

Analysis of Achievement on Biology Test in Lao People's Democratic Republic

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Abstract:

We studied the 9th grade science achievements, focusing on Biology, of Lao students in Vientiane capital, Lao People's Democratic Republic (Lao PDR, or Laos). Our survey—using selected questions on Biology from Trends in International Mathematics and Science Study (TIMSS) 2011—was conducted in February 2015 on a total of 388 9th grade students from 3 lower secondary schools (3 districts in Vientiane capital). We analyzed the average correctness of Lao students, and compared them with Japanese and average of all OECD countries. We found that a school with less ideal educational condition in the Outskirts Zone of the Vientiane Capital scored lower points comparing to the Urban schools. Also, it seems that science education in Laos focuses more on Reasoning skills than Knowledge or Application skills.

1. Introduction

Vientiane Capital is a big city in Laos with 9 school districts separating Inner Urban Zone and Outskirt Zone of the city. Using selected questions from the Trends in International Mathematics and Science Study (TIMSS) 2011 test, we collected test data from students of 3 lower secondary schools—a school in Outskirt Zone (school A) and 2 schools in Inner Urban Zone (schools B and C).

School A have relatively high ratio of ethnic students who have some difficulties speaking Lao language fluently. Condition of this school is not ideal. For example, each grade has 4 classes with up to 40 students in each. However, number of classrooms and teachers are not enough to accommodate all students comfortably. On top of it, educational materials such as textbooks and equipment for

scientific experiments are not enough.

Compared with school A, school B and C are located at the Inner Urban Zone of the Vientiane Capital. These schools are with much better educational environment with more educational materials and less students in each class. Especially school B is founded and supported by both Lao and Vietnam governments with enough textbooks and experiment equipment for each student. Also, parents of students belonging to school B and C are economically more stable than school A.

In this report, we will analyze the levels of achievements among these three schools to understand issues and problems in the real educational situation for further research and for the upcoming revision of curriculum and textbooks.

2. Method

2.1. Purpose of study

Main purposes of our study are to:

1. Study science (on Biology) achievements of Lao students in 9th grade.
2. Compare achievements by gender.
3. Compare achievements among Lao PDR, Japan and OECD countries.

2.2. Participants

Our sample includes a total of 388 students (161 male, 227 female) from 9th grade from 3 schools in different districts of Vientiane Capital in Laos. Details of the classes and number of students for each school are summarized in Table 1. These participants (students) are tested on science (specifically on Biology) achievement in academic year of 2015.

Table 1 Participating schools and number of classes and students

Prefecture Vientiane capital	School (Code)	Classes surveyed	Number of students
Outskirts District	School A	4	171
Urban District 1	School B*	3	103
Urban District 2	School C	3	114
TOTAL	3 schools	10 classes	388 students

Notes: * School B is supported by both Lao and Vietnamese government with sufficient facility and teaching materials for all students.

2.3. Material used for our research

In our survey, we used a shorter version of TIMSS 2011 test, where 31 questions are selected for Biology exam. Since number of questions was

less than regular TIMSS test, allocated time for answering them was also made shorter to 60 minutes (regular time is 90 minutes). The selected questions are indicated in Table 2.

Table 2 List of selected Biology questions from TIMSS 2011

Q	TIMSS Block_Seq*	Topic Area	Cognitive Domain	Q	TIMSS Block_Seq*	Topic Area	Cognitive Domain
1	S01_01	CF	K	17	S02_05	ES	R
2	S01_02	LCRH	A	18	S02_04	HH	K
3	S01_03	DANS	A	19	S02_03	ES	K
4	S01_06	HH	K	20	S06_03	CCLPO	A
5	S02_01	LCRH	K	21	S02_02	DANS	A
6	S05_11(1)	ES	R	22	S06_04	CF	K
7	S05_11(2-1)	ES	R	23	S06_02	CF	A
8	S05_11(2-2)	ES	R	24	S06_06	CF	R
9	S05_02	ES	K	25	S07_02	ES	R
10	S02_01	CCLPO	K	26	S07_03	CCLPO	A
11	S03_05(1)	ES	A	27	S07_01	HH	K
12	S03_05(2)	ES	A	28	S07_13	ES	A
13	S03_04	CF	K	29	S05_03	LCRH	K
14	S03_03	ES	A	30	S05_04	CCLPO	K
15	S03_02	DANS	K	31	S07_04	HH	K
16	S03_01	CCLPO	K				

Notes: * TIMSS Block Sequence (Block_Seq) number is a different number than TIMSS Item Number. The characters used to indicate in each column are as follows:

1. Topic area:

- CF—Cells and Their Functions
- LCRH—Life Cycles, Reproduction and Heredity
- DANS—Diversity, Adaptation and Natural Selection
- HH—Human Health
- ES—Ecology Systems
- CCLPO—Characteristics, Classification and Life Processes of Organisms

2. Cognitive domain:

- R—Reasoning
- A—Applying
- K—Knowing

2.4. Data collection

This survey was conducted on February 5 and 6 of 2015. Two staff members of Research Institute for the Educational Science (RIES) visited three schools in Table 1.

2.5. Data entry and analysis.

Survey results (answers to multiple questions) were entered to a Microsoft Excel worksheet during July and August of 2015. The entered data were checked randomly by multiple members or our team for accuracy.

Descriptive statistics such as percentage (%),

mean and standard deviation (SD) were used in data analysis. Once the analysis was completed, we compared it with the averages of Japan and of all countries belonging to Organization of Economic Cooperation and Development's (OECD's).

Table 3 shows the exam results of 3 schools in Vientiane Capital as well as the results of Japan (JPN) and average of all OECD countries for the same selected questions. Scores shown are ratios of obtaining correct answers, or percentage of correct answers. Table 3 also shows the differences between Laos and averages of Japan and all OECD.

Table 3 Average score (in %) of science achievement by each school in Vientiane vs. Japan and OECD

No. of Questions	Total	Cognitive Domain		
		Knowing	Reasoning	Applying
No. of Questions	31	11	8	12
School A	26.8 ± 10.4	19.7 ± 4.5	34.1 ± 5.3	28.4 ± 4.6
School B	44.6 ± 13.0	37.3 ± 5.2	61.2 ± 5.6	40.3 ± 6.5
School C	28.7 ± 10.4	22.8 ± 4.6	40.1 ± 5.7	26.5 ± 5.1
Laos (combined)	32.1 ± 13.5	25.3 ± 5.4	43.1 ± 6.2	31.0 ± 5.8
Japan*	59.2	56.7	55.3	64.1
OECD*	43.3	43.1	38.8	46.4
Laos - JPN	-27.1	-31.4	-12.2	-33.1
Laos - OECD	-11.2	-17.8	4.3	-15.4

Notes: * The scores for Japan and all OECD are manually calculated for the same 31 questions from the published results by International Association for the Evaluation of Educational Achievement (IEA)

3. Results and Discussion

3.1. Comparison among three countries

Figure 1 shows the combined distribution of scores for all 3 schools in Vientiane Capital of Laos.

Average scores for Japan and all OECD countries are also indicated.

This figure shows that while some students are able to obtain more than 60% of correctness (more than 18 correct answers) that is the average

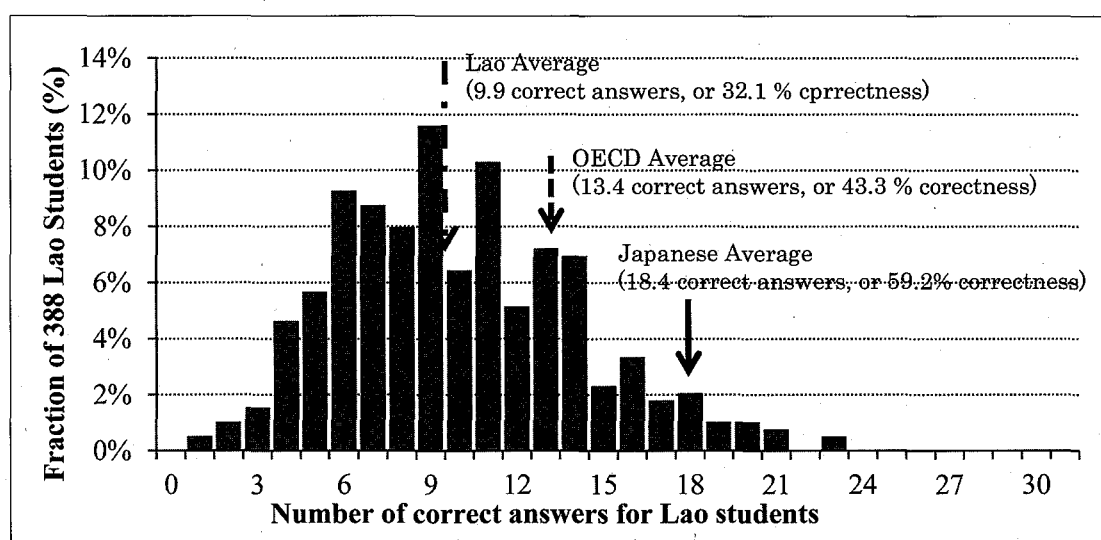


Figure 1. Distribution of numbers of correct answers (out of 31 total) for Lao students from all 3 schools combined. Vertical axis shows the percentage of total number of 388 students who obtained x -number of correct answers. Average number of correct answers for Lao students is 9.9 ± 4.2 indicated by dot-dash line, which corresponds to the correctness of 32.1 ± 13.5 (%). Japanese average (solid line) and OECD average (dash line) is also indicated for comparison.

for Japanese students, most students can answer correctly for less than half of the questions (43.3%, OECD average) as shown. This figure shows that most students in Laos have not reached high enough scientific achievement compared to the other countries (OECD average) by a significant degree.

3.2. Science achievements of three Districts in Vientiane Capital

Among the three schools in Vientiane Capital (schools A, B and C), overall score for school B (44.6% in Table 3) is much higher than the averages for the other schools (26.8% and 28.7%). Considering the characteristics and policy of school B, which is one of special schools within Vientiane, this result matches our expectation. When each cognitive domain is looked at for school B, Knowledge and Application are much above other Lao schools, yet they are still not reaching the OECD and Japanese average. On the other hand, these students scored much higher scores—even higher than OECD and Japanese average—for Reasoning.

Similar trend for scores can be seen for schools A and B as well: Lao students generally have

better results in Reasoning area. This suggests that Lao education is more focused on reasoning skills than simple knowledge or application. Since our survey this time was limited to only 3 schools in Vientiane Capital, we cannot conclude about this or treat this as a representative of entire Laos, but at least it is very interesting that all 3 schools from Vientiane shows the similar trend regardless of their educational environment.

3.3. Comparing science achievements by gender in Laos

Figure 2 and Table 4 show the distribution of number of correct answers for our survey by genders in 3 schools in Vientiane capital. In Figure 2, bars with red stripes indicate the distribution of girls and those with solid blue color indicate boys. Average scores for both genders are indicated in the figure. When looking at the distribution, both boys (9.5 ± 4.4) and girls (10.3 ± 4.0) have similar distribution with the similar highest lowest scores. Table 4 confirms that between boys and girls, there is no significant difference between genders.

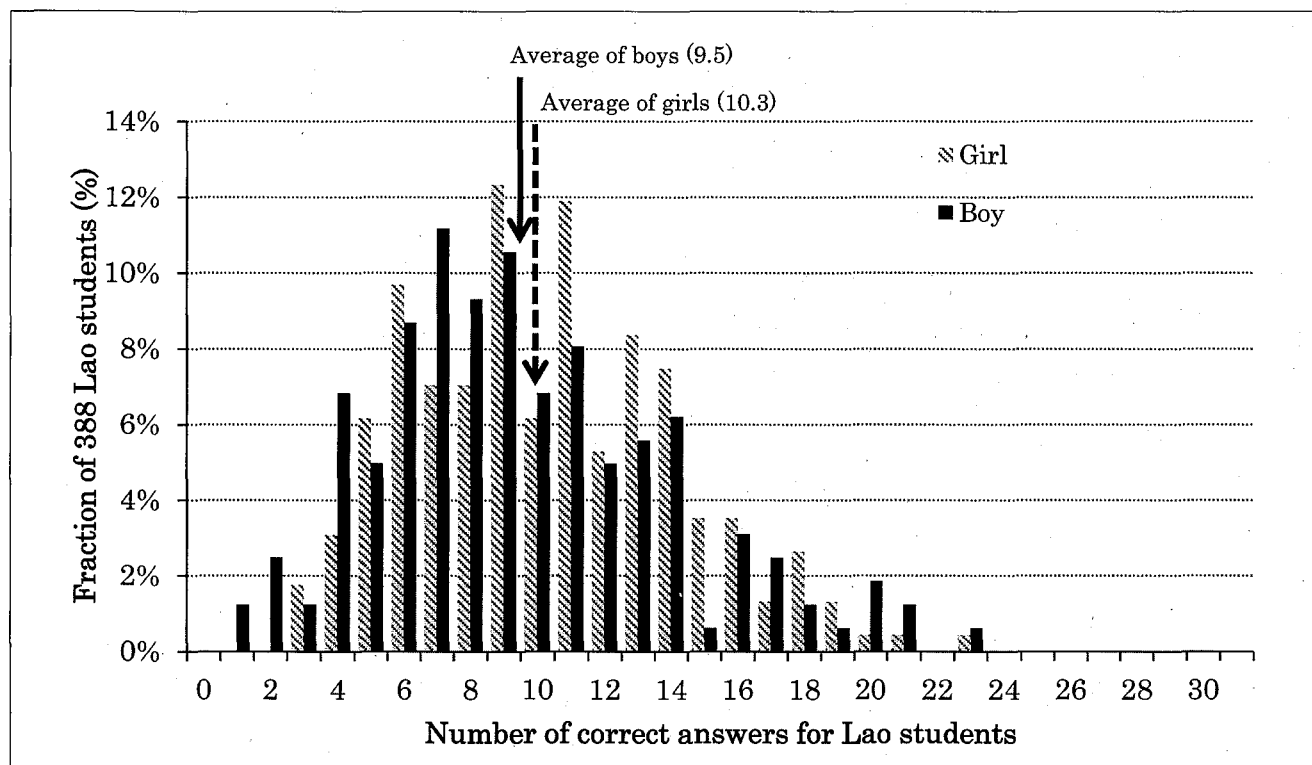


Figure 2. Percentage distribution of students for correct answers out of 31 total questions for Vientiane capital. Red stripes indicate girls and solid blue indicates boys. Total number of boys from 3 schools are 161 and girls are 227 students (total to 388 students). While girls have slightly higher average (10.3) than boys (9.5) there are no significant different between genders (as can be seen in Table 4).

Table 4 Score statistics for in Vientiane capital

	Vientiane		
	Total	Girls	Boys
Number of Students	388	227	161
Average score	9.9	10.3	9.5
Standard deviation	4.2	4.0	4.4
Median	9.0	10.0	9.0
Mode	9.0	9.0	9.0

3.4. Comparing Scores of Laos to Japan and OECD countries

Figure 3 shows the average scores for each question for Laos (blue slanted lines), Japan (solid red) and OECD (green horizontal lines) countries. As it is apparent from this figure, Lao scores are usually much lower than the other two. However, for some questions, it shows that Lao students are scoring better than OECD and even Japanese students.

Looking at individual scores, Lao students tend to have higher correctness in questions 2, 5, 7-9, 17, 25 and 31. These questions belong to LCRH (Life Cycles, Reproduction and Heredity: Q2 & 5), ES (Ecology Systems: Q7-9, 17 & 25) and HH (Human Health: Q31). Since our focus is simply analyzing the general pattern of Lao student's achievements, looking into each question will be

differed to sequential papers. However, by looking at the different topic areas of the TIMSS 2011 exam used, we might be able to say that these areas are more directly related to Lao everyday life than the other topic area (i.e., 'Cells and Their Functions', 'Diversity, Adaptation and Natural Selection' and 'Characteristics, Classification and Life Process of Organisms'). In other words, the latter topic areas where Lao students are having trouble are not directly related to student's life and hence not treated enough in the topic of World Around Us (WAU).

However, since not all questions in each topic area have the same tendency—some questions for HH (Q4, 18 & 27) Lao average score is much lower than Japan and OECD—the summary above are not conclusive at all until detailed analysis of individual questions are conducted.

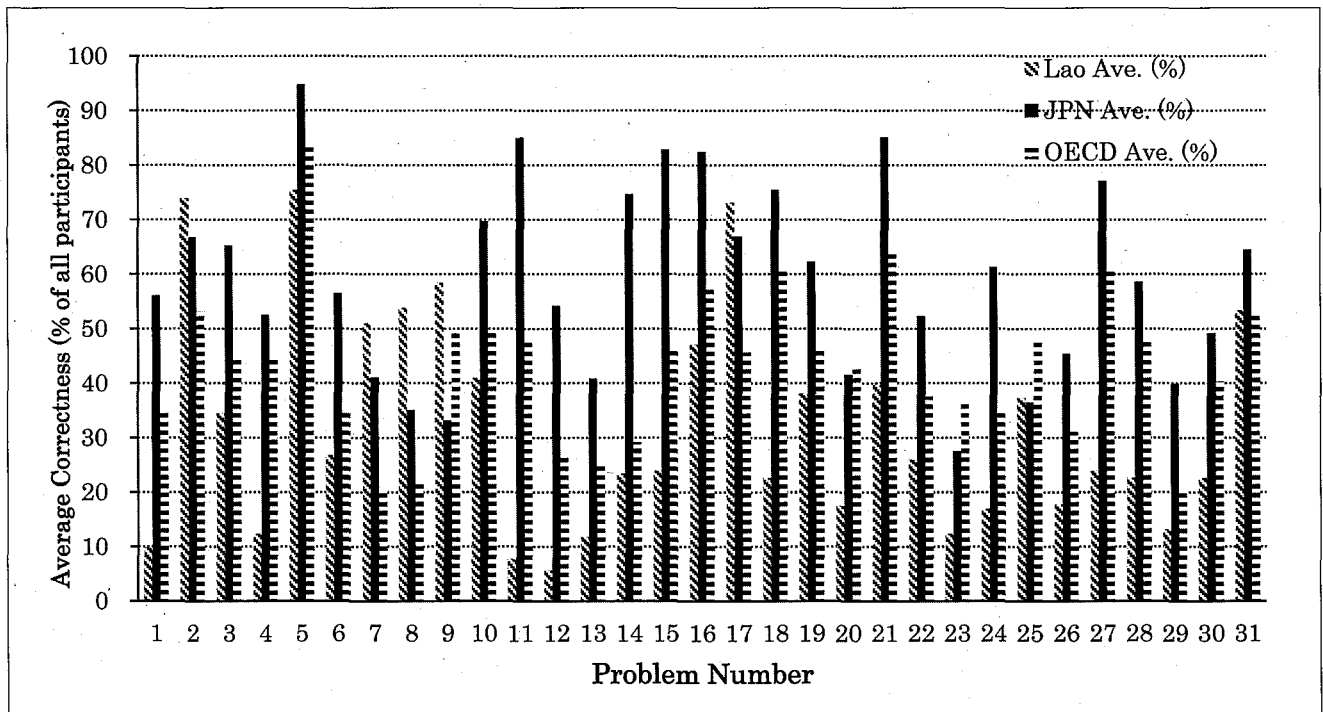


Figure 3. Average percentage scores of each problem for Laos (blue slanted lines), Japan (solid red) and OECD (green horizontal lines). For some questions, Lao students reached better scores than Japan or OECD average. This might be due to these questions might be related to Lao everyday life than other countries.

Figure 4 shows the average scores for different cognitive domains and topic areas for Laos (blue slanted lines), Japan (solid red) and OECD (green horizontal lines) countries. From this figure, it is clear that Lao students have relatively high (about the OECD averages) scores for a cognitive domain of Reasoning (R) and topic area of Life Cycles, Reproduction and Heredity (LCRH) as well as Ecology Systems (ES). A reason for this might be because lives of Lao people are mainly supported by

agriculture, which most people are associated with. Topic areas of LCRH and ES are strongly related to agriculture compared to other topic areas. Since the detailed analysis for each question is out of the scope of this paper, from Fig. 4, it is not conclusive why Lao students are good in cognitive domain of reasoning compared to knowledge and application. But this might also relate to the same reason as above.

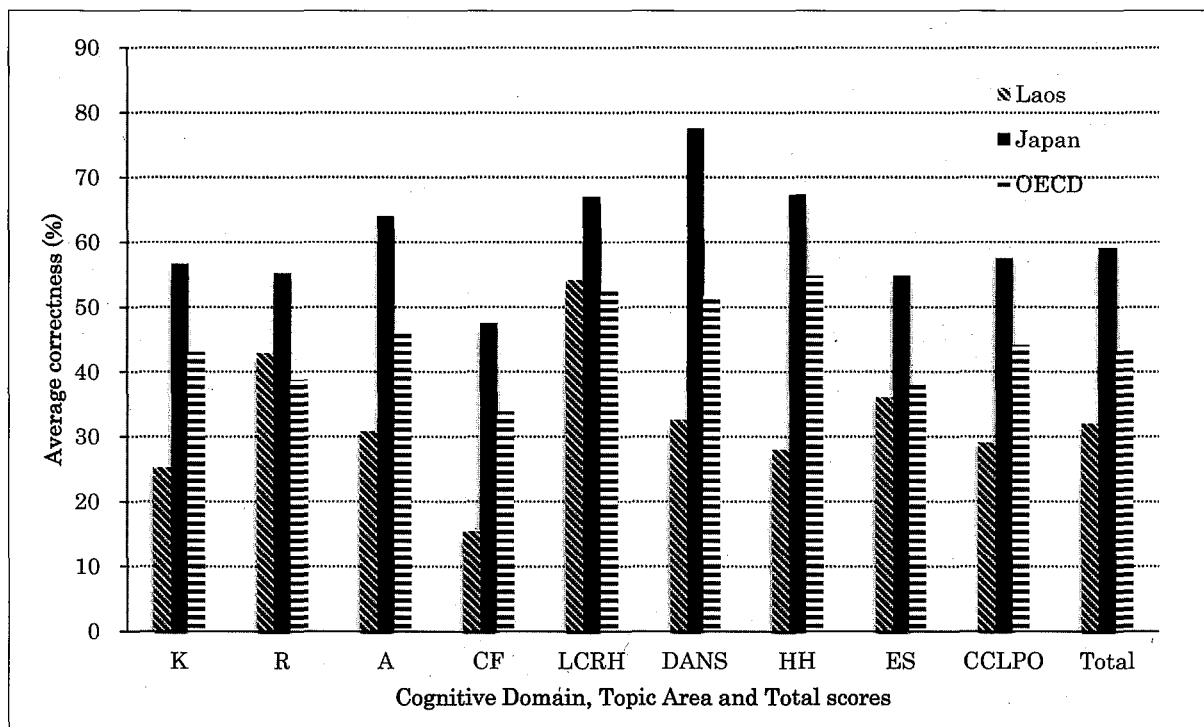


Figure 4. Average percentage scores of different cognitive and topic areas for Laos (blue slanted lines), Japan (solid red) and OECD (green horizontal lines). Abbreviations on the horizontal axis is the same as in the notes of Table 2. Lao students reached relatively higher scores for Reasoning domain as well as in topic areas of LCRH and ES.

In the future, we are planning to study further into details of individual questions. At the same time, we are hoping to have a chance to observe the actual science classes of Lao junior high schools in near future.

4. Conclusion

In this study, we conducted a survey of science achievements for Biology in Vientiane Capital using selected questions from TIMSS 2011. Our analysis shows that while students in School B have much higher score than other two schools in Laos, there is no considerable difference when statistically analyzed due to very large standard deviations.

Analysis between genders of Lao students also shows no difference at all. This indicates that at least there is no educational difference between boys and girls in Laos, or both genders are taught equally in education.

On the other hand, when the science achievements are compared among Laos, Japan and the average of OECD countries, we saw there is still a huge gap between the world and Laos. For some questions, which might be strongly related to Lao everyday life, Lao students are scoring much better than Japan and OECD countries. Yet as shown in Fig. 3, Lao students are left behind for most of the questions. By analyzing different cognitive domains, it shows Lao students are especially weak in

knowledge level and application of what they have learned.

In our future study we are planning to further analyze the details of individual questions as well as to observe the actual lessons conducted in Laos to come up with how to improve the weak points of scientific achievements for Lao students.

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