institute for Educational Policy Research 2007). Thus, every sampled school did not have classes with the other curriculum; the schools have exclusively general education classes or vocational education classes. General education-schools were shown as 1, and vocational schools were coded as 0.

School SES. To create this variable, individual SES was aggregated at each school.

School City Size. A questionnaire filled out by school principals has an item about a size of community where each school is located, according to OECD (2005a). There are four categories of city size: (1) a small town: 3000 to about 15000 people, (2) a town: 15000 to about 100,000 people, (3) a city: 100,000 to about 1,000,000 people, and (4) a large city: with over 1,000,000 people. By using school principals’ responses to this item, I created two dummy coded variables: City and Large City.

Private/public School. Private schools were coded as 1, and public schools were shown as 0.
5.4 Analysis

One multilevel ordinal regression analysis was carried out to investigate how individual characteristics and school structural characteristics are related to students’ duration of self-studying hours. To do so, three models were created with the dependent variable: (1) a null model, (2) a model with student-level predictors and (3) a model with both student and school-level variables. The model 3 (full model) was written as follows:

**Level-1 (Student Level) Model**

- Probability[$R_{ij} <= 0$] = $\phi_{0ij} = \phi_{0ij}$
- Probability[$R_{ij} <= 1$] = $\phi_{1ij} = \phi_{0ij} + \phi_{1ij}$
- Probability[$R_{ij} <= 2$] = $\phi_{2ij} = \phi_{0ij} + \phi_{1ij} + \phi_{2ij}$
- Probability[$R_{ij} <= 3$] = 1.0

- $\phi_{0ij}$ = Probability[Self-learning hours (0) = 1]
- $\phi_{1ij}$ = Probability[Self-learning hours (1) = 1]
- $\phi_{2ij}$ = Probability[Self-learning hours (2) = 1]

- $\log[\phi_{0ij}/(1 - \phi_{0ij})] = \beta_{0ij} + \beta_{1j}(SES_{ij}) + \beta_{2j}(Math Score_{ij}) + \beta_{3j}(Female_{ij}) + \beta_{3j}(Shadow Education Participation_{ij}) + \beta_{6j}(Free Lesson Participation_{ij})$
- $\log[\phi_{1ij}/(1 - \phi_{1ij})] = \beta_{0ij} + \beta_{1j}(SES_{ij}) + \beta_{2j}(Math Score_{ij}) + \beta_{3j}(Female_{ij}) + \beta_{3j}(Shadow Education Participation_{ij}) + \beta_{6j}(Free Lesson Participation_{ij}) + \delta_{1}$
- $\log[\phi_{2ij}/(1 - \phi_{2ij})] = \beta_{0ij} + \beta_{1j}(SES_{ij}) + \beta_{2j}(Math Score_{ij}) + \beta_{3j}(Female_{ij}) + \beta_{3j}(Shadow Education Participation_{ij}) + \beta_{6j}(Free Lesson Participation_{ij}) + \delta_{2}$

**Level-2 (School Level) Model**

- $\beta_{0j} = \gamma_{00} + \gamma_{01}(School SES_{j}) + \gamma_{02}(Private_{j}) + \gamma_{03}(General Education_{j}) + \gamma_{04}(School Rank_{j}) + \gamma_{05}(City_{j}) + \gamma_{06}(Large City_{j}) + \mu_{0j}$
- $\beta_{1j} = \gamma_{10}, \beta_{2j} = \gamma_{20}, \beta_{3j} = \gamma_{30}, \beta_{4j} = \gamma_{40}, \beta_{5j} = \gamma_{50}, \beta_{6j} = \gamma_{60}, \delta_{1}, \delta_{2}$

It should be noted that all reported models are random intercept models; that is, the variation in the levels of the intercepts was freely estimated to reflect between-school differences in students' self-studying hours. Within-slopes were fixed, as (1) all random slopes appeared to be insignificant and (2) no specific hypotheses were made concerning variability in the between-school differences in the predictive power of the predictors (e.g., Math Score, Student SES and Gender), given that the primary focus on the study was in identifying possible self-learning hours-gap between schools according to schools' track locations. Additionally, possible interaction effects were investigated preliminarily but found to be insignificant; therefore, the model contains only main effects.

6 Results

6.1 Descriptive Statistics

**Dependent Variable**

Table 1 shows descriptive statistics of the dependent categorical variable: self-learning hours. The
The table indicates how many hours students study mathematics by themselves (i.e., coded 0 = no time; 1 = less than two hours a week; 2 = two or more but less than four hours a week; 3 = four or more a week).

Table 1:  Dependent Categorical Variable

<table>
<thead>
<tr>
<th>Self-Learning Hours in Mathematics</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 up to 6 hours or more</td>
<td>447</td>
<td>7.6</td>
</tr>
<tr>
<td>2 up to 4 hours</td>
<td>1109</td>
<td>18.8</td>
</tr>
<tr>
<td>Less than 2 hours</td>
<td>2848</td>
<td>48.2</td>
</tr>
<tr>
<td>No time</td>
<td>1499</td>
<td>25.4</td>
</tr>
</tbody>
</table>

Independent Variables

To facilitate interpreting the results of the multilevel analysis, continuous variables such as student SES and the math outcome variables in the analysis were standardized as summarized in Table 2. All student-level variables summarized in the table were weighted with the normalized final student weight.

Table 2: Student Background Continuous Variables (Standardized)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>SD</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student SES</td>
<td>5865</td>
<td>-3.80</td>
<td>3.50</td>
<td>0.00</td>
<td>1.00</td>
<td>0.06</td>
<td>-0.46</td>
</tr>
<tr>
<td>Math Score</td>
<td>5952</td>
<td>-3.87</td>
<td>3.10</td>
<td>0.00</td>
<td>1.00</td>
<td>-0.17</td>
<td>-0.08</td>
</tr>
</tbody>
</table>

There are four categorical variables at the student level: Female (gender), academic attitude, shadow education participation and free lesson participation. Table 3 shows 33.3% of the sampled students are considered to have academically oriented *habitus*, compared to 66.7% of the students who are described as less academically oriented. Also, the descriptive analysis shows that 13.8% of the tenth grade students obtain some form of shadow education lessons in mathematics. Additionally, about 18% of the students attend supplemental free lessons taught by their school teachers. There is overlap between the students taking shadow education lessons and those attending free lessons; approximately 6% of the sampled students gain both types of extra lessons. Meanwhile, about 8% of the students only receive shadow education lessons and about 12% of the students attend only supplemental free lessons. It should be highlighted that roughly 26% of the sampled tenth grade students take some type of additional instruction in mathematics outside of regular lessons in the third or fourth month of the first year of the high school education after passing entrance examinations and entering into the upper secondary schools.

Table 4 shows the descriptive statistics for the school-level continuous variables. All of these variables were standardized (M=0, SD=1) and normally distributed. School SES is an average of student SES at each school, while school rank 1 to 5 represents the average of each school’s PV for math.
Table 3: Categorical Variables at Student Level

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>2984</td>
<td>50.1</td>
</tr>
<tr>
<td>Female</td>
<td>2968</td>
<td>49.9</td>
</tr>
<tr>
<td>Academic Attitude</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academically Oriented</td>
<td>1965</td>
<td>33.3</td>
</tr>
<tr>
<td>Less Academically Oriented</td>
<td>3928</td>
<td>66.7</td>
</tr>
<tr>
<td>Shadow Education Participation in Mathematics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>811</td>
<td>13.8</td>
</tr>
<tr>
<td>No</td>
<td>5072</td>
<td>86.2</td>
</tr>
<tr>
<td>Supplemental Free Lesson Participation in Mathematics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1070</td>
<td>18.2</td>
</tr>
<tr>
<td>No</td>
<td>4812</td>
<td>81.8</td>
</tr>
</tbody>
</table>

Table 4: School Level Continuous Variables (Standardized)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>SD</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>School SES</td>
<td>185</td>
<td>-2.58</td>
<td>2.27</td>
<td>0.00</td>
<td>1.00</td>
<td>-0.08</td>
<td>-0.56</td>
</tr>
<tr>
<td>School Rank</td>
<td>185</td>
<td>-2.44</td>
<td>2.78</td>
<td>0.00</td>
<td>1.00</td>
<td>0.02</td>
<td>-0.40</td>
</tr>
</tbody>
</table>

Table 5: School Level-Categorical Variables

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>School Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>52</td>
<td>28.1</td>
</tr>
<tr>
<td>Public</td>
<td>133</td>
<td>71.9</td>
</tr>
<tr>
<td>Curriculum Track</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>138</td>
<td>74.6</td>
</tr>
<tr>
<td>Vocational</td>
<td>47</td>
<td>25.4</td>
</tr>
<tr>
<td>City (Dummy)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>City</td>
<td>76</td>
<td>41.1</td>
</tr>
<tr>
<td>Other City Size</td>
<td>109</td>
<td>58.9</td>
</tr>
<tr>
<td>Large City (Dummy)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large City</td>
<td>44</td>
<td>23.8</td>
</tr>
<tr>
<td>Other City Size</td>
<td>141</td>
<td>76.2</td>
</tr>
</tbody>
</table>

Table 5 is a frequency table of school-level dichotomous variables. The table suggests that most schools in the sample are public and are described as general in curricular orientation. “Large city” means a population with over one million people, and a population of “city” ranges from ten thousand to one million people. The rest of the schools are in towns, smaller towns or village with population less than ten thousand people.

6.2 Model 1 (Null Model) and Model 2: Student background variables

For the ordinal outcome (reported hours of self-study in math), the four categories are ordered from lowest (no time) to highest (4-6 or more hours). Model 1 in Table 6 provides an estimation of the log odds that a student reports studying mathematics by him/herself (the highest category versus combined lower categories).

As Table 6 shows, for Model 2 the student-level-predictors (i.e., student SES, academic attitude, math score, female, shadow education participation, and supplemental lesson participation) are significant in explaining the duration of time students report studying math by themselves during a typical week. For ordinal outcomes, the odds ratio for the logit model represents the odds of the highest category occurring as compared to all lower categories combined. In other words, it is a
cumulative odds ratio representing the increased predicted odds to be the highest category relative to the lower categories for each unit increase in the predictor. The change in odds ratio related to a 1-unit change in the predictor is therefore independent of the specific response category (Hox 2010).

Table 6: Self-learning hours

<table>
<thead>
<tr>
<th></th>
<th>M1</th>
<th>M2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimates</td>
<td>SE</td>
</tr>
<tr>
<td><strong>School Level (N=185)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>-3.136****</td>
<td>0.115</td>
</tr>
<tr>
<td><strong>Student Level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(N= 5902 for M1, 5739 for M2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SES</td>
<td>0.175****</td>
<td>0.038</td>
</tr>
<tr>
<td>Academic Attitude</td>
<td>0.362****</td>
<td>0.068</td>
</tr>
<tr>
<td>Score</td>
<td>0.204****</td>
<td>0.045</td>
</tr>
<tr>
<td>Female</td>
<td>0.331****</td>
<td>0.084</td>
</tr>
<tr>
<td>Taking Shadow Education</td>
<td>0.449****</td>
<td>0.096</td>
</tr>
<tr>
<td>Taking Free Lesson</td>
<td>0.686****</td>
<td>0.093</td>
</tr>
<tr>
<td>Threshold 2</td>
<td>1.815****</td>
<td>0.056</td>
</tr>
<tr>
<td>Threshold 3</td>
<td>4.488****</td>
<td>0.084</td>
</tr>
<tr>
<td><strong>Random Effect</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 2 Variance</td>
<td>1.518****</td>
<td>0.926****</td>
</tr>
<tr>
<td>ICC</td>
<td>0.316</td>
<td>0.220</td>
</tr>
</tbody>
</table>

*p < .10, **p < .05, ***p < .01, ****p < .001

6.3 Model 3: Full Model (Student background and high school variables)

In the complete model in Table 7, at the school level, school academic rank, SES composition, general education school, and large city are significantly related to hours of self-study, while private school and city are not. Possible interactions were examined; however, since none was significantly related to perceptions of self-study hours, this is the final model. These results indicate that for students who attend high schools academically ranked 1-SD above the grand mean, the odds of being in the highest category of math self-study versus the lower categories are increased by 1.659 times (a 65.9% increase) compared with their peers who attend high schools at the grand mean, while the others in the model were controlled. Regarding SES composition (School SES), for a 1-SD increase in school SES, the odds of students reporting being in the highest self-study category versus the lower categories are increased by 1.25 times (or a 25% increase) compared with their peers in schools at the grand mean, holding other variables constant. Being in general-education schools also influences students’ reported hours of self-study in math (OR = 1.79); that is, compared with students in vocational schools, students in general-education schools are 1.79 times more likely to report being in the highest category of reported math self-study rather than the lower categories (an increase
of 79%), holding other variables constant. It should be noted that students whose schools are located in large cities are less likely to report being in the highest category of math self-study versus the lower categories (OR = .592) compared with their fellow students who reside in the reference group of smaller cities (small town and town whose population is under 100,000 people), holding other variables in the model constant. This represents a reduction in odds of 40.8% compared with their peers in the reference group.

Table 7: Self-learning hours

<table>
<thead>
<tr>
<th>School Level (N= 185)</th>
<th>Estimates</th>
<th>SE</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-3.734****</td>
<td>0.204</td>
<td>0.024</td>
</tr>
<tr>
<td>School Rank</td>
<td>0.506****</td>
<td>0.113</td>
<td>1.659</td>
</tr>
<tr>
<td>General Education</td>
<td>0.582****</td>
<td>0.152</td>
<td>1.790</td>
</tr>
<tr>
<td>School SES</td>
<td>0.223**</td>
<td>0.105</td>
<td>1.250</td>
</tr>
<tr>
<td>Private</td>
<td>-0.073</td>
<td>0.162</td>
<td>0.930</td>
</tr>
<tr>
<td>City</td>
<td>-0.260</td>
<td>0.162</td>
<td>0.771</td>
</tr>
<tr>
<td>Large City</td>
<td>-0.525****</td>
<td>0.170</td>
<td>0.592</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Student Level (N= 5739)</th>
<th>Estimates</th>
<th>SE</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>SES</td>
<td>0.136****</td>
<td>0.040</td>
<td>1.146</td>
</tr>
<tr>
<td>Academic Attitude</td>
<td>0.378****</td>
<td>0.069</td>
<td>1.459</td>
</tr>
<tr>
<td>Score</td>
<td>0.085*</td>
<td>0.051</td>
<td>1.089</td>
</tr>
<tr>
<td>Female</td>
<td>0.317****</td>
<td>0.085</td>
<td>1.374</td>
</tr>
<tr>
<td>Taking Shadow Education</td>
<td>0.420****</td>
<td>0.097</td>
<td>1.522</td>
</tr>
<tr>
<td>Taking Free Lesson</td>
<td>0.696****</td>
<td>0.096</td>
<td>2.006</td>
</tr>
<tr>
<td>Threshold 2</td>
<td>1.770****</td>
<td>0.066</td>
<td>5.873</td>
</tr>
<tr>
<td>Threshold 3</td>
<td>4.534****</td>
<td>0.114</td>
<td>93.175</td>
</tr>
</tbody>
</table>

Random Effect

<table>
<thead>
<tr>
<th>Level 2 Variance</th>
<th>0.441****</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICC</td>
<td>0.118</td>
</tr>
</tbody>
</table>

* = p < .10, ** = p < .05, *** = p < .01, **** = p < .001.

Turning to the student-level part of the model, all student level-variables are significant predictors of the length of self-studying. For student SES, students whose family background SES is 1-SD above the grand mean are about 1.15 times more likely to report being in the highest category of self-studying versus the lower categories than their peers of average family SES, holding other variables constant. For students with academically-oriented habitus, the predicted odds of being in the highest self-study category (4-6 hours or more) versus the lower categories are increased by a factor of 1.459, or are 1.459 times greater, than for students of less academically oriented habitus, holding other variables in the model constant. Student math score is also related to reported math self-study hours. The odds of being in the highest category of self-studying hours versus the lower categories are increased by about 9% for a 1-SD increase in math score (OR = 1.089), holding other variables constant. Female students are 1.37 times more likely than males to report being in the
highest category of self-studying versus lower categories. Furthermore, students who obtain the two types of supplemental lessons inside/outside of their high schools tend to report studying longer. Holding other variables constant, for students who obtained shadow education (versus those who did not), the odds ratio of being in the higher category versus the combined lower categories is increased by a factor of 1.522 or about 52%; while for students who obtained supplemental free math lessons (versus those who did not), the odds ratio of being in the highest category versus the combined lower categories is increased by a factor of approximately 2.0 (or about a 100% increase).

7 Discussion

The results of the study support the hypothesis and extend findings by previous studies, which are substantial differences in hours of studying outside school among eleventh graders (Kariya 2000b) and senior (Aramaki 2002), depending on students’ family background and school rank. Specifically, using the nationally representative data, this study finds one’s tracking location represented as School Rank, School SES and curriculum tracking (General/Vocational education) shape how long students study mathematics by themselves. Also, all the student-level variables affect students’ practice of self-studying: Student (Family) SES, Student Math Score, Academic Attitude, Female, Shadow Education Participation and Supplemental Lesson Participation. Among these factors structuring how much effort one exerts, it is understandable that students who attend additional lessons study longer, since (1) they are probably supposed to complete assignments from these extra lessons along with assignments given by school teachers in regular lesson and (2) students may feel peer pressure in those extra lessons and then study longer by themselves.

Among the significant predictors, School SES, General/Vocational Education and School Rank are direct tracking-factors: consequences of sorting students into different tracks based on entrance examinations. At the student-level, both Student (Family) SES and Academic Attitude explain how long one studies mathematics by his/herself. This suggests that both parental and students’ dispositions (habitus) structure the students’ studying practice, assumingly contributing to improving students’ performance in mathematics and leading to next learning practices (structuring/re-shaping their habitus by taking this action). Since high SES/academically oriented/ high performing students are more like to be in high ranked/high SES/general education-schools, the combined influences of tracking (school) and family effects are substantial; one’s amount of effort is not independent from these structural factors. As for Large City being negatively significance, it may be because there are (1) great disparities in urban areas in terms of SES level and (2) simply more places for tenth grade students to go/play in large cities rather than in sub-urban and rural areas.

8 Implications

Tracking effects on social agents’ educational practice outside of regular school lessons. As
Carbonaro (2005) finds out tracking effects on social agents shaping their achievement, this study’s primary purpose was to unpack tracking effects on social agents’ studying-behavior. The findings of this study reveal that students in highly-ranked general education-schools tend to study longer by themselves, while they receive more demanding regular instructional lessons. These results are consistent with the theoretical model: \((\text{Habitus} \times \text{Capital}) + \text{Sub-Field} + \text{Field}) = \text{Practice}\); students’ tracking location (sub-field), students’ SES (capital) and Academic Attitude (habitus) work together to structure/generate their different levels of effort (practice), widening achievement and \text{habitus}-(dispositions toward academic success)-gaps that already exist. Higher SES students are known to have academically oriented \text{habitus} through early-family socialization which generates practices (self-studying longer), re-shaping its already-academically oriented \text{habitus}; one’s \text{habitus} at one time generates a practice in relation to his/her capital and field, and this practice/experience re-shape/structure the \text{habitus}, while their high school (sub-field) also shapes their practice. The findings of the study suggest that one’s family background (capital), academic attitude (student’ \text{habitus}) and tracking location (sub-field) in the hierarchal ranking system maintain this cycle in the academic competition for higher education (field). By attending highly-ranked schools through entrance examinations, high SES students’ learning aspects of \text{habitus} could become more academically oriented as they are exposed to rigorous academic learning opportunities (in rigor regular lessons) and peer pressure (likely related to relatively high School SES) in high schools. On the contrary, low SES students are more likely to attend low-ranked schools due to their relatively poor academic performance: having fewer opportunities to shape their \text{habitus} in the academically oriented way. This gap between these social agents with different levels of capital and \text{habitus} seems to become wider and wider because of their different sub-fields (tracked high schools). Without understanding inequality of effort shaped by not only social class and the school system, as Kariya (2000b) argues, how much effort they exert would be taken as individual choices in a meritocratic sense.

**Policy Implication.** While higher SES students at competitive high schools are more likely to study longer due to their tracking location, lower SES counterparts who successfully entered into high ranked schools also tend to engage in self-studying for longer duration of time. Additionally, “Taking Free Lesson” helps students study longer outside of any instructional lessons. These findings suggest that disadvantaged students would study if rigorous learning environments and additional learning opportunities are provided.

**Acknowledgements**

- This work was supported by the Center for the Study of Social Stratification and Inequality at Tohoku University under the Global COE Program and by JSPS KAKENHI Grant Number 24830009.
- This article is based on parts of the dissertation of the author: Matsuoka, R. (2012). Investigating the intersection of school academic position and student background on Japanese tenth graders’ educational choices and study habits. Ph.D in Education, University of Hawaii at Manoa, Honolulu.
Notes

1) Students’ responses to “6 or more hours a week” was combined with those to “4 or more but less than 6 hours a week” so as to create “3 = four or more a week” (7.5%), since small percentage of students selected these two choices. It should also be noted that the findings of the study could partly be interpreted as structural issues, not agency ones, as the dependent variable includes not only self-studying but also time for working on homework.

2) School SES represents School compositional effect. As higher SES students are tracked into higher tracks due to their relatively higher academic performance, high ranked schools are likely to have higher SES students. This high concentration of high SES students in higher tracks would have not occurred if the tracking system had not existed. Thus, School SES should be regarded as a consequence of tracking students into different tracks: one of the tracking factors. In fact, School SES is significantly and strongly correlated to the school rank variables (.730), suggesting that higher SES students attend higher tracks. It should also be noted that this high correlation between the variables do not affect the presented findings of the study.

3) The index of home possessions was “obtained by asking students whether they had at their home: a desk to study at, a room of their own, a quiet place to study, a educational software, a link to the Internet, their own calculator, classic literature, books of poetry, works of art (e.g. paintings), books to help with their school work, a dictionary, a dishwasher, a DVD player or VCR, three other country-specific items, as well as the number of cellular phones, televisions, computers, cars and books at home” (211). The report by OECD (2007) also provides a rationale for why these variables were included; "socio-economic status is usually seen as being determined by occupational status, education and wealth (333). Principal Component Analysis, which is "standardised to have an OECD mean of zero and a standard deviation of one” (211), was used to develop the index. The analysis was performed for every participating country, and "patterns of factor loadings were very similar across countries” (333), with internal consistency of the index ranging from 0.52 to 0.80 (333).

4) This way of coding was used to make a clear contrast between who chose “very important” for the two subjects and those who selected the other options; these students consider the academic subjects as critical matters in the third or fourth month of the three year high school education. Also, this helps readers to interpret the meaning of this variable’s significance; it would have been difficult to understand the meaning of odd ratio of the variable, if it had been treated as a continuous variable. It should be also noted that this variable was significant in the models when it had been created as a continuous variable.

5) The following items were combined into one measure, in order to identify who participates in “shadow education” and/or “additional free lessons provided at schools.” Students checked “Yes” or “No” to six items respectively.

Q32 What type of out-of-school-time lessons do you attend currently (if any)?
These are lessons in subjects that you are learning at school, that you spend extra time learning outside of normal school hours. The lessons might be held at your school, at your home or somewhere
else. These are only lessons in subjects that you also learn at school. “(a) <One to one> lessons with a <teacher> who is also a teacher at your school, (b) <One to one> lessons with a <teacher> who is not a teacher at your school, (c) Lessons in small groups (less than 8 students) with a <teacher> who is also a teacher at your school, (d) Lessons in small groups (less than 8 students) with a <teacher> who is not a teacher at your school, (e) Lessons in larger groups (8 students or more) with a <teacher> who is also a teacher at your school, (f) Lessons in larger groups (8 students or more) with a <teacher> who is not a teacher at your school” (OECD, 2005b:26)

As this study is to investigate tracking effects on students’ study habits, the three types of lessons (one to one, lessons in small or larger groups) were not separately used but, rather, combined to define (1) shadow education (i.e., lessons with a teacher who is not a teacher at the student’s school) and (2) additional free lessons provided at schools (i.e., lessons with a teacher who is also a teacher at students’ school). These constructed variables are consistent with their meaning within the Japanese educational context. Some students’ sibling, parent, or neighbor may be “a teacher who is not a teacher at [the child’s] school,” but this is likely a rare case. Furthermore, since teachers in Japan are not supposed to teach for additional lessons to gain money, “a teacher who is also a teacher at [the student’s] school” should provide this additional instruction without compensation.

I identified who studied mathematics by obtaining lessons outside of the normal school day (i.e., attending outside-of-school-time lessons) by using responses to Q31. Then, I used students’ responses to Q32’s (a), (c) and (e) to identify who received some types of lessons “with a teacher who is also a teacher at [the child’s] school.” This should indicate additional free lessons provided at schools. In a similar way, I utilized responses to Q32’s (b), (d) and (f) so as to create a variable which indicates which student studied mathematics by participating in lessons outside of the normal school day “with a teacher who is not a teacher at [the student’s].”

6) For the multilevel analyses, HLM7 was used. Five PVs were separately included in each model, and then five sets of results were averaged, while final student and school weights were applied. It should be noted that eighty replicate weights were tested, but, as the results substantially unchanged with the replicate weights, the averaged results with the five PVs (Student Score and School Rank) with the final student and school weights were reported in this article.

7) In the model, the first threshold is allowed to vary across units as a random slope, but the others are fixed parameters that are cutpoints and generally not interpreted.

8) As no interaction between student-level variables and school-level ones (e.g., School SES x Student SES and Student SES x Math Score) was found, the variables’ effects on students’ studying practice need to be taken as additive; the existing tracking system seems to function to benefit those in higher tracks regardless one’s SES, while high SES students are more likely to be in higher tracks.

9) Missing value of the dependent variable is 50 with the final student weight.

10) There are five variables that indicate students’ math score. One variable was shown in this table, as the distribution of the variables is almost identical.

11) Missing value is excluded in Table 3, but these student level-variables only include about 1% of
Among the sampled 185 schools, there are only 7 schools where no student claims to take any additional math lessons from their school teachers (Free lessons).

There are five variables that indicate School Rank as they are averaged scores of students’ scores (five PVs). One variable was shown in this table, as the distribution of the variables is almost identical. For School Rank and School SES, the final school weight was not applied for this descriptive presentation.

These variables have no missing value and the final school weight is not used for this descriptive presentation.

As the student-level variables were not group-mean centered, the estimates of the variables might include both student- and school-level effect, not only student-level effect in the second model.

“Large City” is not significantly related to neither “taking shadow education” nor “taking free lesson”, according to a school-level correlational analysis. Also, no significant interaction was observed between “Large City” and each type of additional lesson participation in the multilevel analyses.

References


Honda, Yuki. 2009. "Toritu kokosei no seikatu kodo isiki ni kansuru tyosa hokokusyo [Report about investigating metropolitan high school students in terms of their lives, actions and feeling]." Pp. 22-33.


Origuchi, Tomoki. 2008. "Kate no kyoiku kino ni kansuru kenkyu: Kaiso to gakugyo tassei no aida heno tyakumoku [Research of the educational function of home: Focus on relations between class and achievements]." Kyoikugaku Zassi [Journal of Educational Research] 43:97-111


Transition to University in Japan. "American Journal of Sociology" 97(6):1639-57

(Received July 5, 2012/ Accepted November 9, 2012)