

The Japanese word “YUGE” available for teaching “steam”.

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Abstract

In Japan, school boys and girls learn the word “YUGE” in science class, for a cloud appearing white coming up from the spout of a kettle of boiling water, whereas in America or New Zealand they learn no name as stuff for it because they have not any word corresponding to “YUGE”. It is considered that students would be able to easily understand the process of change of steam into water (steam→cloud in the state of tiny droplets of water→rain in the state of drops of water) with knowledge of YUGE. Watching it microscopically would make students enjoy science class. Teachers would be able to enjoy their class more and more actively with their students to use the Japanese word, YUGE in school education all over the world.

Received Sept. 27, 1993

Key words : Water, Steam, YUGE (湯気)

Introduction

In Japan, we have YUGE in Japanese, which is very available for teaching steam. According to the Course of Study¹²⁾ (which means a leading curriculum) issued by the Ministry of Education, primary school forth grade students are obliged to learn that 1. water turns to steam by evaporation on boiling, 2. steam changes back to water on cooling and 3. the air around us includes steam, which goes up to a lower atmospheric pressure- and lower temperature-zone, changing into clouds by cooling.

Primary, junior high and senior high school textbooks are made based on the Course of Study. So, every book has almost similar contents each other, in whose item of “water and steam” is used the word YUGE in Japanese. The word is not used in any textbooks written in English.

I will report in the present paper, regarding that a microscopic observation of

YUGE²⁰⁾ is very important for students to know what difference exists between steam and YUGE and to enjoy science class.

Instruction of water, steam and YUGE in Japan, America and New Zealand

1. Japan

Two textbooks, A¹⁾ and B²¹⁾ were investigated, where the relations among water, steam and YUGE are illustrated as shown in Figs. 1. and 2. Concerning the concept that air includes steam, Fig. 3 shows that steam included in air around the wall of a drinking glass with some ice in water cools and turns to YUGE which appears cloudy.

2. America

1) The illustrated book²²⁾ for children under the age of six shows good expressions for them to be able to enjoy science, concerning water, evaporation, steam, cooling, cloud and droplets of water as mentioned below :

Heat up some water, very hot. What happens? The water boils. Air bubbles pop out. The water turns to steam. We call it water vapor. It floats away in the air. We say it is a gas. You have seen water vapor go up into the clouds from a sunny lake. The gently warmed water is slowly turning to vapor. We say it evaporates. It forms clouds. Have you ever been inside a cloud? Perhaps you have been, in an airplane. Or in the mountains, clouds may settle down close to the slopes. Wherever you live, you may have been in one kind of cloud, called fog. Fog is a cloud lying near the earth.



Fig. 1. YUGE and steam on boiling water illustrated in the textbook A.¹⁾

The Japanese word “YUGE” available for teaching “steam”.

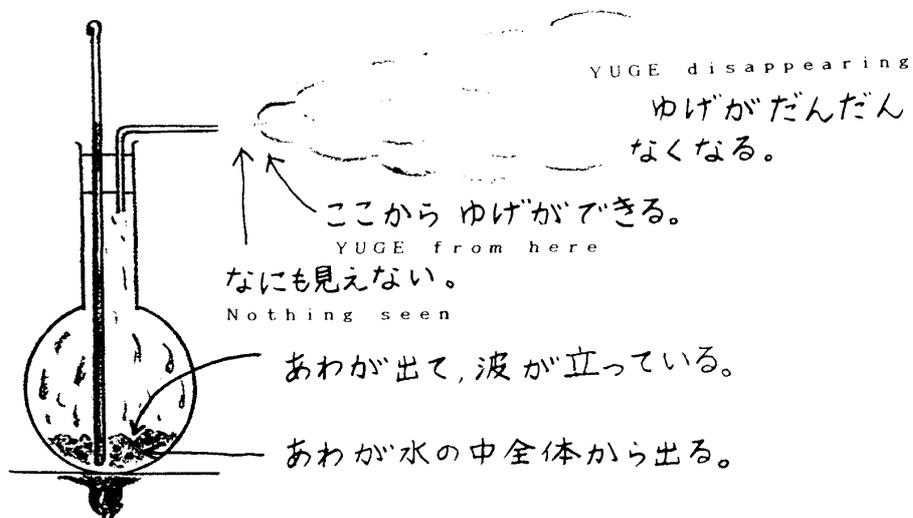


Fig. 2. YUGE and steam on boiling water illustrated in the textbook B.²¹⁾

It is full of tiny droplets of water. You cannot see far through fog. The droplets of water feel damp on your face. High up above the earth, the air is cool. The water vapor in high clouds often turns to drops again. it falls as rain. Air picks up water vapor. Warm air is light.

To read the sentences themselves or to listen to what their mother read for them, children might be able to understand steam as scientific materials and phenomena.

2) In the primary school textbook¹⁶⁾ are described the sentences for the item of experiment as follows:

You will need a kettle of boiling water. The cloud coming out of the kettle will be your warm, moist air mass. You will also need a saucepan with some ice or very cold water in it. The outside of the pan will be the cool “land”. Let’s see what happens when a warm, moist air mass spreads over cool land. Hold the saucepan near the spout. Watch the drops begin to collect and fall. It’s raining! (Fig. 7)

Both the two kinds of books have very fascinating contents and students would be sure to enjoy science.

3. New Zealand

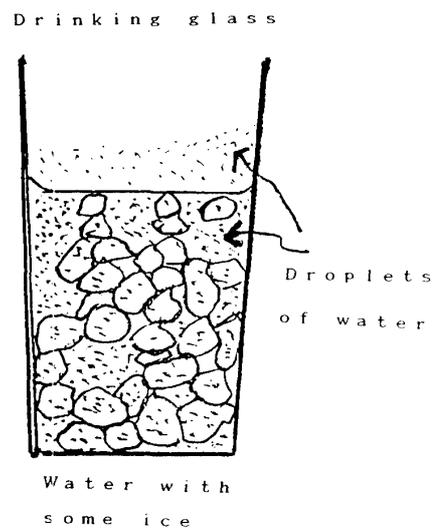


Fig. 3. YUGE from steam in air.

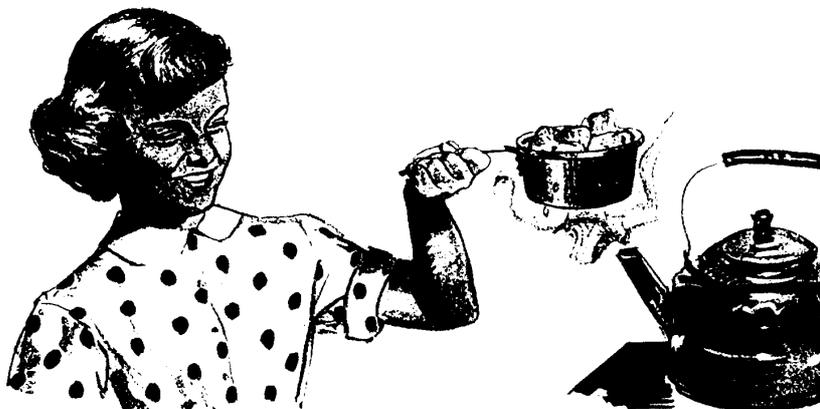


Fig. 7. Drops of water outside of the pan with some ice.¹⁶⁾

Osborne and Cosgrove (1983)¹³⁾ reported on “children’s conceptions of the changes of state of water”. The survey was carried out for forty three school students ranging in age from eight to seventeen years, using an interview-about-instances method regarding the following five aspects of children’s views :

- 1) About boiling in a jug
- 2) About steam and condensation from steam on the plate placed above it
- 3) About evaporation
- 4) About water condensing on a cold surface
- 5) About ice melting

Concerning Item 2), the interviewees answered as follows :

- a. one or two of the youngest pupils--the stuff coming off the water is “smoke”
- b. the majority of students-- “ steam”
- c. many of these pupils consider steam to be “water” or “kinda like water” or “water in a different form” and that the steam had changed into air when it was no longer visible.

As concerns Item 4) also, some differences of answer exist between younger interviewees and older ones.

Judging from the data above, it seems to be very hard for boys and girls to learn comprehensibly a change of steam into droplets of water, using the word, condensation, which refers to conception of atom and molecule. I think it is very attractive to them to use the word, YUGE and to observe it through the microscope in science class. This

The Japanese word “YUGE” available for teaching “steam”.

is why what I am much interested in are marked with underlines, regarding the sentences described above.

Explanations for YUGE by dictionaries

1. Dictionaries in Japanese
 - a. KOJIRIN⁸⁾ : YUGE is steam rising up from the surfaces of hot water, water, ice, etc.
 - b. SHINCHOKOKUGOJITEN⁷⁾ : YUGE is vapor rising up from water and ice.
 - c. SHINSENKOKUGOJITEN⁹⁾ : YUGE is material that steam cooled off and has changed back into tiny droplets of water.
 - d. KOJIEN¹⁷⁾ : YUGE is stuff that steam rising up from hot water, water, ice, etc. has changed into tiny droplets of water and looks white like smoke.
 - e. DAIJIRIN¹¹⁾ : YUGE is stuff that steam rising up from hot water and something likewise has changed into tiny droplets due to cooling, which looks like white smoke.
2. Japanese-English dictionary--English for YUGE.
 - a. SHINWAEIDAIJITEN¹⁰⁾ : (white) steam.
 - b. SANSEIDO'S SHIN-KONSAISU WAEIJITEN¹⁵⁾ : (a jet of) steam, vapor.
3. Dictionaries in English--explanations for steam
 - a. Encyclopedia Britanica⁶⁾ : Steam is the form commonly applied to vaporized water. In the pure state steam is an invisible gas, but when interspersed with minute droplets of water, it has cloudy appearance familiar to anyone who has seen it, issuing from the spout of a teakettle.
 - b. American Educators' Encyclopedia⁴⁾ : Steam is a colorless gas and therefore cannot be seen. The white cloud that comes from a kettle of boiling water is commonly called steam, but it is not really steam. The cloud we see is steam that cooled off and has changed back into water droplets.
 - c. Encyclopedia of Science and Technology¹⁴⁾ : Steam, water vapor, water in its gaseous state.

Generally speaking, the sentences I marked with underlines are what is considered to be correctly explained, but severely thinking, it is not adequate from the viewpoint of science education.

Experiments for students in my class

Experiments are divided into four kinds.

1. You will need a test-tube with water 2cm high. Grasp the lower part of the tube. The

water becomes warm and evaporation is accelerated. The steam goes up, making the white cloudy zone composed of droplets on the inner wall by cooling, because the room temperature is lower than the steam. Observe the droplets with a Lupe(25x). You can recognize that YUGE is made of droplets(Fig. 4).

2. Observe the white cloudy material, YUGE over and the steam just close to the spout of a kettle of boiling water respectively, which you can watch directly as familiar phenomena around us (Fig. 5).
3. Watch a 100cc beaker with water inside up to 50cc and another one with ice added. You can compare the two beakers, finding

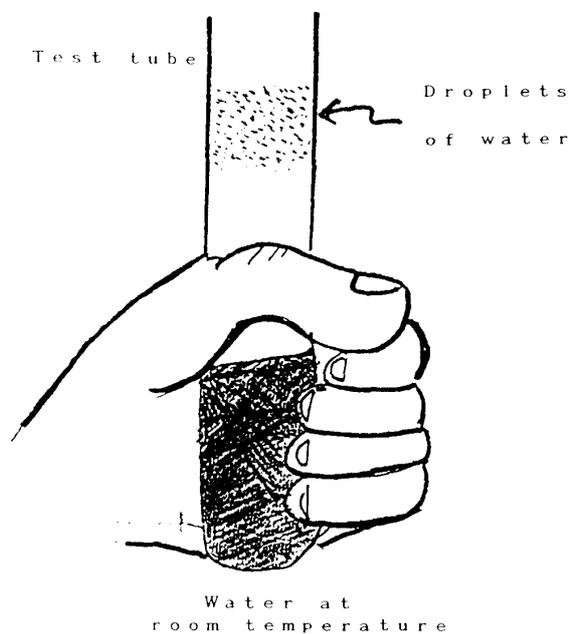


Fig. 4. YUGE from the steam warmer than room temperature.

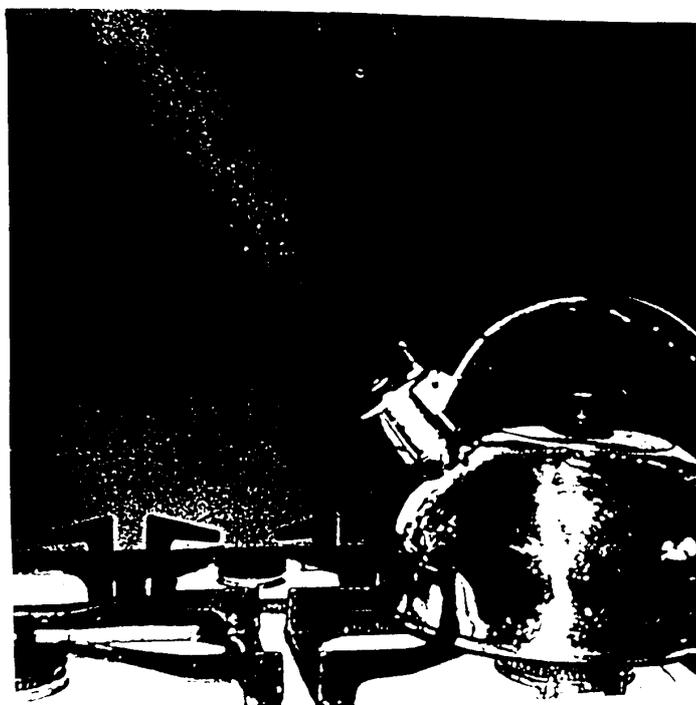


Fig. 5. YUGE and steam from the spout of kettle of boiling water : black plate in rear.

The Japanese word “YUGE” available for teaching “steam”.

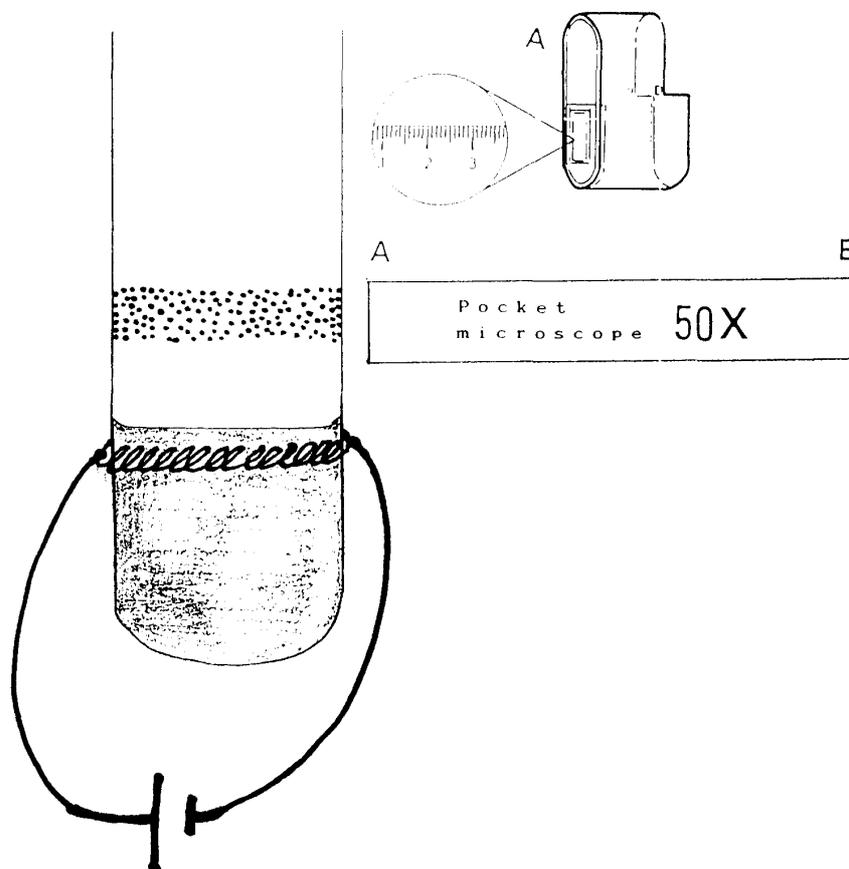


Fig. 6. Microscopic observation of YUGE : pocketmicroscope has a scale with 10 marked spaces within each milimeter.

out a cloudy zone on the outer wall of the latter one (Fig 3).

You will observe YUGE just qualitatively, in these experiments, which may not be enjoyable for you. You would want to observe quantitatively a grain-size of droplets.

4. You will need a test tube, water, a nickel-chrome wire, a dry cell, a pocketmicroscope (50x) with a micro-scale. You can find out each droplet coming to appear here and there on the tube-wall, which would make you get excited. (Fig. 6). YUGE would be proved to be composed of droplets of water in grain size approximately close to a few micrometers just like fine-grained clay minerals.

Discussions

The Japanese word, YUGE is used for teaching the change of the state of water on

vaporizing, in every school-textbook in Japan and is defined as a white cloudy material consisting of tiny droplets of water which we can see over the spout of a kettle of boiling water due to cooling of the steam issuing from the spout (Figs. 1 and 2). However, any word equivalent to the word, YUGE is not used in textbooks in America or New Zealand, because they do not have any English word called as a material name for YUGE. So, we would not be able to find out it in any dictionaries, too. We can notice of that “white steam” as shown in the Japanese-English dictionary¹⁰⁾¹⁵⁾ is not in good form for YUGE, because steam is a gaseous state and should not be used as a common noun for droplets of water in liquid state. In the English-dictionary, “American Educators’ Encyclopedia”, it is mentioned that “the white cloud that comes from a kettle of boiling water is commonly called steam, but it is not really steam”. The latter sentence in the “that” clause is correct from the viewpoint of science education, but the former one is not adequate. We can understand that if explanation will be carried out in English concerning a change of steam in the state by cooling, expression would not be used for the stuff showing cloudy appearance produced on cooling but for a natural scientific phenomenon itself only. Even if the name of a white cloudy material over the spout of a kettle is not used, it is true that an aim of learning will be attained regarding the changeback of steam into water in liquid form by the experiment as shown in Fig. 3 or Fig. 7. And students would enjoy class to watch water drops, listening to their teacher’s saying, “It’s raining”. In New Zealand, the word “condensation” which means a change to liquid state from vapor by cooling is used, but the word is a science special word and difficult for boys and girls. In case of learning it in Japanese, students would be able to understand it systematically. It is very available particularly to use the Japanese word for an explanation of cloud. I say, “It’s YUGE.”

Comparisons in learning steam among Japan, America and New Zealand are shown as follows :

- * water→boiling→steam→cooling→YUGE (waterdroplets, cloud)→waterdrops (rain)
—— in Japan
- * water→boiling→steam→cooling→waterdroplets (cloud)→waterdrops (rain)—— in America
- * water→boiling→steam→condensing→water —— in New Zealand

Judging from what is mentioned above, my idea might be considered to be better for students to easily understand the change of steam to droplets of water by cooling. Students would be able to recognize a live action of appearance of water droplets due to

The Japanese word “YUGE” available for teaching “steam”.

cooling of steam through the microscope and to enjoy science. Consequently, teachers would get to have few failures who are called “OCHIKOBORE” in Japanese and also their class would become activated¹⁸⁾¹⁹⁾.

Some Japanese words are described in Roman letters, not translated into English, in dictionaries²⁾⁵⁾ : for example, Judo, Karate, Kimono, Tsunami, etc. In addition to it, we have the word, GAEROME-NENDO³⁾ which is a kind of clay, that is used globally among geologists, mineralogists, ceramists and so on. So, it is hopeful that the Japanese word, YUGE should be used in school education for countries without any word corresponding to YUGE, all over the world.

Acknowledgments

Sincere thanks are due to Associate Professor S.Tonishi of Aichi University of Education for copy of the literature. Much appreciation is paid to Ms.Y. Terasawa, Librarian and Ms.K.Fujii, Laboratory Assistant of Gifu University for Education and Languages who helped with this study, respectively.

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