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メタデータ	言語: English 出版者: 公開日: 2012-03-08 キーワード (Ja): キーワード (En): 作成者: TUPAS, Fernan Peniero, MATSUURA, Toshihiko メールアドレス: 所属:
URL	https://doi.org/10.32150/00006008

A Comparative Study of Science Lessons in Elementary and Secondary Education in Japan and the Philippines

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日本とフィリピンの初等・中等教育における理科授業の比較研究

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ABSTRACT

This study compared science lessons in elementary and secondary education in Japan and the Philippines. Unlike the system of public schools in Japan, schools in the Philippines organize students into classes according to academic ability. To stimulate interest in science, teachers in both nations devise various methods of instruction. Laboratory resources provided in Japanese schools are more substantial than those in the Philippines, where more focus is placed on extracurricular science activities. In a survey, Japanese science teachers answered that an advantage of the science textbooks they used was their colorful illustrations, while the lack of scientific explanations and the inclusion of answer keys were drawbacks. Teachers in the Philippines indicated that the advantages of the science textbooks they used were ease of understanding and their inclusion of suggestions for various activities, while the high number of errors they contained and a lack of illustrations were drawbacks.

1. Introduction

School classrooms are places where individuals are nurtured to become productive and responsible members of society, and can be seen as a second home for students. Various educational activities are carried out in classrooms, and students generally take lessons

covering a range of subjects. Science in particular is one of the most important subjects in schooling.

Comparisons of science curricula in elementary education^{1,2)} and secondary education³⁾ between the Philippines and Japan have previously been made. Tupas and Matsuura reported on a comparison of prescribed science

textbooks for public schools,⁴⁾ and examined similarities and differences between science education curricula across the entire spectrum of basic education in the two countries.⁵⁾ However, there was previously a lack of focus on science lessons in research, which promoted us to pursue this study. The main purpose of the study was to compare public school science lessons in Japan and the Philippines. A questionnaire survey of teachers was also conducted to clarify the advantages and drawbacks of the science textbooks used.

2. Method

A number of articles and websites were used as references for this study, and schoolteachers in the Philippines and Japan were invited to complete the questionnaire. The Philippine participants were science teachers at Alejo Posadas Memorial Elementary School and Ajuy National School in the city of Ajuy in the Philippines' Iloilo Province. To further clarify the situation of Japanese science education, we interviewed principals, vice-principals and science teachers from three linked schools: Hakodate Elementary School attached to Hokkaido University of Education (HUE), Hakodate Junior High School attached to HUE, and Hakodate Municipal High School in the city of Hakodate in Japan's Hokkaido Prefecture. Participants in teachers' workshop held at HUE also contributed to the study.

3. Results and discussion

3.1. School systems and class organization

In Japan, public schools usually have classes from Monday to Friday with the school year starting in April and ending in March. Elementary and junior high schools generally

have trimester per school year with holidays in summer, winter and spring.⁶⁾ High schools have semester or trimester, with the former becoming more common recently. Japanese children whose 6th birthday falls on or before April 1 enter the first grade of elementary school in that year, and all children must enter junior high school at the age of 12.⁶⁾ After graduating at 15, pupils may choose continued studies at an upper secondary education establishment or seek employment. About 97% of students enter upper secondary education establishments such as senior high schools and national colleges of technology (known as *kosen* in Japanese). According to statistics, in 2005 there were 23,123 elementary schools, 11,035 junior high schools and 5,418 senior high schools in Japan. The numbers of students at elementary, junior high and high schools were 7,197,458, 3,626,415 and 3,605,242, respectively.⁷⁾ The quota of students is 40 per classroom, but classes in many schools do not reach this capacity due to the decreasing birthrate.⁸⁾ It is rare for students to be divided into classes according to academic ability in Japanese public schools.

In the Philippines, the school year starts in June and ends in March, with a five-day break in October, a two-week break in December, and a summer break in April/May. All public schools carry out grading in August, November, January and March. Overall, 96.77% of Filipino children enter elementary school at the age of 7. After graduating at the age of 12, 66.09% immediately enter high school, and graduate at 16.⁹⁾ As of 2009, there were 44,691 elementary schools and 10,066 secondary schools on the nation's 7,107 islands. The numbers of students at elementary schools and high schools across the entire archipelago were 13,686,643 and 6,763,858, respectively.¹⁰⁾ Public schools in the

Philippines usually have about 40 students per classroom, but those in larger cities have 60 or more. In Justice Cecilia Muñoz-Palma High School in Quezon City, for example, there are 100 students to each classroom.¹¹⁾ Philippine schools usually organize students into classes according to academic ability as demonstrated by indicators such as entrance examination results and report cards.

3.2. Science teachers

In Japan, teachers must have a teacher's license obtained by taking prescript credits at a university. Passing the teacher employment examination of a prefectural board of education allows them to work at public schools as regular teachers.¹²⁾ In the Philippines, the professional regulation commission (PRC) controls teacher's licensure examinations. Elementary school teachers in both countries generally teach all subjects including science, but science teachers in secondary education are specialists. In particular, Filipino science teachers at high schools teach their specific field of expertise (general science, biology, chemistry or physics).

3.3. Lesson plans and strategies for science lessons

In Japan, teachers are obliged to prepare lesson plans, but these are not necessarily checked by superiors. In the Philippines, science teachers are required to create plans for all lessons, and these are checked by the science coordinator or head teacher before the start of each lesson. In some schools, teachers failing to make lesson plans incur penalties, so many utilize ready-made plans issued by the Department of Education (DepEd).

Philippine teachers use a variety of strategies and motivational techniques to make science fun and interesting. Elementary school teachers

generally employ a range of teaching methods such as discussion, experimentation, discovery, games, puzzles, storytelling, and question-and-answer sessions, and use real objects and pictures. Science teaching methods used in high schools include the predict-observe-explain (POE) technique, the practical work approach, use of rotational learning stations, tricks in chemistry, demonstrations, group activities, concept mapping, and understanding by design (UbD). The POE technique is a teaching strategy that probes understanding by requiring students to carry out three tasks. First, they must predict the outcome of an event and justify their prediction; then, they describe what they see; and finally, they must reconcile any conflict between the prediction and the actual observation. POE is used in association with demonstrations or hands-on activities. Meanwhile, UbD is a popular tool for educational planning focused on teaching for understanding, and provides a framework for improving student achievements.

3.4. Science laboratory equipment

Figures 1 (a)-(c) show scenes from science laboratories in public schools in Japan. All schools in the country have a science laboratory with a variety of equipment suitable for the subjects to be taught. Chemicals are stored in a separate staff room for safety reasons. In the Philippines, there is a lack of laboratory equipment in some public schools. To ensure effective science teaching, most Filipino science teachers use their initiative to improvise science equipment from everyday materials or discarded items. Pupils in public elementary schools can only view science equipment displayed in a cabinet, as shown in Fig. 1 (d). High school students can use science equipment, but not everybody has a chance for hands-on ex-

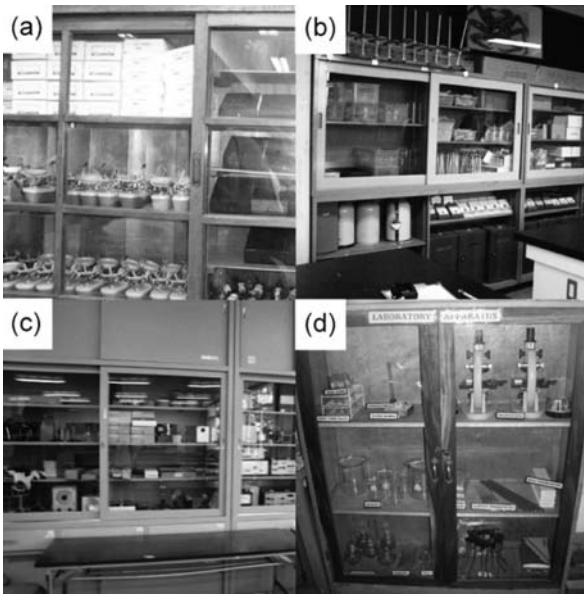


Figure 1 Scenes from science laboratories of public schools in Japan and the Philippines. (a) Hakodate Elementary School, (b) Hakodate Junior High School, (c) Hakodate High School, and (d) Alejo Memorial Elementary School.

perience of it during experiment lessons.

3.5. Science lessons

Figure 2 shows scenes from science lessons in public schools in Japan and the Philippines. Japanese science teachers are authorized to develop science teaching based on the course of study, and conduct lessons using blackboard presentations with various colors of chalk. Group discussions and science experiments are also performed depending on the nature of the lesson, as shown in **Figs. 2 (a) and (b)**. At Hakodate Junior High School attached to HUE, students write their experiment hypotheses and results on worksheets during lessons to enhance their understanding of science, and also use them to note their considerations and discussions on experiments. Notations may be made in the form of symbols, drawings or writing. The contents of this worksheet are approved by the vice-principal, and all parents pay a fee of 300 yen for each worksheet.

Science components in the Philippines are fixed because the DepEd stipulates precise standards for all public schools, and these components are strongly related to the grading system. Science teachers administer daily quizzes and assignments to evaluate comprehension among students, who must also submit four projects each school year. In addition, teachers push students to play an active part in class discussions and experiment lessons, as shown in **Figs. 2 (c) and (d)**. Philippine teachers are encouraged to make worksheets (commonly referred to as laboratory manuals), which are then approved by the science coordinator and principal and made available for students to purchase at prices ranging from 180 to 250 pesos depending on the number of pages.

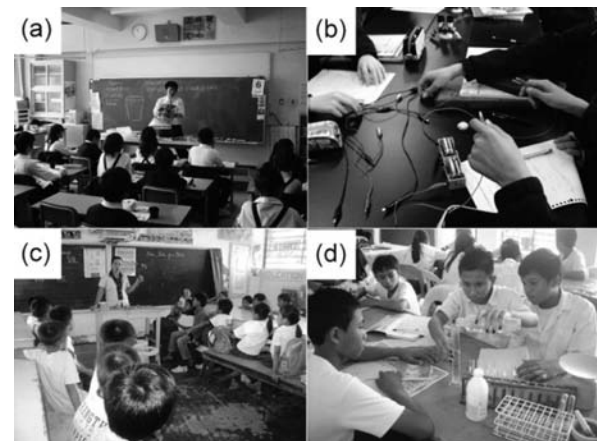


Figure 2 Scenes from science lessons in public schools in Japan and the Philippines. (a) Class discussions at Hakodate Elementary School, (b) Science experiments at Hakodate Junior High School, (c) Class discussions at Alejo Memorial Elementary School, (d) Science experiments at Ajuy National High School.

3.6. Grading system for science subject

In Japan, students generally move to the next grade as scheduled, as long as there are no particular issues. Public schools adopt an absolute assessment standard by which students are evaluated according to the degree of achievement

of the study target. Three levels (good, average and slow) are used for assessment at Hakodate Elementary School attached to HUE, with homeroom teachers evaluating students at the end of each term based on test scores and day-to-day performance. In Hakodate Junior High School attached to HUE, the criteria follow five grades: excellent (100 – 75%), very good (74 – 50%), good (49 – 25%), average (24 – 12.5%) and poor (12.5 – 0%). The teacher in charge of each subject provides evaluation for performance in that area.

In the Philippines, the DepEd stipulates certain criteria for each subject to enable evaluation of students' performance. Science assessment in public elementary schools is based on the total score from periodic examinations (25%), summative tests (15%), experiments (25%), class recitations (20%), projects (10%), and assignments (5%). In public high schools, the criteria for science are experiments (35%), periodic examinations (25%), projects (20%), assignments (10%), and attendance/attitude (10%). Science teachers issue academic assessments at the end of each school term (in August, November, January and March), and the average of these assessments becomes the final grading for the school year. Students failing to achieve the 75% pass mark must retake the subject the following year or attend summer classes.

3.7. Extracurricular science activities

In Japan, not all schools have science clubs that provide opportunities for students to experience natural environments such as lakes, forest and beaches. Against this background, parents who are enthusiastic about their children's education may have them attend hands-on classes provided by private or public

organizations. Most junior high school students in Japan go to a private cram school (known as a *juku*) after the regular school day ends.

Extracurricular science activities in the Philippines are actively promoted, with students enjoying various initiatives (e.g., science camps, science educational tours, tree/mangrove planting and beach cleaning) organized by science clubs. The science quiz bee – a quiz contest entered by teams representing their schools – is also a popular event. Although these activities are not compulsory, science teachers may award extra evaluation marks to students engaging in them.

3.8. Science textbook questionnaire results

Science textbooks used in Japan are written in Japanese, and science teachers often use them in class for reference. **Table 1** shows questionnaire results from Japanese teachers regarding the advantages and drawbacks of these books. The most common answer regarding advantages was that colorful illustrations are provided, while the most commonly cited drawback was that answer keys are provided at the back of textbooks; teachers believe that these detract from students' motivation to consider their answers carefully. Senior high school teachers believe that explanations of scientific phenomena in textbooks are insufficient.

Science textbooks used in the Philippines are written in English, and teachers generally use them for guidance and reference in lesson discussions and experiments. Science education should be provided in English, but in reality some teachers speak in Filipino or regional dialects to aid understanding of scientific concepts because not all students fully understand English. **Table 2** shows questionnaire results from

Table 1 Questionnaire results from Japanese teachers regarding the advantages and drawbacks of the science textbooks they use.

(a) Advantages

Kinds of School	Colorful illustrations	Ease of understanding	Arrangement of lessons	Emphasis of keywords	Usefulness of references
Elementary School	7	2	1	0	2
Junior High School	1	1	0	0	0
Senior High School	4	2	4	2	0
Total	12	5	5	2	2

(b) Drawbacks

Kinds of School	A lack of explanations	Answer keys	None	Excessive volumes	Difficulty of understanding
Elementary School	2	6	1	0	0
Junior High School	1	1	0	0	0
Senior High School	5	1	2	2	1
Total	8	8	3	2	1

Table 2 Questionnaire results from Filipino teachers regarding the advantages and drawbacks of the science textbooks they use.

(a) Advantages

Kinds of School	Ease of understanding	Suggestions for various activities	Illustrations
Elementary School	4	3	2
High School	4	4	1
Total	8	7	3

(b) Drawbacks

Kinds of School	A lack of illustrations	Misprints
Elementary School	1	1
High School	2	2
Total	3	3

Filipino teachers regarding the advantages and drawbacks of the science textbooks they use. The most common answer regarding advantages was ease of understanding, and the various activities suggested to stimulate student interest were also often cited. In terms of draw-

backs, Philippine teachers pointed out the problem of a large number of errors contained in textbooks and a lack of illustrations.

4. Conclusions

We compared science lessons across the entire spectrum of basic education in Japan and the Philippines. It was found that teachers in both nations devise various instruction methods to stimulate students' interest in the subject. An advantage of Japanese science textbooks was their use of colorful illustrations, while drawbacks included a lack of scientific explanation and the inclusion of answer keys. Advantages of Philippine science textbooks included their ease of understanding and the inclusion of suggestions for various activities. Drawbacks included a large number of errors and a lack of illustrations. Laboratory equipment provision in Japanese schools was substantial, while schools in the Philippines tended to promote extracurricular science activities more.

Appendix

Survey sheet

School ()

Q1. What is an advantage of the science textbooks you use?

Q2. What is a drawback of the science textbooks you use?

Acknowledgments

Our sincere thanks go to Ms. Sakura Hosokawa, Ms. Yukie Sakairi, Mr. Kazutoshi Ise and Mr. Yuki Hoshi for their translation work. One of the authors (F.P.T.) was supported by

MEXT's scholarship program for teacher training. This study was partly supported by a Grant-in-Aid for Young Scientists (B) from the Japan Society for Promotion of Science.

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