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# The role of cramming for examinations and its impact on the use of learning strategies

—A comparison between Japanese students and Singaporean students—

\* TAIRA Makio<sup>1</sup>, \*\* Leong Chan Hoong

## Abstract

Students use variety of learning strategies to achieve their perceived learning goals. These strategies range from memory-oriented learning typical of cramming for objective tests, to deep-processing strategies characteristic of what we have defined as “authentic learning.” Students’ choices of learning strategies depend not only on the style of teaching and assessment, but also on students’ perceptions of their learning goals. This paper intends to show that cramming for high-stakes test can foster use of psychologically sound and creative learning strategies such as meaningful learning, structural learning, and metacognitive judgment. The larger the amount of content knowledge students must learn in order to pass a high-stakes exam, the more sophisticated the learning strategies need to be. Our data from Japanese students and Singaporean students show the effect of cramming for high-stakes test foster developmental changes in students’ learning strategies.

**Key words :** cramming for examination  
learning strategy  
metacognitive judgment

## Decline of academic abilities

There are three major methods for comparing academic abilities: (1) international comparisons, (2) cohort comparisons, and (3) comparisons between individuals (in each country).

From a political and administrative viewpoint, the international and cohort comparison methods are important in evaluating each government's effectiveness in education policy. However, what is more important is the third method, comparisons among individuals, which aims to examine changes in individuals' learned academic abilities. This paper focuses on the decline of the academic abilities at individual post-secondary education/high school students.

Taira (2004) and Taira and Leong (2006) made “within-individual” comparisons of university freshmen’s academic abilities in several subjects. Taira (2004) asked Japanese university students to retake entrance examinations in three subjects that they had taken six months earlier. It turned out that their scores dropped by an average of 40 to 50 percentages in two of the three subjects. Only the score of modern Japanese did not decline (Taira, 2004). This differential result may be related to the different strategies students may have utilized to study

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modern Japanese versus the other subjects. They may have studied mathematics and English mainly through rote memorizing and/or repeating drills, which are not effective for studying Modern Japanese.

Empirical study needs to investigate whether or not the choice of learning strategies is dependent on country-specific educational and social factors, such as (a) learning goals, (b) value systems, (c) value and morality of study in general, etc. According to the PISA (2000), Japanese students ranked lower in major evaluative items – learning motivation, basic interest in school subjects, and study time – than students in other OECD countries. Japanese students' attitudes towards study in general may influence students' perceptions of and decisions about their learning goals.

These results suggest that we should take into consideration motivational factors in discussing students' learning strategies. That is, students' perceptions of learning goals may significantly affect their choice of learning strategies, which in turn affects the amount of retained knowledge.

### Epistemological Model of Learning Strategies

There are three major learning strategies (Wellman, 1990): Memory-Oriented Learning Strategy (MOLS), Elaboration-Oriented Learning Strategy (EOLS), and Organization-Oriented Learning Strategy (OOLS). These strategies are related to epistemologies of students: MOLS strategy is used for making isolated concepts, EOLS strategy is for interconnected and OOLS strategy is for open-ended concepts. Each learning strategy is described as follows:

Memory-Oriented Learning Strategy (MOLS): If a teacher teaches students the formula of a trapezoid as a simple procedure, the most students can calculate the area of a trapezoid immediately after the class, but they may forget the formula rather quickly. This suggests that when a teacher forces students to learn a formula through rote memorization. The students may perceive their learning goal to be simply to memorize the formula. Although they can successfully recite the formula, the information may be lost through disuse after recitation the information may be lost through disuse.

Elaboration-Oriented Learning Strategy (EOLS): On the other hand, if a teacher teaches the trapezoid formula in a meaningful way, students may be able to recall it over the long term, and even if they forget the formula, they can deduce it by using the formula for the area of triangles to calculate the area of a trapezoid. The specific component of the formula may be forgotten soon, but its meaning may be retained (FIGURE 1). A teacher's assessment style may also significantly affect students' learning goals. For example, teachers should use paper-and-scissors to examine students' understanding of the process of conversion of trapezoid to two parallelograms instead of a conventional objective test.

Organization-Oriented Learning Strategy (OOLS): Authentic learning will not end with simple elaboration of formula; advanced students may organize a conceptual network with respect to calculating the area of quadrilaterals (FIGURE 2). Note that the area of a square can be calculated by using the formula of area of a trapezoid. More advanced students may discover that to get the area of a polygon, they can cut it into triangles and rectangles and find those areas. However, this type of "authentic learning" may happen only if the teacher has taught it explicitly, it is very difficult for ordinary students to learn authentically by themselves. For example, a

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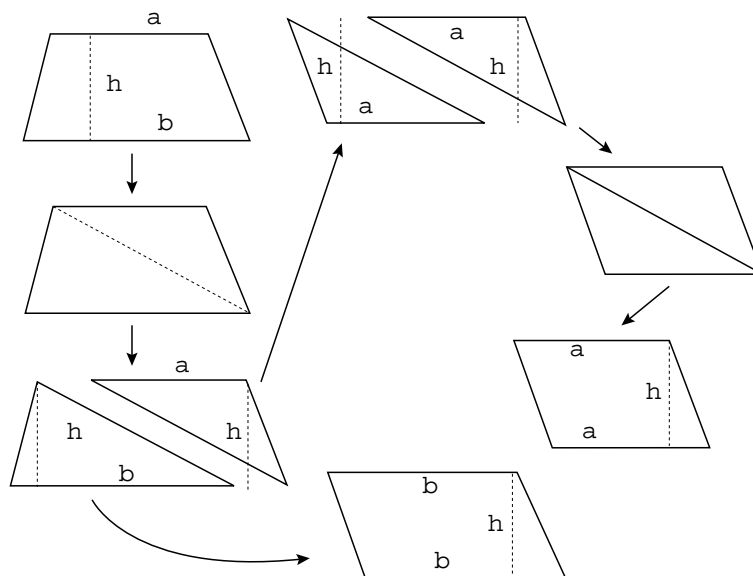


FIGURE 1 Transforming a trapezoid to triangles and two parallelograms

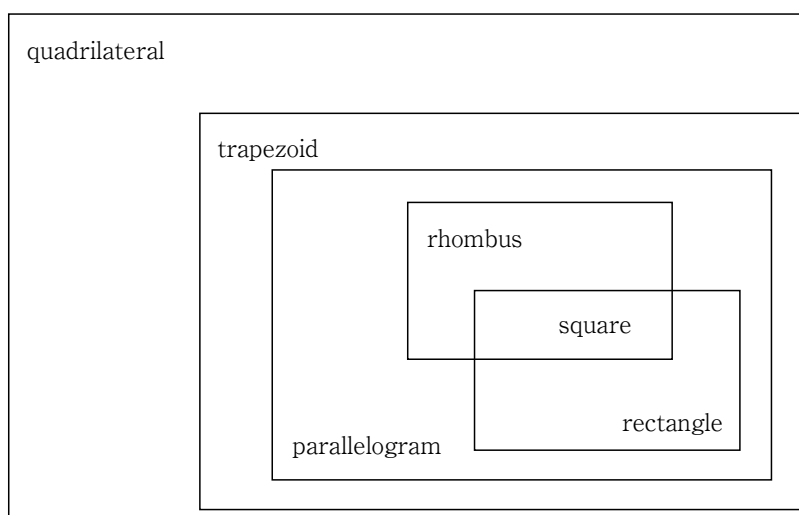


FIGURE 2 Conceptual map of quadrilaterals

good teacher may ask students to tackle the problem of calculating the area of a square by using the formula for the area of trapezoid. In this way, a good teacher uses conventional objective-tests very differently.

As students grow up, they become more able to judge and choose the most suitable learning strategies to achieve their perceived learning goals, and this judgmental process is called metacognitive judgment (Veenman, et.al, 2006). When students perceive that their learning goal was to pass a high-stakes test and the format of the exam was mainly multiple-choice questions, they might employ MOLS. “Test format schema” refers to knowledge relevant to a specific test format, and the learning strategies suitable for successful test completion; for objective tests, surface- or superficial-strategies are sufficient (Murayama, 2006). It has been pointed out that objective tests encourage the use of surface-processing strategies and reduce the use of deep-processing strategies. Superficial

**Table 1 Defining features of two modes of learning**

	Camouflaged Learning	Authentic Learning
Learning style	Conventional / convenience-oriented	Contriving/strategy-oriented
Motivation	Extrinsic – test-driven motivations	Intrinsic: content-driven motivations
Learning materials	Regulating area of learning (try to reduce or minimize the costs of learning)	Enlargement of learning area (try to interconnect concepts)
Major strategy	Memory-oriented learning strategy	Elaboration/organization-oriented learning strategy
Attends to	Amount of materials	Learning strategies
Preferred reference books	Thin and concise. Very little effort is required from student to digest topics.	Weighty. Some effort is required from student to digest topics.
Important factors for a student	Gain-centered/summative evaluation	Process-centered/formative evaluation

learning may be described as “camouflaged” learning and the use of deep-processing strategies is described as “authentic” learning. (Table 1)

### The pros and cons of cramming

Since cramming for a high-stakes test would seem to test the accuracy of students’ memories, one may think that such cramming would entail students learning textbooks by heart. On the contrary, the larger the amount of content knowledge the students must learn in order to pass for a high-stakes test, the more sophisticated learning strategies need to be. For example, most high-stakes tests require students take several subjects (e.g., most Japanese national universities require applicants take seven subjects in the Center Exam), and each subject tests examine the material covered an entire high school course. Rote learning is not suitable to retain such a huge amount of knowledge over the necessary retention interval. Students have to devise more advanced learning strategies to memorize and retain that huge knowledge. In such case, elaboration-oriented learning strategy or organization-oriented learning strategy is necessary. This process is also subjected to metacognitive judgment.

There are, however, negative effects of cramming, especially when learners lack basic content knowledge. In this case, they have to learn target concept by MOLS instead of EOLS or OOLS.

For example, the authors previously explained how students understand the trapezoid formula meaningfully by using EOLS, however, this elaboration process assumes that they already known the formula of area of parallelogram and the formula of area of triangle. If the learners did not know these basic contents knowledge, it is quite difficult to explain why and how the trapezoid is to be transformed to two parallelograms. In other words, if learners lack basic contents knowledge that is required to explain the target concept, they cannot but rely on MOLS instead of EOLS. Namely, the learners will have to memorize the facts.

It may be possible to conclude that cramming is an advantage for a student who is good at cramming for high-stakes tests. However, what if the learners did not have sufficient time to properly cram (by using EOLS or OOLS) and what if they had to pass for high-stakes test to avoid getting lost from a competition. Weak learner may choose “camouflaged learning” when the pressure for the cramming was fierce (Table 1). For example, if students are gain-centered person and if they choose to learn target concept by utilizing MOLS, they may forget the information they learned through cramming (Taira and Leong, 2006). Consequently, they seem to learn eagerly to forget, the crammed information when recitation is terminated and information is lost through disuse.

The authors hypothesized that the educational rigor in Asian countries results from the social context, and that this passion for education might provide a positive impetus for improving students' learning strategies. The authors examined whether or not cramming for high-stakes testing fosters students' use of the three psychologically sound learning strategies: EOLS, OOLS, and metacognitive judgment. However, the most participants in this survey were strong learners, or excelled at high-stakes tests. Therefore, we mainly focused on the positive aspects of cramming in this survey. The negative aspects and the cultural differences of cramming will be discussed in a latter part of this paper.

## Procedure

The purpose of this survey is to analyze how students' learning strategies develop during their academic tenure. The authors asked participants to think back on their school days – from primary school to junior college/ high school – and to judge their learning. Then, the authors examined whether there were cultural differences between the responses reported by Singaporean students and Japanese students.

Both Singapore and Japan are considered as education-obsessed societies. The number of universities in the two countries, however, is very different, and the pressure to cram for exams might vary according to the degree of competition. Singapore had only three national universities at the time of the survey; this number is far fewer than the number of universities in Japan, which has 99 national universities and 540 private universities in 2006. Moreover, as Japanese society is aging rapidly, the number of applicants taking university entrance examinations is undergoing a sharp decline. In 2006, 62 private universities recruited fewer than 70 percent of the desired number of students and three universities went bankrupt. The competition to enter university is assumed to be fiercer in Singapore than in Japan. The need for cramming in Singapore is consequently higher than in Japan. Singapore society has often been described as “kiasu” - a term used to refer to Singaporeans' innate fear of losing out (Tan, 2012). The authors examined how the need for to cram affects the choice of learning strategies and the development of metacognitive judgment by controlling participants' nationality.

### Design of questionnaires

The authors controlled three factors in this survey: types of school (three levels), nationality (two levels), and high-stakes testing setting or daily setting (two levels). The authors prepared two types of questionnaires: 1) measured cramming behavior and 2) assessed daily learning activities.

Singapore and Japan employ different schooling systems: In Singapore, primary school students take the Primary School Leaving Examination (PSLE) at the age of 11. Based on the results of the PSLE, students are placed in different secondary education tracks or streams: “Special,” “Express,” “Normal (Academic),” or “Normal (Technical).” Both Special and Express are four-year courses leading up to a Singapore-Cambridge General Certificate of Education Ordinary-level (O-level) exam at the age of 15. Junior Colleges (JCs) accept students based on their GCE O-level results and JCs provide a two-year course leading up to the Singapore-Cambridge GCE Advanced Level (A-level) examination at the age of 17.

In Japan, primary school students do not take any high-stakes tests like the PSLE in Singapore when they enter public junior-high school (JH). JH students take an entrance examination to enter High school at the age of 15; each prefectural education board conducts this examination for public HSs but not for private HSs. In most prefectures, except the Tokyo and Osaka metropolitan areas, the public HSs are considered superior to private HSs. To enter a national university, students take two exams; national centralized exam that is administered by the

Ministry of Education, and a second-stage exam that is administered by each university.

At the age of 15 and 17 or 18, both Singaporean students and Japanese students face selection and tracking; the need for cramming is presumed to be higher at these turning points compared to previous years. However, in contrast to Singaporean students who takes the PSLE upon graduation from primary school, Japanese primary school students do not undergo any streaming phase.

### Items

Half of the participants received the “cramming” questionnaire and the other half received the “daily” questionnaire. Each questionnaire was composed of 13 items. Four metacognitive judgments, three MOLS scales, three EOLS scales, and three OOLS scale (TABLE 1). The target academic subject was mathematics.<sup>2</sup> Each questionnaire contained the same items, but the instructions differed. Each question was judged by a six-point scale from one (not at all true) to six (very true).

#### Daily questionnaire: (Singaporean version)<sup>3</sup>

You are supposed to remember three different periods of time and circle a value for each of the following: primary school days (Primary 5, or 10 years old) secondary school days (Secondary 3, or 14 years old), and junior college days (JC1, or 16 years old).

You are supposed to reflect back upon your learning behaviors and attitudes in each of three designated time periods. Please remember your daily learning activities – **not including** cramming for high-stakes testing, i.e., PSLE, O-level exams, and A-level exams.

#### Cramming questionnaire: (Singaporean version)

You are supposed to remember three different periods of time and circle a value for each of the following: primary school days (“Primary 6, or 11 years old”), secondary school days (“Secondary 4, or 15 years old”), and junior college days (“JC2, or 17 years old”).

You are supposed to reflect back upon your learning behaviors and attitudes in each of the three designated time periods. Please remember your daily learning activities – **including** cramming for high-stakes testing, i.e., PSLE, O-level exams, and A-level exams.

Taira et. al. (2005) reported that the Cronbach’s coefficient alpha of each scale (metacognitive judgment, MOLS, EOLS, and OOLS) was .636, .252, .690, and .665 respectively; the participants were 1936 junior high school students. Except for the MOLS scale, each scale seems to have sufficient reliability so the authors considered these items to represent each learning strategy.

### Subjects

76 Singaporean university students and 113 Japanese university students participated in this survey. Thirty-five of Singaporean students completed the “daily” and the rest of them completed to the “cramming”. Fifty-seven

2 In the actual survey, participants were also asked questions regarding Language Arts too. However, because the purpose of teaching and learning in the two countries is very different, it is hard to make a valid comparison. The authors therefore omitted the Language Arts data from this report.

3 The Singaporean students have to take high-stakes test at the age of 11, 15 and 17 years old. The Japanese students have to take high-stakes test only at 15 and 18 years old.

of Japanese students completed the “daily” and the rest of them completed to the “cramming.” All of the students completed the questionnaire in their university’s psychology classes in 2007.

## Results

Two-way ANOVAs were conducted for each nationality and for each scale; the factors were developmental changes (within-subject factor: primary school, middle school, and High school/JC) and settings (between-subject factor: “daily” questionnaire and “cramming” questionnaire).

### Metacognitive judgment

To determine if there were developmental changes in metacognitive judgment, two two-way ANOVAs were conducted for: school type (primary school, middle school, and High school/JCs) and settings (“daily” questionnaire and “cramming” questionnaire) for each country (FIGURE 3).

For the Singaporean students, the main effect of settings and school type were significant, but no significant interaction was found [ $F(1, 74)=6.059, p<.05$ ;  $F(2, 148)=42.748, p<.01$ ;  $F(2, 148)=1.877, p>.10$ ].

For the Japanese students, the main effect of types of school was significant, but there was no significant main effect of settings and there was no significant interaction [ $F(2, 222)=58.240, p<.01$ ;  $F(1, 111)=0.000, p>.10$ ;  $F(2, 148)=1.483, p>.10$ ].

Both groups of the students showed significant developmental changes from primary school to HS/JC. The effect of cramming was significant for the Singaporean but not for the Japanese students.

As shown in FIGURE 3, both groups of the students showed almost the same level of metacognitive judgment in the daily setting. The authors conducted another two way ANOVA for nationality and school type in the daily setting. The results showed a significant main effect of school type [ $F(2, 180)=30.837, p<.01$ ], but no significant main effect of nationality. Additionally, no significant interaction was found [ $F(1, 90)=.171, p>.10$ ;  $F(2, 180)=1.223, p>.10$ ]. These results suggested that the need for cramming facilitated the development of metacognitive judgment for the Singaporean students but not for the Japanese students. This difference between the Singaporeans and the Japanese students might be related to the different degrees of competition required for university admissions in the two countries.

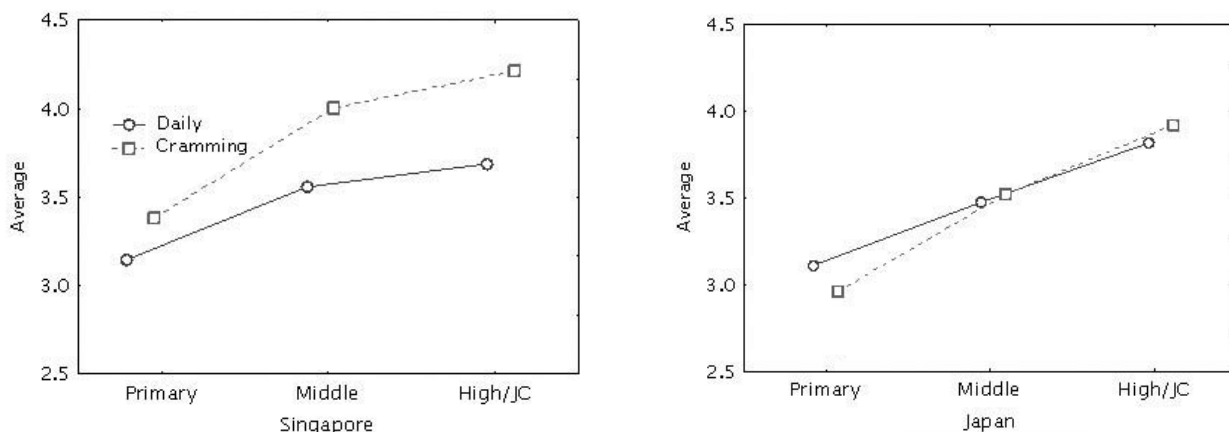


FIGURE3 Nationalities and developmental change of metacognitive judgment



### Memory-oriented learning strategy

To determine if there were developmental changes in the use of MOLS, two way ANOVAs were conducted: school type and settings for each country (FIGURE 4).

For the Singaporean students, there was no significant main effect of settings and no significant interaction. [ $F(1, 74)=.024, p>.10$ ;  $F(2, 148)=.277, p>.10$ ]. A slightly significant main effect was found for school type [ $F(2, 148)=3.000, p<.10$ ].

For the Japanese students, the main effect of school type was significant, but there were no significant main effect of settings and no significant interaction [ $F(2, 222)=24.537, p<.01$ ;  $F(1, 111)=.052, p>.10$ ;  $F(2, 148)=1.053, p>.10$ ].

Both groups of students showed the same tendency to increase the use of MOLS. However, the Japanese students showed clearer acceleration compared to the Singaporean students. The authors conducted another two way ANOVA with nationality and school type serving as the independent factors. The results showed significant main effect of school type as well as significant interaction [ $F(2, 374)=20.443, p<.001$ ;  $F(2, 374)=4.33, p<.05$ ], but there was no significant main effect of nationality [ $F(1, 187)=.001, p>.10$ ]. The simple main effect of nationality on the Singaporean students' use of MOLS was not significant [ $F(2, 374)<1.0$ ], whereas the simple main effect of nationality on the Japanese students' use of MOLS was significant. Furthermore the difference between primary school days and middle school days, and the difference between middle school days and HS/JC days were also significant (Tukey's multiple comparison,  $p<.01, p<.05$  respectively;  $MSw=.923, df=333.92$ ). The Japanese students showed a clear increase in the use of MOLS but the Singaporean students did not. Since the Japanese students showed strong reliance on the use of MOLS as described in table 1 compared to other learning strategies, the current results suggest that they studied mathematics in a "camouflaged" manner.

### Elaboration-oriented learning strategy

To see if there were developmental changes in the use of EOLS, two way ANOVAs with school type and setting serving as the independent factors for each country. (FIGURE 5).

For the Singaporean students, the main effect of school type was significant, but there were no significant main effect of settings and no significant interaction [ $F(2, 148)=60.359, p<.01$ ;  $F(1, 74)=2.305, p>.10$ ;  $F(2, 148)=.714, p>.10$ ].

For the Japanese students, the main effect of school type was significant, but no main effect of settings and no

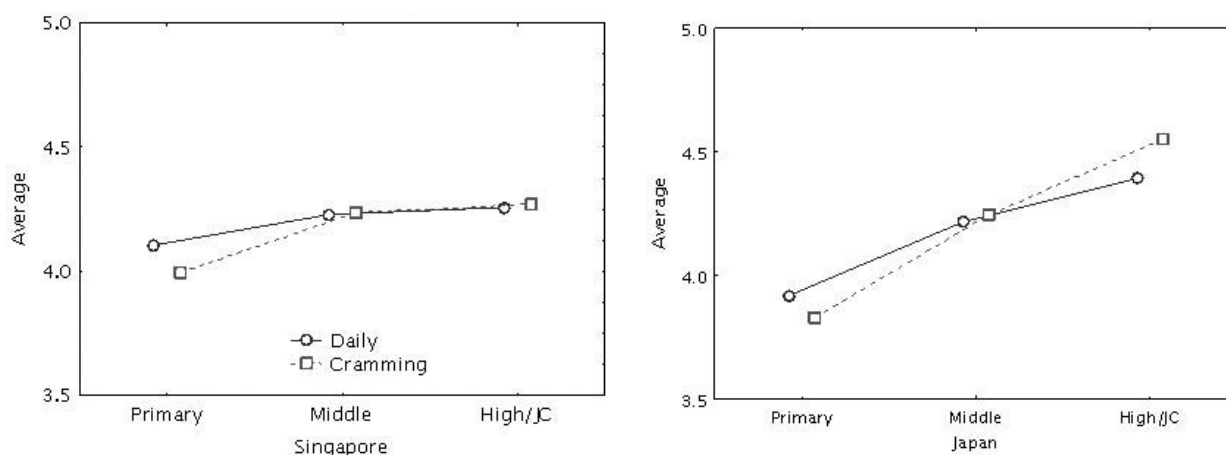
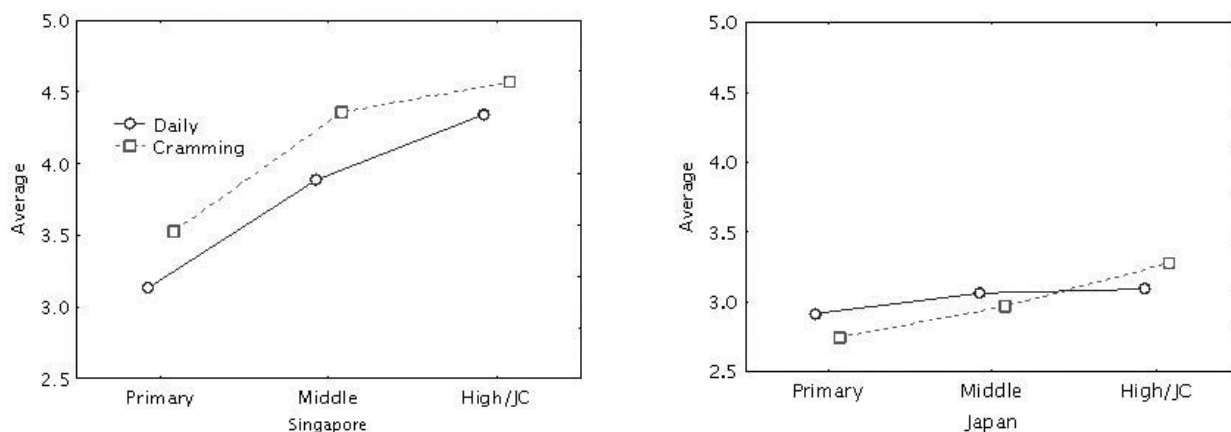


FIGURE4 Nationalities and developmental change of memory-oriented learning strategy



**FIGURE5 Nationalities and developmental change of elaboration-oriented learning strategy**

significant interaction were found [F (2, 222)=7.751, p<.01; F(1, 111)=.019, p>.10; F (2, 148)=2.193, p>.10].

Students of both nationalities showed significant developmental changes in the use of EOLS strategy. However, the Singaporean students showed clearer acceleration, the authors conducted another two way ANOVA for nationality and school type. It showed that significant interaction and significant main effects for both nationality and school type [F (2, 374)=16.615, p<.001; F(1, 187)=38.633, p<.001; F(2, 374)=57.229, p<.001]. As shown in FIGURE 5, the increase in the use of EOLS strategy by the Singaporean students was clear, and there were significant differences between Singaporeans students and Japanese students for all of the surveyed school days (Tukey’s multiple comparison; p<.001, p<.001, p<.001; MSw=1.410, df=290.06). The Singaporean students showed a clear increase in the use of EOLS strategy, which suggests that they might be better learners than the Japanese students.

### Organization-oriented learning strategy

To determine if there were developmental changes in the use of OOLS, two way ANOVAs were conducted with school type and settings serving as the independent factors for each country (FIGURE 6).

For the Singaporean students, the main effect of school type was significant, but the main effect of settings and the interaction were not significant [F(2, 148)=42.93, p<.01; F(1, 74)=1.688, p>.10; F(2, 148)=.76, p>.10].

For the Japanese students, the main effect of the school type was significant, the main effect of settings and the interaction were not significant [F(2, 222)=5.741, p<.01; F(1, 111)=.026, p>.10; F(2, 148)=.803, p>.10].

As with EOLS, the Singaporean students showed clear developmental acceleration in the use of OOLS but the Japanese students did not, so the authors conducted another two way ANOVA for nationality and school type serving as the independent factors. The result showed that the interaction, the main effect of nationality and the main effect of school type were all significant [F(2, 374)=15.463, p<.001; F(1, 187)=17.119, p<.001; F(2, 374)=47.607, p<.001]. As shown in FIGURE 6, the increase in the use of OOLS by the Singaporean students was clear and there were significant differences between Singaporeans and Japanese for all of the surveyed school days (Turkey’s multiple comparison; p<.001, p<.001, p<.05; MSw=1.751, df=254.17). The Singaporean students showed a clearly increase in the use of OOLS, which suggests that they might be better learners than the Japanese students.

When all of these results are considered together, they indicate that the Singaporean students were better learners than their Japanese peers because the Singaporean students employed more effective learning strategies.

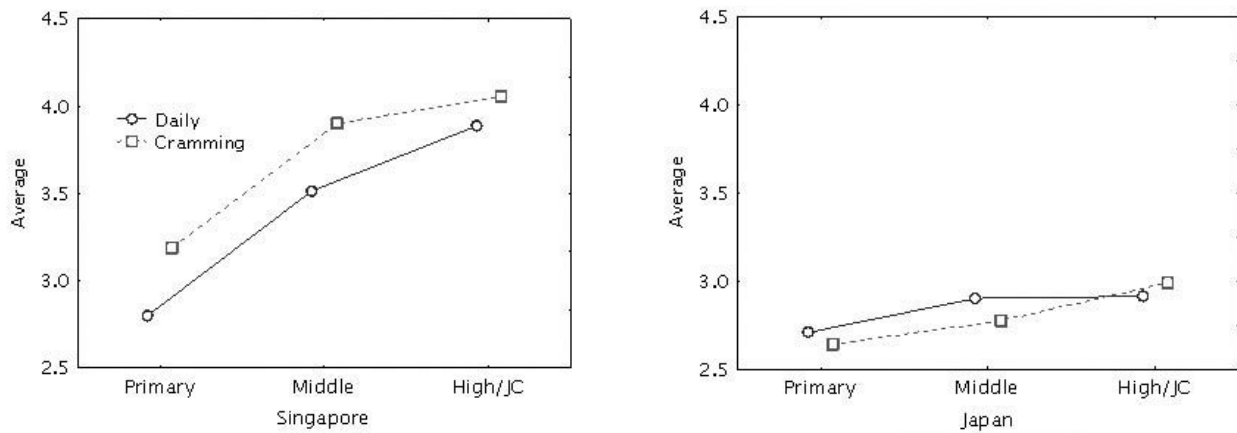


FIGURE6 Nationalities and developmental change of organization-oriented learning strategy

## Discussion

As defined in TABLE 1, the use of EOLS and OOLS is required for authentic learning, and students should be able to make better metacognitive judgments by choosing these authentic strategies.

In the daily setting, the results shown in Figure 3 suggest that both Singaporean and Japanese students showed similar accuracy of metacognitive judgment. However, when it comes to the cramming setting, the Singaporean students surpassed the Japanese students. The Singaporean students also seemed to be better learners compared to the Japanese students for two reasons. They frequently used the EOLS and OOL and they showed less relatively relied on MOLS than did the Japanese students.

The effect of cramming was significant only for metacognitive judgment among the Singaporean students; however, this judgment strongly influenced students' choice of learning strategies. Although there was no clear evidence to connect these two factors – the need for cramming and the choice of authentic learning strategies – the need for cramming might have had some influence on the choices made by the Singaporean students.

These cultural differences might have stemmed from various factors, such as differences in syllabus, curriculum, teaching materials, and teaching methods. However, as the authors indicated at the beginning of this paper, there is a clear difference between Japan and Singapore in terms of the scholastic competitiveness needed to enter the higher education system. In fact, Japanese universities were already expected to face “open admission” in 2008: the number of students who apply to take entrance examinations was estimated to be equal to the number of available positions in universities.

In previous years, Japanese teachers were able to use examinations as a motivator to encourage students to learn in the classroom. For example, many teachers have told their students: “you won't pass the exam if you don't study harder” or “I think this formula may be tested in the next exam.” This extrinsic encouragement might have been previously effective because students and their parents accepted the existence of a competitive exam schedule. However, as Japanese society continues to age rapidly, and as competition grow weaker and less fierce, the importance of cramming for exams is drastically changing. In other words, teachers and parents must create other devices besides high-stakes testing to motivate the students to learn.

Readers may think that this speculation applies only to modern Japanese society. However, cramming is an advantageous for students who are good at cramming in terms of high-stakes test. Compared to those successful students, other students – especially weak learners – tend to experience isolated from peers and sometime feel

“learned helplessness,” a phenomenon described in many psychological textbooks. For those weak learners, passing high-stakes testing is not a sufficient motivator, which means other incentives for learning are needed to replace external reward and punishment.

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**Table 2 Items in the questionnaire**

Metacognitive judgment	1. It was easy for you to see your weak point in learning mathematics. 2. I did not know how to overcome my weak points. 3. There was so much to learn that I devised creative way of learning. 4. I set up goals in learning Mathematics by myself.
Memory-oriented learning strategy	5. In Mathematics classes, rote learning was important 6. I used drills. 7. I tried to copy down everything that was written on the blackboard by teacher.
Elaboration-oriented learning strategy	8. I tried to organize my note to understand meaningfully what I had learned in Mathematics classes. 9. When I learned a new idea, I tried to make a concrete image of it. 10. I tried to understand topics not only by memorizing but also by inferring the meaning.
Organization-oriented learning strategy	11. When I organized my Mathematics notes, I tried to integrate the materials. 12. I tried to create a new conceptual category in which different topics could be grouped. 13. I tried to connect what I had learned in Mathematics classes to daily life.