Experiments about rocks weathering and rocks change, these utilizations in school.

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I have developed several experiments about rocks weathering and rocks change for 25years in junior high school in Tokyo. Here is the summary of my report and effects of practice.

Keywords: rocks weathering, rocks change, science club

A Practical Example of Composite Field Study Program in Mt. Fuji: Geosciences and Arts

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In FY2004 and FY2008 the classes of the Faculty of Education at Ibaraki University "Field works on geology" were carried out at/around Mt. Fuji. In addition to the viewpoints of Earth Sciences, it also has contents of abundant artistic standpoints, and a measurement of the bidirectional educational effects between Earth Sciences and Art was aimed at. In these classes, from the planning stage, science teachers and art teacher are working closely together in addition to pedagogy teacher.
Specifically, we focused on how the experiences of sketches of the landscape affects the field observation in abundance of viewpoint and their deep understanding. Also, at before and after these classes, 1) to express the image of Mt. Fuji at that time, 2) to appreciate the paintings of Mt. Fuji and write out the information that can be read from there, were carried out. They were a clue to know how the student's understanding changed. In addition, reports and impressions submitted by the participating students were used as materials for achieving the classes.
In recent years, some studies are raising doubts on the effect of sketches in class. However, as results of the classes, at the university students' level, large number of positive effects corresponding to the time and energy spent sketching seems to be obtained. In addition, it was suggested that the experience of observation at the site provides various new and concrete viewpoints for appreciation of paintings.

Keywords: Earth Science, Arts, Field observation, Mt. Fuji, cross-sectoral study

Observation and education in geoscience by using low-priced instruments

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In this presentation, we will introduce four experiments and hands-on activities for geoscience observing and measuring by using low-priced and small-sized commercial instruments. The Black Box for Environmental Measuring (BBEM) system is based on Arduino platform, low-power consumption sensors are employed to measure meteorological and environmental parameters. Built-in accelerometer on BBEM or smartphone could be used to observe shake and vibrations by earthquake and strong wind. Webcam is used to detect and record sprites, thunders, and the development of cumulonimbus, as well as automatically visibility observation. A simple VLF receiver is built by using the audio interface on computer, and the observed signals show the variations of the ionospheric D-region. These experiments are practical which have been applied in classroom and science outreach in Taiwan.

Keywords: geoscience education

Educational view of the simple seismometer recordable by an optical mouse

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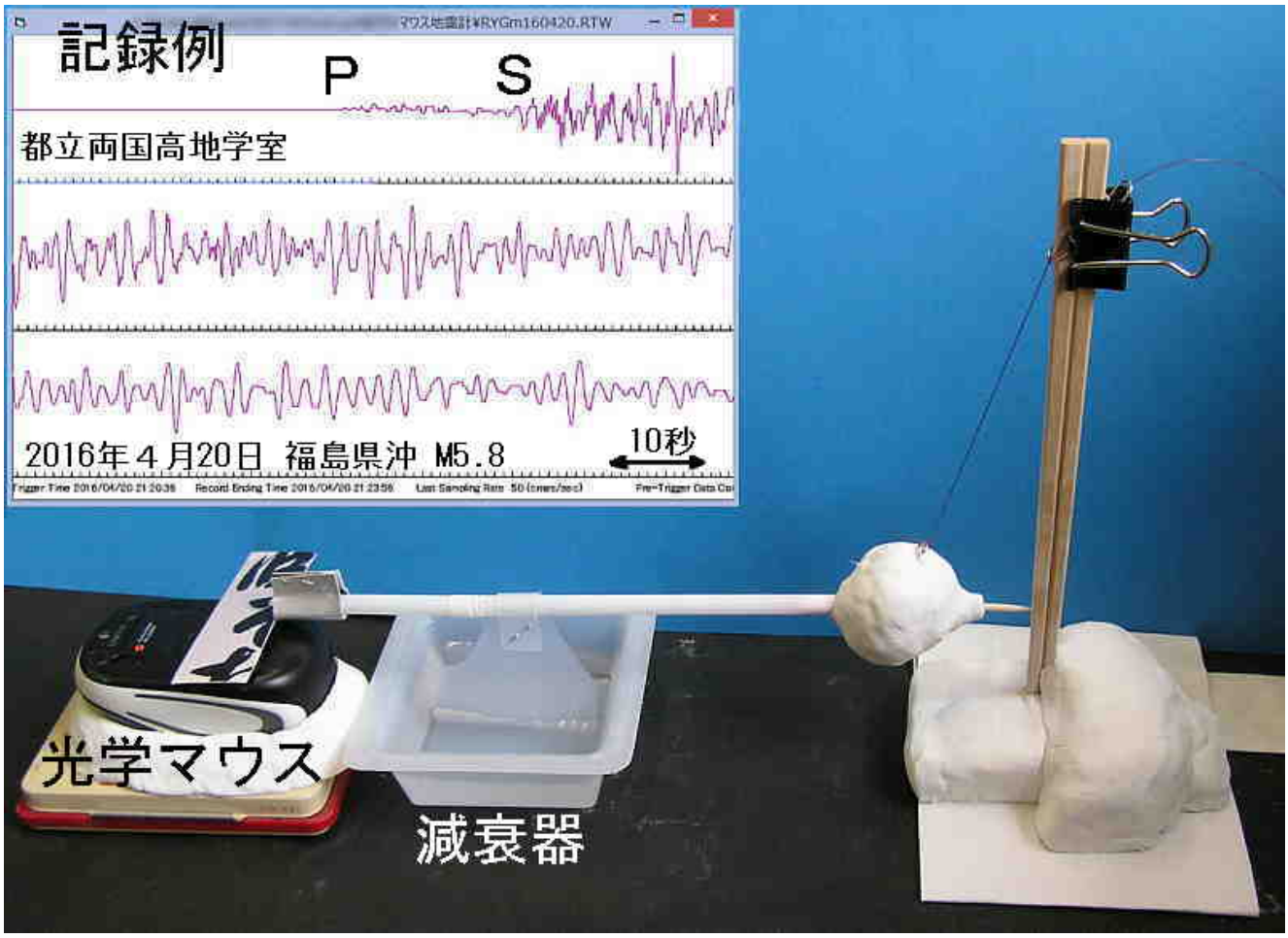
Using an optical PC-mouse, the simple seismograph is developed for secondary education.
Within 1 hour, the mechanical one modeled on Omori-type seismograph can be made from a piece of paper clay, a polypropylene straw and a pair of disposable chopsticks. Using an optical mouse as sensor, the displacement of its pendulum is recorded without friction.
The classical seismograph shows a principle of a seismometer system, and its output can also be utilized as digital data. Students can learn a mechanism of seismometer through their handmade of this, and observe the real seismic wave by themselves. Therefore, this remarkable seismograph brings with actual feelings to the scientific understanding of earthquake.
Examples of educational practice and future's educational view using this seismometer will be reported.

Keywords: optical mouse, seismometer, secondary education



An Example Geoscience Class of Model Experiment of River Process Utilizing EMRiver Color-coded Media

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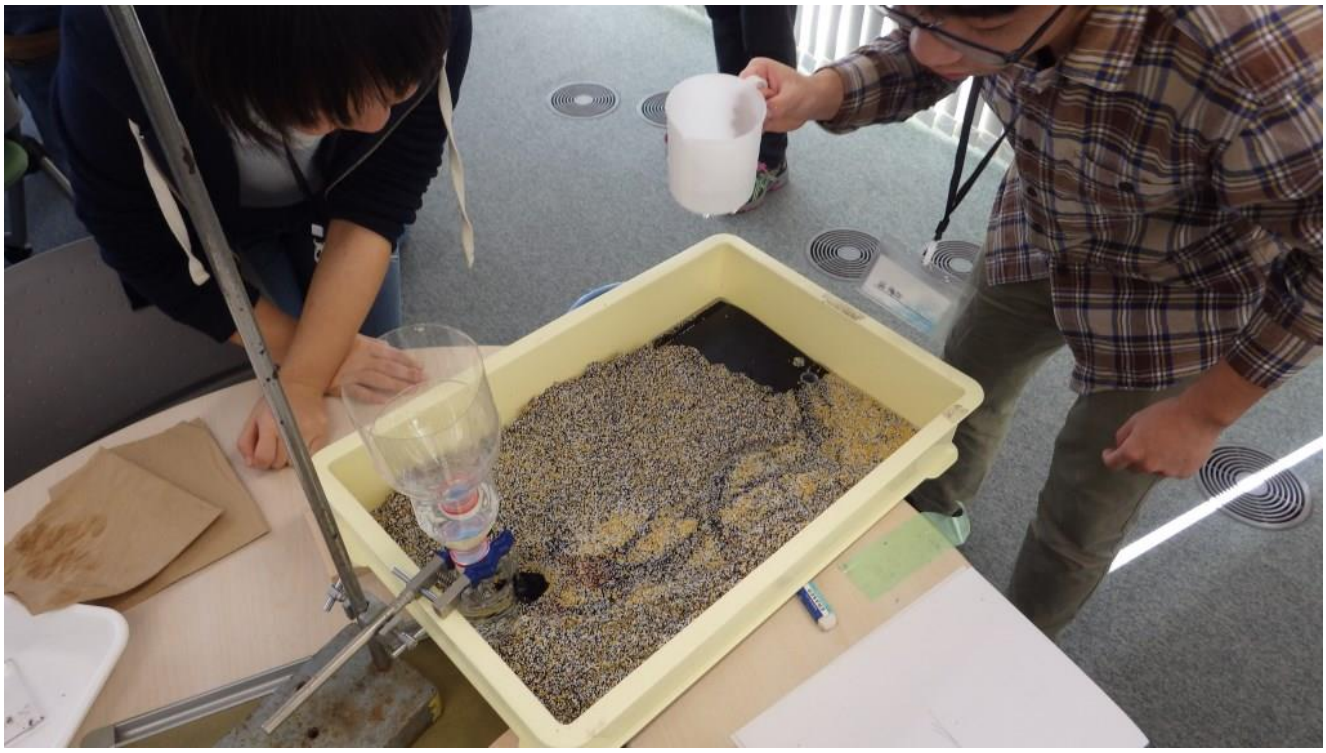
The author conducted a geoscience class for lower and upper middle school students. The modele experimantal apparatus for river process could develop utilizing EMRiver Color-coded Media supplied by Little River Research & Desing, US. This device can form meandering river in small box such as 50cm X 30cm. Responces by the students in a geoscience class are as follows,
"Good because I could observe geomorphology such as meandering river and ox-bow lake. " and
"My prediction for results on model experiment was wrong. It was interesting".
This apparaus may intense understanding on morphology of river.

Keywords: EMRiver, Lower middle school, Upper middle school, Meandering river



Development of GNSS Radio Telescope with Rawdata Output using Smartphones

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The android smartphones are useful for high-school students to observe multi-GNSS satellites such as GPS and learn the space technologies actively. It is important to foster young people inthe field of space technologies. We can observe GPS, Glonass, BDSS and QZSS more than thirty GNSS satellites over the sky of eastern Asia. On JpGU 2016 we showed that smartphones of high-school students can receive the GNSS satellites and display the skyplots or levelplots on the screen of their smartphones very easily, just as radio telescopes . On JpGU 2017 we will show the big step of GNSS raw data output from the Android7 smartphones. They can offer the pseudo-ranges, the carrier phases and even the doppler data of GNSS satellites precisely. We will show that the students can learn the higher experiments and data reductions regarding satellite-orbits determination, navigation and positioning using the raw data from their radio telescopes now.

Keywords: GPS, GNSS, smartphone, raw data, radio telescope, fostering

Development of portable Jovian radio wave receiver system for application in high school science education

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We propose portable receiver system for Jovian radio waves in high school science education.
Radio waves are used ordinarily in our daily life as a result of the development and spread of cell-phone and other wireless equipment. The radio is emitted not only by artificial system, but also by natural phenomena. Planets and the Sun that have magnetic fields and atmosphere would be the natural radio sources such as Sun, Earth, and Jupiter. Solar and Jovian radio waves whose frequency range is higher than 10 MHz can be observed from ground stations because they can penetrate the terrestrial ionosphere. So, the ground-based radio wave receiver can be a useful tool for exploration of the planets and the Sun. Furthermore, among several types of the Jovian radio waves, decametric S-bursts shows unique occurrence such as quasi-periodicity with the repetition frequency of ~20Hz, and the negative drift rate (~-20MHz/s). Ergun et al. [2006] and Su et al. [2006] proposed Jovian ionosphere Alfven resonator model. According to these previous studies, eigenfrequencies of Jovian IAR are expected to determine the repetition rate of S-bursts of Jovian decametric radiation.
Observing Jovian radio waves would interest to high school students and be attractive scientific experiment-teaching material. In this study, we propose Jovian S-bursts receiver system that is easy to use in high school education. However, if we install antenna and receiver in the high school site in or near the urban area, artificial noises would make it difficult to detect Jovian radio waves. Therefore, the receiver system must be transportable. For getting the data to provide contributions for studies on mechanism of Jovian S-bursts in the future, the time resolution of the receiver must be better than 1 milliseconds. Hence we will develop it in considerations of the following points: (a) the portability, (c) the cost, (d) sensitivity, (e) the frequency range, and (f) the time resolution.
We have two receiver system plans: One is based on Radio JOVE receiver provided by NASA Radio JOVE project (http://radiojove.gsfc.nasa.gov) and the other is based on 1seg TV tuner USB device controlled by Software Defined Radio. We are going to choose one based on comparisons of the expected performances on (a)-(f).
In this presentation, we will report the scheme and the state of progress.

Keywords: Jovian radio waves, ground-based receiver

High-level science education and research activity program for high school student using video conference system with PC chat

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So far, university has been one of the most effective field to educate analytical skills of science, and to discuss scientific-topics logically, because teachers and students can gather easily and discuss the results obtained using up-to-date apparatus and advanced research resources. A difficulty arises, however, when we try to educate in a laboratory of university for high school students having a potential in the field of science. It takes much time to gather together in the laboratory, since they inhabit separately in local areas of Japan; especially, in the case of high school students living in except for the area called Pacific coastal belt in Japan. Moreover, when we educate them using only what we call as e-learning, because of the living away from the university, their decreasing motivation in the research activities can frequently occur. To overcome those difficulties, we have developed an original program about science education and research activity for high-school students using video conference system from 2014: Super Scientist Program. This program is clearly different from e-learning. The main feather is below: 1) Lectures and interactive discussions using video conference system with PC chat, which is held once a week. 2) Self-determination of research subjects to promote an active learning and investigations. 3) Adoption of the educational program with several short camps, including fieldwork studies. 4) Group works and scientific discussions for the research subjects in English with foreign students and graduated school students in University. In our presentation, we will show our approach for science education and research activity program in geophysical field. We will also report about the educational effect of PC chat in our program.

Keywords: Science education for high school student, Video conference system, Effect of chat

Process of development of natural science research experienced by high school students

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I have been assigned to this school in April 2014 and immediately founded the Earth Science Club. Initially when it launched the club it consisted of 31 members. After that, the number of members gradually increased, and now the Earth Science Club is the largest departmental activity of the cultural club that works with 50 people. The basic policy of Earth Science Club are the following three points. 1. Study without using special equipment, with the theme of familiar natural phenomena as a theme, and obtain professional outcomes. 2. Provide the obtained results to the administration and local residents. 3. Open the movement experiment classroom and tell local elementary school students the results obtained. Regardless of the name of the Earth Science Club, if it is a theme of the natural science system, study regardless of the field. There are five research groups currently - physics 1, biology 2, geology 1, social engineering 1. The leader is the author only. Since the beginning of organizing this club, we have nationwide high ranking of evaluations and grades at the Ministry of Education, Culture, Sports, Science and Technology Ministry certified conferences and specialized academic societies etc.

Students in the field of geology continuously conduct research on the same theme for three years from the beginning of the founding. The magma team has been awarded the Japan College of Science Awards' Central Convention, awarded the Kanagawa University High School Science Paper Awards Excellence Award, and the Japan Geological Society of the Year Award for the third consecutive year. This research team leading the Earth Science Club. Continuing research with the same theme allowed the students to have the opportunity to experience the process of development of natural science research unexpectedly.

1. Research results in 2014

Students who suffered floods of the first grade river Kakogawa flooded every year thought to elucidate the cause. Students examined a wide range of 20 kilometers east - west x 18 kilometers north - south, and 94 samples were sampled, and all of which observed with a polarizing microscope. They also measured the modal compositions and magnetic susceptibilities and analyzed the total rock chemical compositions. They drew a geological map of the southern part of Hyogo Prefecture and created a schematic sectional view to clarify the cause of the flood of Kakogawa.

2. Research results in 2015

After the 2014 research fulfilled the nationwide top prize, students discovered evidence in the hiking shortly overturning the idea that was the basis of the research in 2014. The fluctuations of the students were large, and they were confused as I can’ t say that they were wrong at the moment. The students were inspired by the words only you can fix it by the author, and they began to observe their research outcomes denying. They examined Hyogo prefecture from the Seto Inland Sea to the Sea of Japan, 20 km east - west x 160 km north –south, and 146 samples were collected and analyzed. They created schematic diagrams of modified geological maps and formation process by rock mineralogical research method, and showed the formation process of Hyogo prefecture.

3. Research results in 2016

For our research paper in 2015, several papers on controversies from specialized researchers was published. The students realized that they finally entered the stage of discussing with experts beyond the level of research of high school students. To respond to these objections, they intensively investigated 60 km east-west x 90 kilometers north-south from a new structural geological point of view. They also analyzed 103 samples by rock and mineralogical methods and published papers showing that their research results were correct in 2015. Through these series of studies, students experienced that natural science develops while correcting errors by discussion.

Keywords: Earth Science Club, correction, argument

Problems as seen from the transition of geoscientific terminology described in high school textbooks

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It is predicted that "Basic Earth Science" and "Earth Science" will be set continuously in the next learning guidelines of high school.
However, there is no doubt that many teachers who have not studied Earth and planetary science while in college will be in charge of these subjects.
Under such circumstances, the following things should be avoided as much as possible.
・To use geoscientific concepts and terminology which can only be understood with a certain geoscientific background,
・Different expression by textbooks on certain concepts and phenomena,
・Array of learning contents and configration of logic are different from textbook to textbook,
It is considered, as a result, that these probrems negatively act on the student's formation of geoscientific literacy and on their course selection.
However, it is pointed out that such problems are found in current textbooks of "Basic Earth Science" and "Earth Science", and that similar problems are occurring with "Geography", and studies for problem solving have been made in JpGU.
In fact, such problems have been continued without improvement, in over 150 kinds of geoscience textbooks published in the past 70 years.
The depth of the problems mentioned above is thought to be here. As long as they are not solved, it is considered that there is no advance in the task.
Some examples of probrems are shown below.
·earthquake ground motion
·S-P time
·magnetic poles
·classification of igneous rock
·cross lamina

Keywords: high school textbooks, geoscientific terminology, transition and problems of contents

