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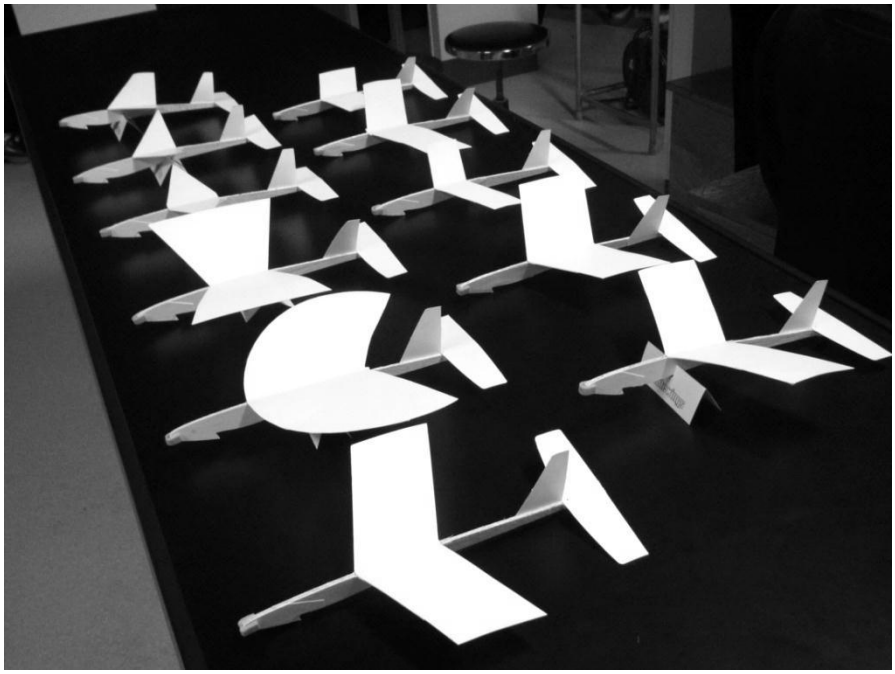
Science Research Ⅱ

－Collection of Research Abstracts－



Group 22　　Paper plane

MEXT designated Super Science High School (2012 - Year One)

Gifu Prefectural Ena High School

Contents

Euler's Identity

<INTRODUCTION>

The subject of our research is Euler's identity.

<OBJECTIVE>

The objective of our research is to prove Euler's identity.

<METHODS>

First, we learned Taylor's expansion.
Then, sinθ, cosθ, e^x were expanded in the form of a series using Maclaurin expansion.
Finally, Euler's identity was proved.

<RESULTS>

The following results were obtained; e^{ix}, sinX, cosX, were expanded using Maclaurin expansion. So, we got Euler's identity, $e^{ix} = \cos X + i \sin X$. Finally, we solved the identity for $X=\pi$ and got $e^{i\pi}=-1$.

Application development using Corona SDK

<INTRODUCTION>

The subject of our research is the development of an Application using Corona SDK.

<OBJECTIVE>

The objective of our research is to learn the method and techniques of smartphone application development, through the experience of making a smartphone application.

<METHODS>

First, Corona SDK was downloaded, what came next was designing the application.
The program was written using the Corona SDK Programing Language.
Next, making images and downloading them.
Finally, the application errors were checked and fixed to improve the application.
This process is repeated.

<RESULTS>

The Content of the application that was made is as follows. Push the start button and the game will start. Then a timer starts and apples begin to drop. The player moves the basket right and left, and catches the apples as they drop. When apples are caught in the basket, points are added.

Increasing the ability to run long distance

<INTRODUCTION>

The subject of my research is special endurance training for the purpose of increasing the ability to run long distance.

<OBJECTIVE>

The objective of my research is to examine the effects of three different kind of special endurance training on long distance running ability; endurance training with oxygen, endurance training without oxygen, and endurance with lactic acid.

<METHODS>

First, I ran long distance with a watch and measured my pulse and EPOC.
Then, I examined the data.

<RESULTS>

The following results were obtained; it is best to do endurance training with oxygen done best for a long time, and it is best to do endurance training without oxygen done best for a short time.

Paper Plane

<INTRODUCTION>

The subject of research is the maximization of paper plane flight time. It was for that purpose that the shape of its wings was changed. As a result, best shape of wings is the “V” wing plane planes and smaller area of wings is better than bigger.

<OBJECTIVE>

The objective of our research is to examine the effect of wing shape on flight time and make a paper plane that flies the longest time in the field with lift and air resistance.

<METHODS>

1. First, make six paper airplanes with different wing shapes were made. Second, the flight duration of each plane was timed three times with a stopwatch. Finally, the average was calculated and recorded and then the wing shape with the longest time was determined.
2. First, “V wing” paper planes of different sizes were made. Both the width and the length were changed. Second, the planes were divided into five wing types (normal, 1.3 times wide, 0.7 times wide, 1.3 times long and 0.7 times long). Third, the flight duration of each plane was timed three times with a stopwatch. Finally, the average was calculated and recorded and then the wing size with the longest flight time was determined.

<RESULTS>

1. The following results were obtained; the “V wing” paper plane flew about four times longer than the paper planes with triangle wings, circle wings and diamond – shaped wings and so on. According to this test, the “V wing” paper plane flew the longest out of all the other paper planes.
2. The following results were obtained; 0.7 times long paper plane flew the longest of five paper planes. The 1.3 times wide type paper plane and 1.3 times long paper plane received such large air resistance that they couldn’t fly for very long. The normal sized paper plane flew close to our image of the ideal flight and it flew second the longest of the five paper planes.

CanSat-A mock artificial satellite

<INTRODUCTION>

First, a mock artificial satellite (Can Sat) is launched into the sky with a computer. Second, Can Sat is released in the sky. Finally, it collects physical data with a parachute while it floats back down to the ground.

<OBJECTIVE>

The objective of our research is to maximize the satellites ability to collect physical data and make a parachute that maximizes the flight duration time.

<METHODS>

1. First, a soft of “mbed” was downloaded. And, it fed to the program about “yellow led flashed”. Finally, the “mbed” started up and yellow led flashed.
2. First, vinyl bags are cut into various shapes. Then, the vinyl bags are attached with strings to a can in order to create a parachute. Finally, the parachute was dropped from a height of four meters in the gym and the parachute test was recorded.

<RESULTS>

1. The following results were obtained; it is thought that the number in the program changes the times of emission of light. It can be used not only emission of light but also anything else.
2. The circular parachute had the longest flight duration time of the three. A triangle parachute is the shortest flight duration because the parachute didn’t opened. The square parachute opened but the flight duration time was short. It was concluded that the shape of the parachute and the direction and strength of the wind affected the results.

Humanoid Robot

<INTRODUCTION>

Our subject of our research project is to make a humanoid robot for a robot contest.

<OBJECTIVE>

The objective of our research is to learn how to build and program a humanoid robot.

<METHODS>

First, the robot body and a microcomputer board were made.
Then, the microcomputer board was programmed to carry out walking motion.
Finally, the computer gathers date as the robot walks and this is repeated many times. The experimental control is the frame structure and the variable is the angle of the motor.

<RESULTS>

The following results were obtained; we changed the original program. We changed the walking distance to 90mm. The upper half of the body leaned 10 degrees right, and 12 degrees left. Then, the humanoid was able to robot walk very well.

Model Rocket

<INTRODUCTION>

The subject of our research is the construction and safe launch of model rockets.

<OBJECTIVE>

The objective of our research is to build a rocket that will stay in the air for a very long time, so that our rocket can win a first place prize.

<METHODS>

First, we built many model rockets. It will be flying by ourselves. And we will.
Then, we collected. He model rockets we launched and we recorded the rockets flight data.
Finally, we repeated this process, and made the best model rocket that we possible could make.

<RESULTS>

Five rockets were made. However, they were not able to fly very well. We redesigned the rocket so that it could fly better, and stay in the air for a long time. For example, we experimented with changing the material used for the device makes the parachute easy to open, the weight and size of the rocket, and the parachute.

Synthesis of ruby

<INTRODUCTION>

The subject of our research is ruby synthesis by using the flux method way. To synthesize bigger rubies, we examined the effects of heating time and melting pots made of different materials.

<OBJECTIVE>

The objective of our research is to synthesize bigger rubies.

<METHODS>

First, the materials (MoO3, Al2O3, Cr2O3) were weighed and mixed.
Then, the mixed materials and platinum wire were put into a melting pot.
Finally, the melting pot was covered and heated in an electric furnace. The experimental controls are the materials and their quantities and the variable is the material that the melting pot is made of and the hearting time.

<RESULTS>

The following results were obtained; first, we found that compared with an aluminum melting pot, a platinum melting pot was easier to heat and performed better at the experiment. Second, when we had changed the heating time while using a platinum melting pot, we found that increasing the heat gradually was better than doing it all at once.

Plant pigment and mordanting

<INTRODUCTION>

The subject of our research is the use of plant pigments to dye clothes green. Green pigment can be extracted using alkaline water and then it can be used to dye clothes green.

<OBJECTIVE>

The objective of our research is to test the mugwort's leaf pigment's ability dye a cloth of cotton green, to examine how it is different from dyeing with alkaline water.

<METHODS>

First, mugworts are extracted by boiling alkaline water for 12 minutes three times. Each liquid dye was mixed.
Then, the liquid dye was mixed with 0.4cm^3 of acetic acid. A cloth was inserted into the solution and it is boiled for 6 minutes. $CuSO_4 \cdot 5H_2O$ was mixed into the water. The cloth was left to soak in the solution for six hours.
Finally, the liquid dye was mixed with 0.2cm^3 acetic acid. The cloth was inserted into the solution and boiled for 6 minutes. And then, the cloth is washed.

<RESULTS>

The following results were obtained; the cloth can be dyed bluer before it is dyed with purple amaranth. But the cloth was not so much green as it was Khaki.

Ultraviolet rays and plastic

<INTRODUCTION>

The subject of our research is the synthesis of UV-resistant plastic through the addition of titanium dioxide to urea resins.

<OBJECTIVE>

The objective of our research is to make a UV-resistant plastic.

<METHODS>

First, plastic is made from a urea, formaldehyde solution and sulfuric acid. Some of these plastics contain titanium dioxide.
Then, the durability of each plastic and the amount of that the ultraviolet rays were applied and the variable the presence of titanium dioxide exposed to ultraviolet rays.

<RESULTS>

	apply ultraviolet rays (1week)		control(no UV) (1week)	
	once	twice	once	twice
normal(kg)	0.50	1.00	0.57	1.50
with titanium dioxide	0.57	1.50	0.59	1.60

Fullerene Synthesis

<INTRODUCTION>

The subject of our research is the production of Fullerenes by the method called 'contact arc' (invented by *Smalley*).

<OBJECTIVE>

The objective of our research is to produce Fullerenes by contact arc.

<METHODS>

First, a vacuum is made in a container.
Second, the container is filled attn Helium.
Third, carbon sticks are electrified in the container. The distance carbon sticks is 1~2mm.
Finally, the produced soot is added to toluene and it is percolated. The experimental controls are the tools used during the experiment and the variable is the number of power units.

<RESULTS>

The number of power units	0 (only soot)	1	2	3	4
Color of toluene	colorless	colorless	light yellow	yellow	light red

The following results were obtained; if the color of toluene changed, Fullerenes were produced. When only one power unit was used, the current was too small to produce Fullerenes.

Changing the efficiency of bioethanol synthesis using sugar

<INTRODUCTION>

The subject of research is to survey the way of most efficiency generating ethanol and the research find when we generate ethanol from various sugar concentration of ethanol differ each other.

<OBJECTIVE>

The objective of our research is to determine the type of sugar that generates the most ethanol.

<METHODS>

First, yeast beads are made from yeast, calcium chloride, and sodium alginate. Then, 10g of sugar is mixed with 50ml of distilled water. This sugar-water solution is passed through a pipe full of yeast beads. As a result, ethanol is generated. Finally, the presence of ethanol is determined by using the F-kit. The experimental controls are the quantity of the distilled water (50ml) used to make the sugar-water solution, the quantity of sugar at (10g), the temperature environment of the pipe (40℃), the speed at which the water was poured 3, and when determining the presence of ethanol ,the precipitate was diluted 10 times. Also, the variable is the type of sugar.

<RESULTS>

After ethanol was produced by C6H12O6, light absorption coefficient was 0.190 without using the experiment liquid of F-kit. For the control, light absorption coefficient was 0.119 without experiment liquid of F-kit. On the other hand, ethanol is produced by C6H12O6, light absorption coefficient was 0.366 with liquid of F-kit. For the control, light absorption coefficient was 4,000 with liquid of ethanol. The light absorption coefficient of ethanol with sucrose is 4,04352g/l. On the other hand, the light absorption coefficient of ethanol with C6H12O6 was 4,26816g/l.

Dye-sensitized solar cells

<INTRODUCTION>

The object of our research is Dye-Sensitized Solar cells. We focus on the concentration of pigmental solution, adhesion to Titanium Dioxide and improving the efficiency of power generation.

<OBJECTIVE>

The objective of our research is to improve the efficiency of power generation by Dye-sensitized Solar cells.

<METHODS>

First, a paste was made from TiO2 and HNO3. It was spread on a conductive glass, and dried using a gas burner.
Then, it was soak spread liquid pigment extracted from hibiscus. If it is colored, it is cleaned using pure water and ethanol.
Then we spread carbon on another glass. And we heat them over gas burner.
Finally, these glasses were put together and both edges were sealed.
Then, electrolyte was allowed to enter. The experimental control is how the paste is made and the volume of water of water Search as on the glasses are not controlled and affect the result.

<RESULTS>

We think dye sensitized solar cell will last for a long time, if we prevent the solution from evaporating. So we glue the glasses together. As a result, we couldn't generation electricity because the solution evaporated.

Small scale experiments

<INTRODUCTION>

The subject of our research is small scale experimentation.

<OBJECTIVE>

Our objective is to experiment on a small scale and to achieve the same result as the original experiment. Consequently, small scale experiments have some advantages: that reduction of expenses, consideration of the environment and they use smaller quantities of reagent. In addition, small scale experiments are safer. We experimented with a small scale Daniell cell and Kipp's gas generator.

<METHODS>

○Daniell cell

First, a $CuSO_4$,$ZnSO_4$ was used as agar and was put into a cell. Then, both the agar and a water solution are connected to an ammeter and a voltmeter. Finally, they are connected to an electronic music box. The experimental variables are the water solution and agar.

○Kipp’ s gas generator

First, a small generator was made from a plastic bottle and a rubber stopper. Finally, a reagent was put into a small generator. And this reagent reacted inside the generator to produce gas.

<RESULTS>

○Daniell cell

The following results were obtained: the electric current in agar was smaller than the current in a water solution. But, the electronic music box in agar played as long as the one in a water solution.

○Kipp’ s gas generator

The following results were obtained: a small generator produced the same reaction as the Kipp's gas generator. It made a gas. A Kipp's gas generator uses ten times as much reagent as the small generator we used in our experiment.

Power generation

<INTRODUCTION>

The subject of our research is the relationship between the number of fan blades on a wind power generator and the amount of electricity generated.

<OBJECTIVE>

Objective of our research is to examine the above relationship using a model.

<METHODS>

First, the kit, WINDY was built.
Then, voltage power and electrical power and differences of distance between the wind source and the model were taken down. The experimental controls are the amount of wind and distance between the wind source and the model and the variable is the number of fan blades.

<RESULTS>

The following results were obtained; at first we tried to build a machine which generates electrical power. However after we listened to Mr. Sumino at the Sumino factory we found it difficult to build. So we gave up on building it. Then we bought a wind-power generation kit. Now we are doing the experiment.

The Quality of the water at Ena Gorge

<INTRODUCTION>

The subject of our research is water quality how it is affected by seasonal environmental changes.

<OBJECTIVE>

The objective of our research is to examine why a color of the water changes with the change of the season.

<METHODS>

First, water was collected from Ena Gorge.
Then, the water examined with a water quality standard kit.
Finally, microbes in the water were inspected using microscope. The experimental control is the source of the water used in the experiment.

<RESULTS>

The following results were obtained; we can find a lot of microbes in summer. But, we cannot find any microbes in winter. Also, chemicals were not found in the water from Ena Gorge.

A study of growth promoting factor of tobacco on plants

<INTRODUCTION>

The subject of research is the affect of tobacco on the growth of plants.

<OBJECTIVE>

The objective of our research is to determine the tobacco ingredients that affect plant growth and examine how it affects it.

<METHODS>

First, each kind of tobacco with difference amounts of Nicotine and tar were given to white radish sprouts.
Then, only Nicotine was given to white radish sprouts.
Finally, the tops of corn sprouts were containing a growth hormone removed and the given tobacco.

<RESULTS>

The liquid extraction of hastens the growth of white radish. Nicotine didn't control germination but it controlled growth, the corn sprouts without tips didn't grow.

Volvox

<INTRODUCTION>

The subject of our research is to culture Volvox carteri.

<OBJECTIVE>

The objective of our research is to increase in the number of cultured Volvox and distribute them to neighboring schools. As well as, study the way most suitable to increase the number of cultured Volvox.

<METHODS>

First, we mixed hyponex (5.0ml), menedael (50ml), hyatonic (5.0ml) and volvic (1ml). These are chemical fertilizers except Volvic (Volvic is water), and we put four times as much Volvic as the mixture.
Then we put the dilution (1000ml) and Volvox in a bottle and we cultured them with and without a temperature regulator. We mixed Magamp k (6drops), limestone (1) and loam (2ch) and then we added Volvox and cultured with and without a temperature regulator. We put Volvic and limestone in a bottle, and we cultured them with and without a temperature regulator.

<RESULTS>

The following results were obtained; the Volvox which had been grown in the solution made from only hyponex and the solution made from Volvic and limestone had died out. But the other Volvic which had been grown in the solution made from loam, Magamp k, and limestone had cultured. Compased with Volvox grown under a fluorescent lamp, Volvox grown under sun light grew much better.

Influence of ultraviolet rays

<INTRODUCTION>

The subject of our research is the influence of ultraviolet rays on white radish sprouts and floating weeds.

<OBJECTIVE>

The objective of our research is to examine the influence of ultraviolet rays on plants.

<METHODS>

First, the growth rates of floating weeds irradiated by natural light were compared with floating weeds irradiated by ultraviolet germicidal lamp.
Then, the amount of ultraviolet rays that passed through stacked glass slides was measured and recorded.
Finally, the growth rate of white radish sprouts and floating weeds that were exposed to ultraviolet rays were compared. The experimental controls are the quantity of white radish sprouts the quantity of floating weeds and the strength of the ultraviolet rays and the variables are the quantity of ultraviolet rays, the number of beakers, and the number of glass slides.

<RESULTS>

The following results were obtained;
1, the floating weeds irradiated with ultraviolet rays turned white.
2, as more glass slides were stacked less ultraviolet rays were able to reach the plants.
3, the plants, covered with three beakers were exposed to few ultraviolet rays and plant growth was not negatively influenced. But sometimes the plants, covered with two beakers grew better than the others.

Vitamin C in vegetables

<INTRODUCTION>

The subject of our research is to study the amount of vitamin C in vegetables and fruit under different conditions. To test vitamin C levels, the reaction of L-ascorbic acid and a water solution of iodine potassium iodide was used. We used cauliflower, yellow paprika, oranges and lemons in our experiment, the conditions we compared are natural, boiled, and, frozen.

<OBJECTIVE>

The object of our research is to examine change in vitamin C levels of vegetables and fruits across three different states: raw, boiled and frozen.

<METHODS>

First, a standard solution of ascorbic acid 10ml is put into an Erlenmeyer flask with whole pipette. A solution of starch 5ml is added to it. Three of these were made.
Then, a water solution of iodine potassium iodide is put into a burette. Add few drops of this to the Erlenmeyer flask.
Finally, the color of the solution changes blue and purple. That ends the experiment.

<RESULTS>

The following results were obtained; the amount vitamin C boiled oranges greatly decreased and the amount of vitamin C in frozen oranges increased. The amount of vitamin C in boiled lemons greatly decreased and the amount of vitamin C in frozen lemons increased. Vitamin C in boiled yellowish paprikas increased, vitamin C in frozen yellowish paprikas greatly increased. The amount of Vitamin C in cauliflower saw very few changes when boiled and frozen.

Distribution of Medaka in Gifu

<INTRODUCTION>

The subject of our research is the distribution of medakas in the Tono area of Gifu Prefecture.

<OBJECTIVE>

The objective of our research is to determine whether or not medakas can be found in the Tono area of Gifu Prefecture. If they can't be found there, we will pinpoint the cause.

<METHODS>

1. First, the device capable of changing water temperature was placed in an aquarium where medakas were living. Then, the water temperature was lowered by 1-5℃ day after day. Finally, we observed the state of the medka. The experimental controls are the speed of the water and the quality of the water and the variable is water temperature.
2. First, we collected water from the Agi River. Then, we put three medakas and the water we collected into a fish tank. Finally, we observed the state of the medakas everyday for a month. The experimental control is water temperature and the variable is the kind of water used.
3. First, we put together our experimental setup. Then, we put a medaka into the set up. Finally, we observed the state of the medaka. The experimental control is the force of the water's current and the variable is the water's temperature.

<RESULTS>

The following results were obtained; we found that medakas were weak against strong currents, distribution of medaka and medakas could live at low temperature, such as water temperature of 5℃.

Study of the lactic acid bacterium

<INTRODUCTION>

The objective of our research is the use of lactic acid bacteria in making yogurt.

<OBJECTIVE>

The objective of our research is to examine the different uses of lactic acid bacteria in the production of yogurt.

<METHODS>

First, various kinds of milk were poured into different beakers.
Then, yogurt was mixed with the various kinds of milk.
Finally, a machine was used to keep the solutions at a fixed temperature, a thickness was examined about 24 hours later. The experimental control is temperature the variable is the type of milk.

<RESULTS>

The following results were obtained; if a small amount of yogurt was used, it didn't curdle.We examined the difference in thickness of the milk and found that fresh vegetable cream became the thickest, and that soy milk didn't curdle well.

Investigating water quality using diatoms

<INTRODUCTION>

The subject of our research is water quality testing by using diatoms we did water quality tests by inspecting the kind of diatoms living in the river not using tests such as, the pack test. This way we can get correct results if there are sudden changes in the river. We found that diatom type differs depending on water quality.

<OBJECTIVE>

The objective of our research is to do exact water quality criteria by the diatoms, not burden to nature and not be affected by environment such as the heavy rain.

<METHODS>

First, we went to Agi River and gathered diatoms.
Then, the diatoms were treated with a washing lotion. After that, we looked at the diatoms through a microscope.
Finally, we sorted them using the Internet and books.

<RESULTS>

The following results were obtained; Ceratium was only seen in bad quality, Comphonema and Achnanthes were seen in good quality water.

Sexual pheromone of silk moths

<INTRODUCTION>

The subject of our research is about sexual pheromones of silkworm moths.

<OBJECTIVE>

The objective of our research is to examine how a male silkworm reacts in various environments.

<METHODS>

First, we used one normal male silkworm moth and examined its reaction to a female.
Then, we cut both of a male silkworm moth's wings.
Finally, we used a male silkworm moth whose wings were cut and examined its reaction to a female. The experimental controls are to use a normal female and keep the air motion constant and the variable is whether the silkworm moth has wings.

<RESULTS>

The following results were obtained; the normal male silkworm moth moved in a zigzag pattern and was able to reach the female. The male silkworm moth without wings could feel the pheromones, but couldn't walk well and reach the female.

Moss resistance to dehydration

<INTRODUCTION>

The subject of our research is to analyze moss structure and its ability to resist dehydration.

<OBJECTIVE>

The subject of our research is to consider to differences of reaction of moss under different environments, and analyze the structures related to moss resist one to dehydration

<METHODS>

First, the moss was divided into three laboratory dishes.
Then, the laboratory dishes treated dehydrately one watered. Excessively one watered moderately and one not watered at all.
Finally, maintain these considerations for a month. The experimental controls are the amount and length of the moss, and the amount of sunlight and the variable is the amount of water given to the moss.

<RESULTS>

The following results were obtained; the amount of water given to the moss changes the state of the moss. When the moss was watered excessively, its tissues were damaged, and its leaves changed its color because of rainfall stress. As we decreased the amount of water given to the moss, the tissues return to their normal state and the leaves retained their green color. On the other hand, the more the mosses were watered, they grew longer and faster.

Atera fault

<INTRODUCTION>

The subject of our research is the fault line that was through our hometowns. The name of this fault-line is Atera- fault.

<OBJECTIVE>

The object of our research is to optimize land usage in the fault-line areas in each of our hometowns.

<METHODS>

First, do feasibility studies on Atera- fault in the Nakatugawa mineral museum.
Then, go to Sakashita, Nakatsugawa-city and visually inspect the area.
Finally, use the internet, reference books, or topographical maps to get rough estimate of our local land usage.

<RESULTS>

The following results were obtained; Atera- fault is a fault that runs from north-eastern Nakatsugawa through Tsukechi, Sakashita and Gero. This is one of the leading high risk faults in Japan. We could see the uneven ground in the fieldwork in Sakashita caused by a slip in the Atera- fault. The Ena and Nakatsugawa basin was formed by the fault. This basin was found to be the center of the traffic in this area.