

A Comparative Study of the Elementary Science Curriculum of Philippines and Japan

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Introduction

The 21st century was the century of progress in science. Science and science education spread around the world (Sumida, 2002). The important role played by science as one of the pillars of development is now recognized by almost all nations. Drori (2000) pointed out that all nations, big and small, rich and poor—strive for the development of their science programs. Such scientific development enables all countries to provide good living conditions for their citizens and to achieve international status and economic stability. Posadas (1993) stressed that economic development could be attributed to the science and technology program of any country. It is not surprising therefore, that science curriculum became a new object of study by educational scholars.

In the advent of the social and environmental changes brought by science and technology, people are so much concern on how the school curriculum responds and prepares the learners to meet the needs and demands of what Knight (1986) called as the “age of science” or in the “knowledge society” described by Drucker (2002).

This paper aims to compare the elementary science curriculum between the Philippines and Japan. It aims to study the commonalities and the differences of the science curricula in each country in terms of the two essential aspects of the science curriculum:

1. Purpose—refers to the aims and goals of the curriculum. What types of goals are emphasized in the elementary science curriculum in both countries?

2. Content and Organization—content refers to the science topic areas and to the expected learning outcomes or the learning competencies that the learners are expected to develop. How are the curricula different? How are they similar? Organization—refers to the arrangement of the curriculum elements into a subjective entity. How these contents were structured? What principles were used in organizing the content?

Japan is well known in the world not only as an economic giant but also as a leader in the field of science and technology. Aside from this, Gardner (2000) points out that as far as educational systems are concern, the Japanese elementary school is one of the best in the world. On the other hand, the Philippines is one of the countries in Southeast Asia striving to strengthen its science education program. National and international examinations showed that the state of science performance in the Philippines is poor. For example, in the study conducted by the 1999 Third International Mathematics and Science Study Repeat (TIMSS-R), the Philippines ranked third from the bottom among the 36 countries that participated. Results of national examinations such as the NEAT (National Elementary Assessment Test) and the NSAT (National Secondary Assessment Test) also show that the achievement of Filipino children in science never go beyond 50%. These show that the Philippines needs drastic changes to be at

par with other countries in science education. It is recommended therefore for the Philippines to study the science curricula of other advance countries, like Japan, to adopt good curricular practices and innovative ideas that could improve its science curriculum.

The Japan and Philippines intended science curriculum for elementary level was used as the main document for the study. To make the analysis and comparison more meaningful, this paper includes a brief introduction of the educational system of the Philippines and of Japan. This paper also includes a short outline of the historical development of science education in both countries. These are necessary in understanding the socio-political context in which the curriculum is situated and developed. This study is necessary to examine the good curriculum practices that can be adapted between the two countries and identify areas for improvement.

I. Brief Description of the Educational System of the Philippines and Japan

A. The Philippine Educational System for Basic Education

As Table 1 shows, basic education in the Philippines is composed of six years of elementary education and four years of secondary education for a total of ten years. It is one of the shortest in the world. With the current system, Filipinos will be able to complete basic education at the age of 16 or 17. Basic education in the Philippines is free in all levels and elementary education is compulsory. The government owned most of the basic education institutions in the Philippines although there is a great number of private schools offering basic education in the country. The school year in the Philippines starts in the month of June and ends in the month of March. The total number of school days is not less than 200 days and it is divided into four grading periods. Classes were conducted from Monday to Friday,

The central office of the Department of Education sets policies and standards in Philippine education. The regional and division offices implement these policies and

standards. Curriculum development in the Philippines is highly centralized. The Bureau of Elementary, and Secondary Education, Curriculum Development Divisions is responsible of developing the curriculum. The bureau defines the learning competences for each subject areas, conceptualize the structure of the curriculum, and formulate national curriculum policies. In exercising this function, other sectors, organizations, and agencies (public and private) were consulted. Often times, teachers, administrators, and teacher education institutions are also consulted for some curricular issues and plans for innovations.

B. Japan Educational System in Basic Education

As shown in Table 2 the Japanese system in basic education is composed of six years of elementary school, three years of lower secondary school, and another three years of upper secondary school. Elementary and lower secondary are compulsory. The government owns most of the schools in basic education in Japan although some private schools also exist. Tuition and textbooks are free of charge. Over 95% of students continue to study to upper secondary school, where subjects are divided into those included in the general education course and those included in the specialized education course (Yoshida, 2004).

Basic education in Japan is centralized like any other countries. The Japanese Ministry of Education, Science Sports and Culture formulates the curriculum standards and policies. Under the current curriculum that was revised in 1998, there are six subjects offered for Grades 1 and 2, seven subjects from Grades 3 to 4, and eight subjects for grades 5 and 6. In lower secondary education, students have nine subjects, and 9 subject areas are also taught in the general education course at the upper secondary school. The Ministry of Education, Science, Sports and Culture prescribed credit units for each subject.

II. Historical Development of Science Education in the Philippines and in Japan

A. Science Education in the Philippines

As shown in Table 3 science education in the Philippines has a long history. Although educational institutions exist during the Spanish regime, a systematic public school system was organized and introduced only in 1901 by United States (Fajardo, 1999). There were few evidences to show that science was already introduced in the country during the Spanish regime particularly in basic education level. Science was first introduced by the Americans in 1904 under the subject matter Nature Study, but abolished after a year to give more time to language arts. Science was again introduced in 1935 with focus on nature and health. The importance of science to development was recognized only in the 1950s by leading scientist. In 1957, Science became a part of the curriculum from Grade 1 to six. This was one of the effects brought by the launching of Sputnik I by the former USSR in 1957. Table 3 highlights the historical development of the elementary science curriculum in the Philippines from 1948 up to the present.

It can be noted that significant changes in science education in the Philippines were influenced and funded mainly by foreign institutions and governments. The trends of science education in US brought and influenced significant innovations in the development of science education curriculum in the Philippines. Filipino teachers and some Filipino scientist were not consulted most of the time during the process of conceptualizing and developing the science curriculum.

B. Science Education in Japan

Science education in Japan dates from the 19th century and has a history of 100 years, and during this time, there have been a lot of changes made. After the World War II in 1947, the Japanese Ministry of Education, Science, Sports and Culture issued an official course of study as the basis of the curriculum. Since 1947, the curriculum has been changed every 10 years. Table 4 shows the

significant development in science education in Japan.

The aim for these revisions was to imbue students with a “zest for living” rather than in terms of the quantity of knowledge acquired. Also these revisions aims to develop among the learners a rich sense of humanity and social sensibilities as well as the ability to learn and think for themselves, and at the same time to enrich and strengthen a form of education that encourage students to realize their individuality within an educational environment that allowed time for thought and reflection. The basic principles of reform in science were set out as follows at the time of revision:

1. Science classes should be related to children's experiences in the environment and daily life and encourage children to make observations and experiments for their own purposes. The emphasis will be placed on children's development of intellectual interest and inquiring mind towards the nature and abilities to solve problems and view things variously and comprehensively.
2. The contents considered difficult for a certain grade will be taught in the next grade or upper, or even eliminated, and the teaching contents that relates closely to the environment in the neighborhood and daily life will be prioritized.
3. At the elementary level, experiments and observations and learning that are related to daily life will be prioritized. Some of the contents of the elementary schools such as plants' transpiration, neutralization, metal combustion and movement of stars will be taught at lower secondary school.

III. The Elementary Science Curriculum of the Philippines and Japan

A. Goals of the Science Curriculum in Elementary School

In terms of the goals of the curriculum, the goal of

science in the elementary school curriculum in the Philippines is:

Demonstrate understanding of how science, technology, and health relate to the comprehension of the environment and application of skills, attitudes and values in solving varied life situations.

In Japan, the overall objective of science education in the elementary school is:

To enable students to become familiar with the nature and to carry out observations with identifying clear purpose, also to develop their problem-solving abilities and nurture hearts and minds that are filled with a love of the natural world, and at the same time to develop their understanding of natural phenomena, and scientific views and thinking.

Although both countries share the same concern on the development of scientific skills, attitudes, and thinking skills in their science curricula, the curriculum goals of science between Philippines and Japan differ significantly in terms of focus and emphasis.

It is apparent that the goal of elementary science curriculum in Japan places great importance on the role of learning science in understanding natural phenomena and developing love of nature. The dependency of living things on each other on the physical environment was emphasized and explained in the curriculum. In this way the elementary science curriculum of Japan fosters the kind of intelligent respect for nature among the students. This kind of act is important in science education as mentioned by the American Association for the Advancement of Science (1990).

On the contrary, the Philippine elementary science curriculum focuses its goal to help the Filipino child gain a functional understanding of science concepts and principles linked with real-life situations, acquire science skills as well as scientific attitudes and values needed in solving everyday problems. These problems pertain to the

concerns on nutrition and health, sanitation, food production, and the environment and its conservation. These are mentioned by UP-NISMED (2001) as the immediate problems and issues in the Philippine communities that should be emphasized in the elementary science curriculum.

B. Science Curriculum Contents and Structure

In terms of content, the elementary science curriculum of the Philippines and of Japan, are the same and different in terms of its organizing themes. Table 5 shows the different themes in different grade levels in the two countries. The Japan elementary science curriculum is organized only into three themes. However, each theme varies in terms of content in each grade level.

Science in both countries is presented as “general science” which includes topics on: “People; Animals; Plants; Matter; Energy; and the Solar System.” In both countries, science themes in the elementary curriculum focus on different topics. To show differences, for example on the theme “Living Things and their Environment,” Japan elementary science curriculum focuses on finding and raising familiar animals and plants, exploring the activities of animals, and plant growth in different seasons from Grade III to Grade V. While in the Philippines, topics on plants and animals are treated separately as different themes and the content focuses on the structures, needs, and taking care of plants and animals.

In the Philippines, science is taught from grades 3 to 6, and it is integrated with health. The name of the subject is “Science and Health.” This was done in order to link science with health issues and concerns that are confronting the Philippine communities where young children are the most affected. This integration is also based on the principle that science is related to health. Health concepts and disease prevention and control are integrated in the curriculum. Figure 1 shows how science content is integrated with health in theme on “People” in the science curriculum from Grade III to Grade VI

curriculum.

Several aspects of the health education like; sanitation, nutrition, and personal hygiene are discussed only in the theme on “People.” The contents of Science and Health aims to help the Filipino child gain a functional understanding of science concepts and principles linked with real life situations, acquire science skills, as well as scientific attitudes and values needed in solving everyday problems. It can also be observed that the science curriculum in the Philippines contains items that are relevant to Philippine practical issues and problems regarding to the environment and particularly on population issues. An example is illustrated in Table 6.

The issues that are related on population growth are discussed in Grade VI. This is because similar concerns like puberty age and sexuality are also discussed in other subjects in the Grade VI curricula. Other social issues that are related to energy conservation, personal hygiene, natural disasters, and climate changes, are also included in the curriculum to make it more meaningful and relevant to Philippine context and conditions. Addressing these social issues and community problems is one excellent practice in curriculum development (Posner 1995).

In terms of language of instruction in science curriculum in the Philippines, the language of instruction is English. Although some schools in the Philippines like the UPIS (University of the Philippines Integrated School) introduced the use of Filipino in the teaching of science. The passion of learning and using English in the curriculum of Philippines schools were also observed by Mulder (1997) in his studies on Philippine culture. The medium of instruction in science remains as one of the problems in Philippine education (EDCOM, 1991).

The daily time allotment for elementary science in the Philippines is 40 minutes in a day for Grade III, and 60 minutes for Grade IV, Grade V, and Grade VI. The daily time allotment was increased for learning science in the Philippines to enable the children to have more time to deal with knowledge in depth.

In Japan, science starts in Grade III. However, science is

also integrated in the subject “Life and Environment Studies” at Grades I and II in which learners are asked to look at their daily living situation and consider their surroundings from social and scientific viewpoints. The Japan elementary science curriculum content follows a spiral approach to curriculum organization that provides a system of prerequisites in the organization of the curriculum content. The progression of topics in terms of scope from Grade III to Grade VI characterized the Japan elementary science curriculum. From the example on “Living Things and their Environment” in Figure 2, it can be observed that the Japan elementary science curriculum follows a logical sequence when it comes to the distribution of the contents.

As early as Grade III, the content of the curriculum introduces science practical works for children to do. Table 7 illustrates an example how the elementary science curriculum requires practical work in a Grade III topic on “Matter and Energy.”

This gives time for the learners to deal with the contents in depth by doing practical works and science activities in the classroom or mostly in science laboratories. The idea of “making things” in the science curriculum through the use of practical work also enables the learners to apply or use scientific knowledge they learned in school and connect it with technology. An excellent feature of the elementary science curriculum in Japan is that, at a certain level and topics, the learners are given freedom to choose a science topic they are interested in to study in school science

The elementary science curriculum in Japan also includes daily or real-life applications of science. For example from the Grade V curriculum content on “earth and space” one of the content is:

“Observing the weather for the day, using visual information such as visual images and exploring the changes in the weather, and thus, enabling children develop ideas about the pattern of weather change.”

In the Japan elementary science curriculum, physical science is introduced gradually in all grade levels. This is evident in the objectives of the curriculum particularly on the theme on “Matter and Energy” (see illustration on Figure 3).

It is also a special feature of the Japanese science curriculum to ensure that all of its educational activities must contain moral education. This holds true not only in science but also in all subjects in the curriculum. It is embedded in the school curriculum to foster a zest of living in all the learners (The Courses of Study in Japan, 2004).

Science curriculum in Japanese schools is taught in Japanese. This allows the learners to freely express their ideas and questions regarding the subject matter. This also allows the flow of science knowledge to flourish in the culture of the people particularly in daily life. The use of the language of the people as a medium of instruction is a powerful tool in the curriculum (Hodson, 1998).

In terms of the number of hours of teaching science in elementary school, the prescribed number of school hours for elementary science in Japan per year is 70 hours for Grade III, 90 hours for grade IV, and 95 hours for Grade V and Grade VI. This amount of time decreased from the previous one due to the reduction or change of the length of school days from the previous Monday to Saturday, and now changed from Monday to Friday.

Conclusion

The development of the elementary science curriculum of Philippines and Japan is unique in both countries. The elementary science curricula from the Philippines and Japan emphasize the importance of learning science processes, skills, values, attitudes, and development of critical thinking. However the use of science practical works is highly emphasized in the Japan science curriculum while the Philippine science curriculum emphasizes health education and Filipino values.

The use of practical works in science as an effective style in learning science and the gradual inclusion of

topics on “Energy” in the content of the elementary science curriculum are recommendable for the Philippines. Japanese way of organizing the science curriculum content into broader themes like: Living Things and their Environment, Matter and Energy, and Earth and Space can be helpful for the Philippines to follow to make science content more meaningful and connected. It is also desirable for the Philippines to have a system for regular evaluation of its science curriculum, a curricular practice that can be learned in Japan.

The Japanese experience of using the Japanese language to teach science is a good paradigm that the Philippines can adapt in its plan to use Filipino as a medium of instruction for science. Both countries adapt their science curricula to the context of the daily-life experience of the people. This is important in making the science curriculum responsive and relevant to the needs and demands of time. Although both curricula are anchored on specific needs and contexts, linking science with peoples’ culture and with other disciplines in the elementary curricula is a promising idea that can be explored in the future.

Table 1. Philippine Basic Education System

Type of Program	Establishing Body	Qualifications for Admission (age)	Duration of Course	Number of Subjects
Kindergarten (optional)	Private (90%) Public (10%)	From ages 3 to 5	Nursery 1 yr. Kinder I 1 yr. Kinder II 1 yr.	Varies from each school. Usually 4
Elementary School	Public Private/sectarian	Age 6	6 years	6 for Grades I & II 8 for Grades III to VI
Secondary School	Public/Private	Age 12	4 years	8 subjects

Table 2. Japan Basic Education System

Type of Program	Establishing Body	Qualifications for Admission (age)	Duration of Course	Number of Subjects
Kindergarten	Private/municipal	From ages 3 to 5	1 to 3 years	None
Elementary School	Municipal Private	Age 6	6 years	6 for Grades I & II 7 for Grades III & IV 8 for Grades V & VI
Lower Secondary School	Municipal Private	Age 12	3 years	9 core subjects
Upper Secondary	Prefectural Private/Municipal	Age 15 or more	3 years	9

Table 3. Highlights of the Historical Development of the Elementary Science Curriculum in the Philippines

Years	Developments
1948	Development of resource units to serve as a guide for teaching science
1960' s	<ol style="list-style-type: none"> 1. Science textbooks were printed and distributed by the United States Operations Mission-National Economic Council (USOM-NEC) Project. 2. The first generation textbooks were developed by the UP Science Teaching Center. Educators from US, UK, Germany, and Australia were consulted in this project.
1970' s	<ol style="list-style-type: none"> 1. Integrated Science and Health was taught in schools 2. The Elementary Learning Continuum (ELC) was developed emphasizing science processes and skills. 3. Enrichment of the study of science at the elementary school level through meaningful home, family and community.
1980' s	<ol style="list-style-type: none"> 1. Science, Technology, and Society (STS) approach was introduced 2. Science and Technology Textbooks were developed for secondary schools 3. In 1987, UPISMED was reorganized and the Needs-Based Curriculum Project was started.
1990' s	<ol style="list-style-type: none"> 1. Video course constituting the telecourse “Science Made Easy” was developed and used for elementary teachers and televised once a week 2. Through the JICA-SMEMDP (Japan International Cooperation Agency-Science and Mathematics Manpower Development Project) two volumes of source book for leader trainees were developed. 3. The development of Television programs like “Sine Eskuwela” for Science in the elementary level 4. The use of Filipino as a medium of instruction in science was explored
2000-	<ol style="list-style-type: none"> 1. Development of an Indigenous Curriculum for science in selected local communities. 2. Integration of Language and Science for Grades I & II 3. Increased time for learning Science

Table 4. Highlights of the Historical Development of the Elementary Science Curriculum in Japan

Years	Developments
1947	Under the direction of USA, Science for daily life experience was promoted as a school subject. It was child-centered, and it emphasizes on linking science in everyday living and on problem - solving.
1958	The content puts emphasis on understanding the content of natural science arranged in a systematic way. Content was arranged in accordance with a systematic ordering of basic scientific concepts concerned with organism, matter, and other items.
1969	During this period, the content of the Japanese Science education emphasizes on hands-on activities in the form of observations and experiment. Emphasis was put on inquiry learning, taking such forms as a careful selection of materials designed to provide a structure for basic science concepts, and a focus on the scientific method.
1977	Careful selection of curriculum content was done with a view to realizing a “stress-free” education that allowed more time for reflection. Social problems were included to develop and equip the students with a rich sense of humanity
1989	In the early grades of the elementary school, Science was integrated with social science under the umbrella of a new subject “life and Environment Studies” . Emphasis was put in elementary school on familiarizing students with the natural world. The number of hours for science and the content were reduced to give more time for reflection.
1998	A period for “Integrated Study” was newly introduced from Grade 3 in elementary schools. Number of school days was reduced to five ?day a week and the number of hours was reduced by 10% more. The content of each subject area was also reduced by 30 %.

Table 5. Themes of the Elementary Science Curriculum in Philippines and in Japan

Grade Level	Philippines	Japan
Grade III	People, Animals, Plants, Matter, Materials, Earth, Sun	Living Things and their Environment, Matter and Energy, Earth and Space
Grade IV	People, Animals, Plants, Matter, Mixtures and Solutions, Earth, Moon and Sun	Living Things and their Environment, Matter and Energy, Earth and Space
Grade V.	People, Animals, Plants, Matter, Mixtures and Solutions, The Solar System	Living Things and their Environment, Matter and Energy, Earth and Space
Grade VI	People, Animals, Plants, and Environment (Interrelationship in the Ecosystem) Materials, Earth, Beyond the Solar System	Living Things and their Environment, Matter and Energy, Earth and Space

Table 6 Sample Content on Focusing on Population Issues in the Philippine Elementary Science Curriculum

Grade Level: VI

Theme: Animals, Plants, and Environment (Interrelationship in the Ecosystem)

- 1 . Infer that some people disrupt the cycles of an ecosystem.
- 2 . Predict the effects of over population in a community.
- 3 . Describe strategies for coping with rapid increase in population.
- 4 . Demonstrate commitment and concern in preserving/conserving the balance of life in the ecosystem.

(Source Philippine Elementary Science .Learning Competencies Department of Education, 2000)

Table 7. Introducing Practical Works in the Japan Grade III Elementary Science on the Topic “Matter and Energy”

- 1 . Using mirrors and other devices, explore the way in which light travels and the brightness and warmth when it strikes an object, and thus enabling children to develop ideas about the nature of light.
- 2 . Attaching a small bulb to a dry battery, explore the connecting path and the objects through which the electricity passes, and thus, enabling children to develop ideas about electric circuits
- 3 . Using a magnet, explore the functions of magnet and attaching objects to the magnet, and thus enabling children to develop ideas about the nature of magnet.

Points for consideration in dealing with the content:

With regards to item (3) a) in Section B, “Matter and energy” about two kinds of making things should be dealt with.

(Source: The courses of Study in Japan (2004) Japanese research Team for US-Japan Comparative Research on Science and Mathematics Education.)

Figure 1. Integrating Health in the Elementary Science Curriculum in the Philippines

Theme: People

Grade VI

1. Identify health habits to keep the heart; blood and blood vessels healthy
2. Demonstrate ways of caring for the circulatory system.
3. Practice desirable habits that help prevent and control common ailments of the nervous system.



Grade V

1. Identify health habits to keep the reproductive organs healthy.
2. State the importance of protecting one's sensitive parts/reproductive organs.
3. Name common ailments affecting the respiratory system.
4. Practice good health habits to keep the respiratory system healthy.



Grade IV

1. Identify injuries and diseases that can harm the skeletal and muscular systems.
2. Demonstrate first aid treatment for sprains, cramps and simple fractures.
3. Name ways of keeping the digestive system healthy

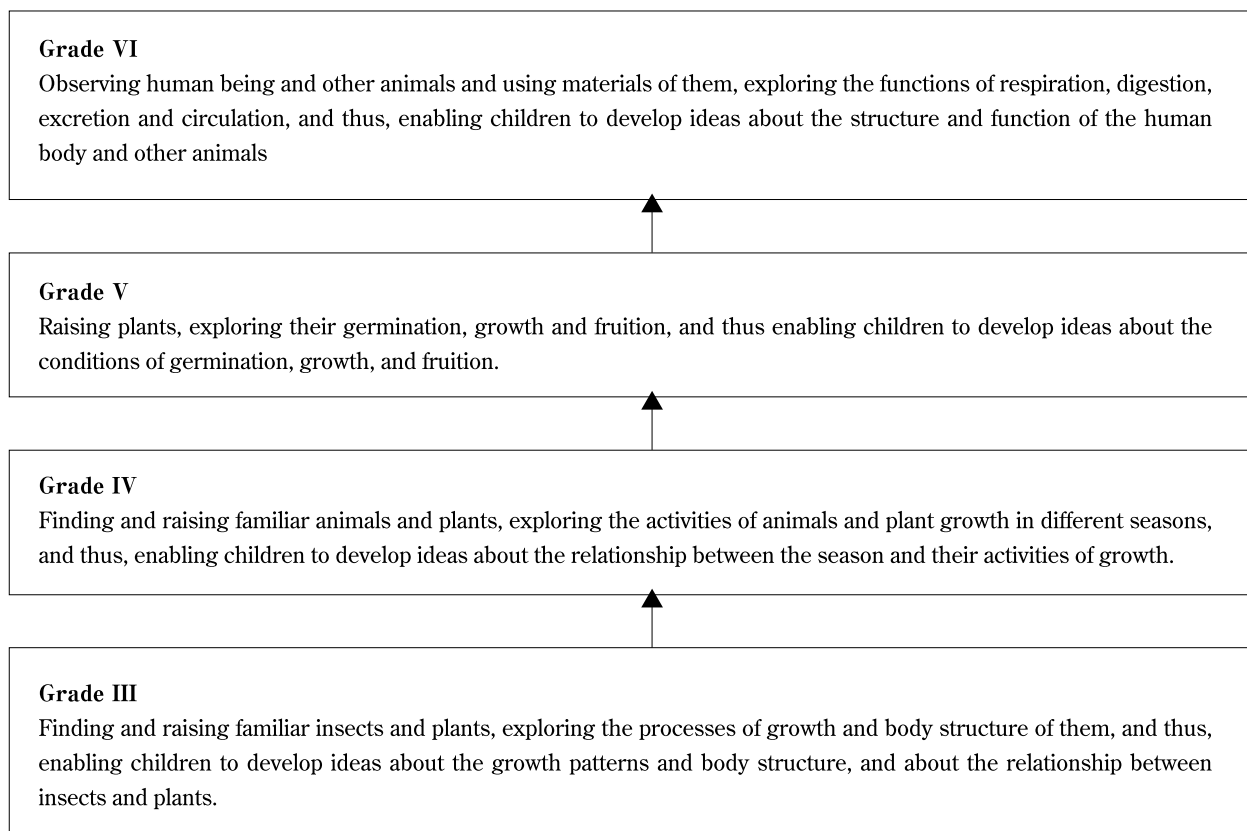


Grade III

1. Identify common ailments affecting the sense organs.
2. Demonstrate ways on keeping the sense organ healthy.

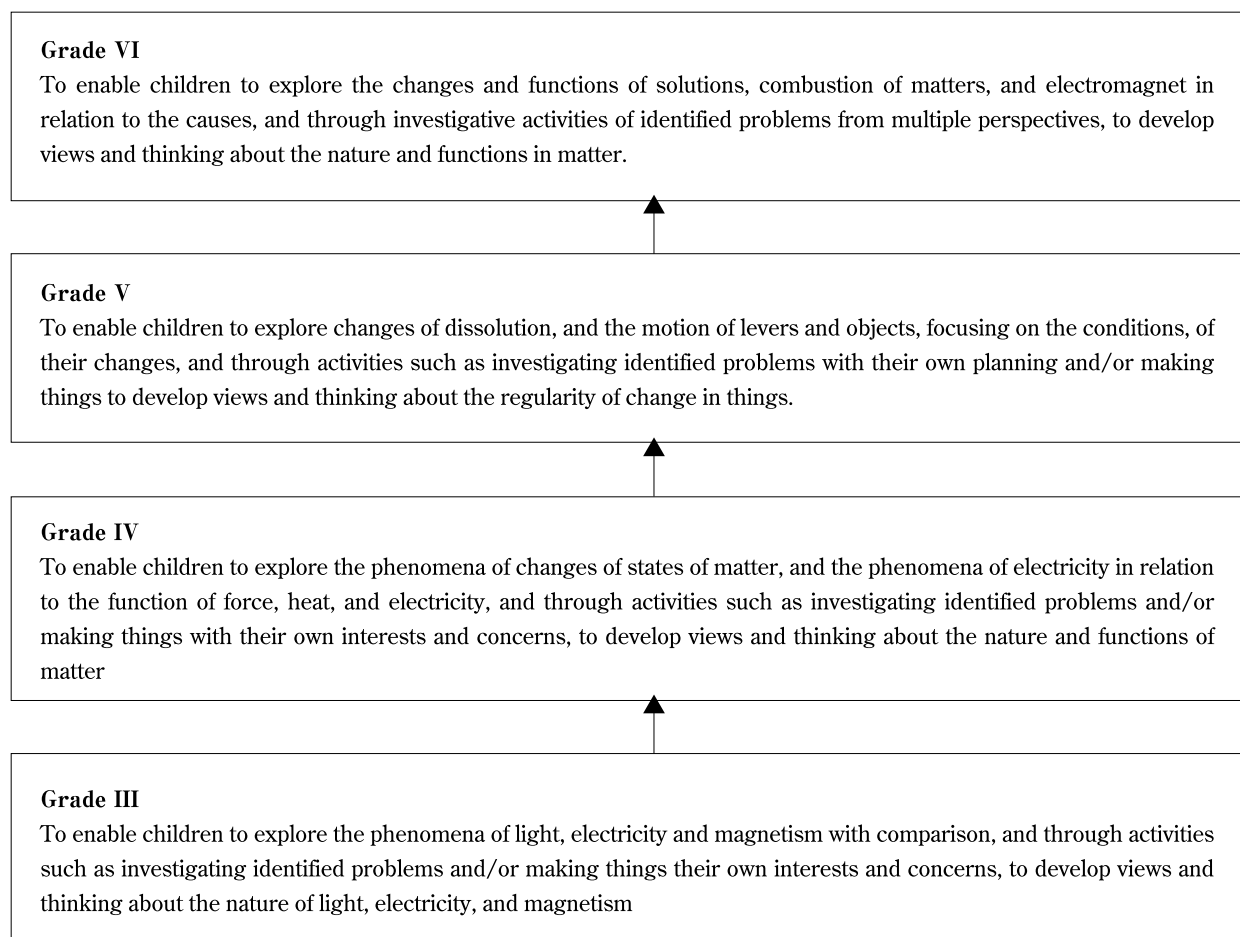
(Source Philippine Elementary Science .Learning Competencies Department of Education, 2000)

Figure 2. Sample Sequence of Content in the Japan Elementary Science Curriculum on the topic “Living Things and their Environment”



Source: *The courses of Study in Japan (2004)* Japanese research Team for US-Japan Comparative Research on Science and Mathematics Education.

Figure 3. Physical Science in the Japan Elementary Science Curriculum on the Topic: “Matter and Energy”



Source: *The courses of Study in Japan (2004) Japanese research Team for US-Japan Comparative Research on Science and Mathematics Education.*

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