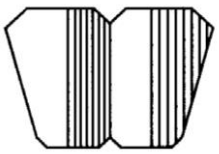
THEMATIC RESEARCH Ⅱ

Annual Report on Research Activities

Abstracts in English



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Kyoto Prefectural Rakuhoku High School

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Discussion of “Dominoes” in Multiple Perspectives

Makoto Fuji, Akira Ishikura, Kanei Sato, Haruto Tanaka, Kenshin Wakano

Abstract

We wanted to study what parameters make dominoes fall the fastest, so we created an experiment to test this. In this experiment, changing the interval between dominoes, we lined them up and measured the time at which all dominoes need to fall down. By calculating the velocity at which the weave of dominoes was transmitted, we found that the velocity is fastest when the interval is 1.7cm. Regardless of the volume of initial velocity, the motion behaved like constant velocity in linear motion. We concluded that the moment of gravity opposed to the direction of moving forward while dominoes were falling down was the cause.

Keywords: **domino, constant velocity, the moment of gravity**

Cause of Difference in Mortar Strength ~Experiment by researching amount of gap ~

Rintaro Makino, Ayame Mishima, Midai Okada, Yoshiki Tanaka

Abstract

We wondered what brings strength to the mortar against the stress of bending, and carried out the experiments. In this study, we focused on the amount of gap between excess water that is created when cement reacts with water in mortar. Therefore, we created mortars with a different density by changing the amount of water added, put a load on the center of the mortar from above, and measured the strength against bending stress by measuring the mass of the load added just when the mortar was destroyed. As a result, the strength decreased when the amount of water was increased or decreased than the standard amount, but both of them had a smaller density. These results suggest that density is related to the strength of mortar.

Keywords: **mortar, cement, strength against bending stress, the amount of gap, density**

Try to Change the Existing Taping!

～How Does Taping Affect the Ankles Range of Motion of Ankle Joints～

Satoru Ishida, Yui Misaki, Tokiha Nishiyama

Abstract

Taping is important for athletes when they are injured, because we can restrict the excursion by athletic taping. The difference of fixing force to athletic taping depends on the kind of athletic tapes. If you can change fixing force in other ways, we think it will increase the likelihood of treatment. In this experiment, the purpose is to change athletic taping's power by changing the way athletic tapes. We made an ankle model. And taped it up by the *heellock*, one of the ways to restrain inversion of the ankle. At that time, we taped it up in three ways. We put the athletic tape, from the Achilles tendon so as to pass through the center of the arch(A), heel side 3 cm from A(B), toe side 3 cm from A(C). We attached the weight(100g) to bend the ankle inward and measured the inward angle of A・B・C. On average, A's inward angle was 7.69°, B's inward angle was 12.7°, C's inward angle was 7.69°. From these results, when we wrap Athletic tape from the Achilles' tendon to the arch of the foot, it is clear that fixing power is strong. If we needed strong fixing force, we ought to wrap Athletic tape according to A. While, if we needed weak fixing force, we ought to wrap Athletic tape according to B or C. These ways to wrap are effective when we cannot change the kind of tape due to allergies.

Keywords: **athletic taping, athletic tape, fixing force, inward angle**

We have just dropped paint, but why?

Hikaru Hamabe, Asuki Matsuo, Yuta Sone, Atsushi Yamaguchi

Abstract

We have succeeded in realizing Viscous Fingering in an open system using two colored paints, and have confirmed a complex tree-like structure that is different from conventional ones. We conducted 36 experiments with 6 different concentrations of the paints. We were able to evaluate the complexity of the tree-like structure by using the index calculated from the lap length and area and when we used 88% yellow paint and 30% blue paint, we could make the most complicated structure. Finally, the concentration range that can be considered as the formation and optimum conditions were derived.

Keywords: **Viscous Fingering, paint, open system, concentration, viscosity**

Sprouting/Growing Condition of a Parasitic Plant, *Orobanche minor*

Shoma Murai, Erika Nakahara, Aki Tamura, Osamu Yamamoto

Abstract

Many parasitic plants exist all over the world, and they may parasitize various plants and cause agricultural damage. We were interested in the mechanism by which parasitic plants parasitize, and we focused on a kind of parasitic plant called *Orobanche minor*, which lives nearby us. We decided to investigate its germination and parasitic conditions and hypothesized that *Orobanche minor*'s seeds are not likely to sprout when the amount of water we give them is small and when they are immersed in phosphoric acidic aqueous solution and nitric acidic aqueous solution, which are nutrients for plants. Also, we guessed that the temperature they grow at and species of host plants affect how many seeds sprout. We placed a red clover or a white clover on a Petri dish with seeds of *Orobanche minor*, and left them for about 2 weeks moistening with water. We varied the temperature and nutrients in water, and then compared the germination rate of each case. The experiment was performed twice, and germination did not occur in the first experiment, but germination was successful by breaking the dormancy at 25℃ for 2 weeks in the second experiment. As a result, it was found that the germination rate was 43% when red clover was used as a host and 16% when white clover was used as a host at 18℃or 25℃. Regarding the relationship between the developmental state of the host and the germination rate, it was also found that germination does not depend on the developmental condition of the host.

***Keywords: Orobanche minor*, parasitic plant, germination rate**

Zebrafish’s Spatial Awareness

Keigo Kusumoto, Shu Negoro, Hiroki Odagaki, Temma Tani

Abstract

We researched zebrafish’s spatial awareness and memorization based on its attachment to bait. We opened a hole in the acrylic boards separating the water tank equally. Then, we recorded the time it took for them to reach one edge from the other. The zebrafish moved faster through the holes in the opaque acrylic boards than those in the transparent ones. Only the zebrafish in the tank with the white walls were able to reduce the traveling time. According to this data, we considered that the zebrafish can memorize the space information which means they have spatial awareness.

Keywords: **zebrafish’s spatial awareness, memorization**

Oxalis and Clover are similar in the appearance, but are there other aspects?

Kosuke Kawai, Kaiki Oba, Kohei Tsuji

Abstract

Like we described before in this title, these two species are, unless they have their own flowers, so alike in their appearance that many people cannot distinguish them correctly. However, they belong to completely different botanical groups and therefore it can be said that such a case is one of the examples of convergent evolution. We came to be interested in them and tried to reveal some differences, especially their vital difference between them. As methods to find differences, we searched some places like the Kamogawa River and schoolyard for an investigation of their vegetation. Concretely speaking, we examined the two in terms of how large their colony is, how bright the place where they grow is, whether they can survive after weeding, and so on. As a result of these approach, incorrect and imperfect as the results may be, we found in our preliminary search that Oxalis tend to grow in relatively dark area independently while Clover don't so much and that the root of clover are tough and entangled with other ones as if they formed a complicated network whereas those of Oxalis are not. These results may indicate that the causes that we found which make the two different with each other is whether colonies are present or not and the form of their roots. However, we think our approach to this subject is not enough at all. So we also think we want to continue to explore them as much as possible.

Keywords: **Clover, Oxalis, vegetation, convergent evolution**

The priority of slime molds' memory

Takato Ihara, Yuma Kitamura

Abstract

Genuine slime mold has survived without changing its appearance for hundreds of millions of years, and recent experiments have revealed interesting behaviors such as the ability to solve solving the maze and having memories. In addition, since it is a field that has been studied relatively recently, I thought that there are still many unknown properties to the mold, so we started experiments. In these experiments we check the priority of slime molds' memory, and the slime mold used in the research moves on average 1 cm per hour at room temperature, but when the temperature of the air was lowered and dried, it stopped moving. When we left it for a while, we found that even if there is no actual stimulation, it stopped moving to match the timing when the environment had deteriorated before. Based on this study, we decided to investigate the priority of the memory.

Keywords: **slime mold group, priority of memory, lower temperature and humidity**

How to Grow Molds

Sakiko Hosono, Chiori Kamibayashi, Rena Nishigaki, Mizuho Nunome

Abstract

To establish the way in which mold grows for later research, we experimented with the change in mold growth in relation to pH change. Our hypotheses are that the closer the pH is to 4-4.5, the easier it is for mold to grow, and that there will be no difference between hydrochloric acid and acetic acid media. The agar medium adjusted by mixing hydrochloric acid or acetic acid was left in a well-ventilated place for one hour, and then the lid was closed to observe whether mold grew or not. We counted the number of colonies. As a result, we saw 5.5 colonies at the medium of acetic acid and pH 6. There were no colonies at the medium of hydrochloric acid and pH 2 and pH 4. In addition to this, there were no colonies at the medium of acetic acid and pH 3 and pH 4, too. There was one colony at the medium of hydrochloric acid and pH 3, and also the number of colonies at the medium of hydrochloric acid and pH 7 was 0.5. According to the results, except optimal pH for molds, from 4 to 4.5, pH 6 is the best. Also, at pH 3, hydrochloric acid is better for growing mold than acetic acid

Keywords: **mold, colony, pH, hydrochloric acid, acetic acid**

Memory Experiment of Slugs

~Instruction Using Carrot Juice and Quinidine Sulfuric Acid Aqueous ~

Rana Igushi, Rin Inoue, Haruka Kaku

Abstract

We experimented on memory with *Ambigolimax valentianus* using carrot juice and aqueous solution of quinidine sulfuric acid to investigate the memory of slugs and apply them to human memory. Two slugs which drank carrot juice was soaked the quinidine sulfate aqueous solution, and 30 minutes later, put a slug in a petri dish where the carrot juice was put, waited 2 minutes, and if the slugs drank carrot juice, we would have been soaked the slugs aqueous solution of quinidine sulfate. This experiment was repeated 7 times every 30 minutes. One slug did not drink carrot juice in all seven experiments. However, the other slug was given an aqueous solution of quinidine sulfuric acid again because it drank carrot juice in the third experiment. In the subsequent four experiments, it did not drink carrot juice. From these experimental results, we were able to sustain the memory of the first slug for three and a half hours, and the memory of the second slug for two hours. A future issue is to sustain the memory of slugs for a longer time. Also, we want to research whether slugs prioritize negative phototaxis or a repellent behavior to carrot.

Keywords: **slug, memory, Quinidine Sulfuric Acid Aqueous Solution, carrot juice**

Producing a Four-leaf Clover through Stimulation

Hanaka Abe, Chihiro Nakanishi, Yuri Nishimura, Koharu Tanaka

Abstract

Clovers grow everywhere in the city. Clovers generally have three leaves but rarely have four leaves. The occurrence of four-leaf clovers is related to the environment and heredity, and we conducted experiments focusing on environmental conditions. We thought that we would be able to produce a four-leaf clover by giving stimulation because there is the report that it is easy to produce a four-leaf clover by stepping on one, then we gave clovers various stimulation and tried to produce one. As a first step, we grew white clovers under six conditions, each with different stresses. Next, we gave two physical stresses to white clovers, changing the timing and tried to observe the growth stage of four-leaf clovers arising. A four-leaf clover sprang up only from a plant cultivation kit which we used in the first experiment. These results indicate that heredity is related to the growth of a four-leaf clover. However, we could not find whether stress affects the growth of four-leaf clovers. We could not stimulate the accurate point of leaf primordium and could not reproduce the stress of stepping on one when dropping a glue stick.

Keywords: **four-leaf clover, stress, primordium**

Make a white flame?

Reita Imayoshi, Tatsuru Morishita, Shintaro Tagomori, Yusuke Tanaka

Abstract

It is well known what the flame reaction of one kind of metal salt is like, while the reaction of mixed metal salt is not known very much, so we began research to investigate it. In previous research, it is reported that the reaction of mixed metal salt appears separately in the internal flame and the external flame, and we thought it was caused by the difference of flame temperature. Therefore, we constructed the hypothesis that each flame reaction occurs at the same time and is seen as additive color mixing when we put it only in the external flame. First, we conducted experiments where two, three, or four of these regents; sodium nitrate (NaNO3), cesium nitrate (CsNO3), copper nitrate (Cu(NO3)2), and strontium nitrate(Sr(NO3)2) were mixed and each of these mixed solutions was placed in the external flame. We observed those conditions by using a spectrometer and a single lens reflex camera. Also, we used cesium nitrate and sodium nitrate at 0.50 mol/L each, and observed these three conditions: the condition where cesium nitrate was placed in an external flame, the condition where sodium nitrate was placed in that flame, and the condition where the sodium nitrate was removed. In the first experiment, each metal didn't react in the same time and place. When we used the aqueous solution of 0.50mol/L, sodium (Na) had the most tendency to react, followed by copper (Cu), strontium (Sr), cesium (Cs) in that order. On the other hand, when we used the aqueous solution of 1.0mol/L, cesium had more tendency than strontium. In the second experiment, the color remained yellow even after we pulled out the platinum wire adhered by sodium. Our results show that the reaction strength is different from metal to metal, and the longer the wavelength of the light emitted from each metal is, the more tendency to react the metal has. However, the electronegativity of each metal is also related to the tendency. Plus, each metal moves around the flame like vapor. From our results, we conclude that the complete color mixing cannot be seen in the flame reaction, because each metal moves around like vapor and reacts where it is easy to react and that the tendency is related to the wavelength of its light and the electronegativity.

Keywords: **flame reaction, color mixing, white flame, wavelength, electronegativity**

Formation and Strength of Films Made from Vegetables

Chiharu Chuma, Yumi Hisamori, Nanami Segawa, Kyoka Tanaka

Abstract

We read previous research from Osaka University and wanted to try to create practical films made from vegetables as an alternative to plastic films. We hypothesized that the more the amount of fiber included in the film increases, the stronger the film becomes. We removed moisture from mixtures which contained different amounts of strained carrot's lees and juice in order to make them film-like, and measured their strength. We changed the dilution of strained lees and juice to 7, 10, 12, 15, 17-fold. The amount of water that each dilution needed was, respectively, 143, 121.3, 60.4, 40, 38.6ml on average. These results show that in dilution between 7-fold to 17-fold, there was a tendency to become stronger with more fiber. We conclude that the proportion of fiber and sugar have influence on making strong films.

Keywords: **carrots, fiber, sugar, strength measurement**

Vegetables Protect You From Sunburn

~ Measurement of UV absorbance of polyphenols~

Mikito Fujimori, Osuke Yamada, Masaki Yamashita

Abstract

We learned that plants with a high amount of polyphenols have the ability to absorb UV rays. We were interested in planet-based sunscreen, so we decided to research how they worked. We studied how the degree of UV absorption changes by mixing them, and whether there is a relationship between the type of polyphenol and the degree of UV absorption. We measured the amount of polyphenols contained in the extracted solutions of the plants by the Folin-Denis method, and examined the UV absorbance of their individual solutions and the solutions mixed with them. As a result, we found that the UV absorbance of the mixed solution was the average of that of the single solution, and we thought that it would be possible to make a sunscreen for a wide range of wavelengths.

Keywords: **polyphenol, UV rays**

The Color Change of Anthocyanins

Yui Sasada, Sara Yokoyama

Abstract

It is known that the color of red cabbage depends on anthocyanins, so we are interested in the color change of anthocyanins. Therefore, we tried to reveal under what conditions what color changes occur. We carried out an experiment where we mixed substances containing anthocyanins, such as red cabbages and hydrangeas, with aqueous solutions containing a variety of ions. As a result, we could see the color change only when we combined aluminum ions with red cabbages. This color change was from purple to blue. From the data which we researched in advance, it should have turned into red, but it actually became blue. As we pursued the cause, we found that the color of anthocyanins changes not only when the pH of the aqueous solution differs, but also when the ion converts into a metal complex.

Keywords: **anthocyanins, pH, ion, metal complex**

Shall we produce yellow precipitate in Fehling reaction?

Makiko Maekawa, Riho Matsuda, Yuzuki Takagi

Abstract

We read a paper that said we can make yellow precipitate if we lower the temperature in a Fehling reaction. We wanted to produce yellow precipitate by changing time, temperature and pH. We hypothesized that the precipitate becomes yellower when the time is shorter, the temperature is lower and pH is lower, because the reaction occurs more slowly. Then, we performed a Fehling reaction using different times, temperatures and pH. Our results show that with pH 13.6, precipitate of 25℃ and 3 minutes is closest to yellow. With pH 11.0, precipitate of 35℃ and 5 minutes is closest to yellow. These results indicate that precipitate gets closer to yellow under lower temperature, shorter time and lower pH. Also, reaction speed becomes slow and particles are small when pH is low. Accordingly, we think that the color of precipitate gets closer to yellow under lower temperature, shorter time and lower pH.

Keywords: **Fehling reaction, yellow precipitate, time, temperature, pH**

Distribution of Bluegill in Takano River Using eDNA, biological sampling, and water quality surveys

Keisuke Adachi, Kai Nakano, Natsu Yoshida

Abstract

A non-native fish called bluegill is raging in Japanese rivers. Previous studies had concluded that bluegill did not inhabit the Takano River, but in recent years there have been reports of bluegill inhabiting the Takano River. Therefore, we used eDNA, biological sampling, and water quality surveys to confirm whether or not bluegills live in the river. The aim of this study is to explore the mechanism of habitat expansion of bluegill. We conducted an environmental survey by collecting water samples from sites in the Takano River system where bluegills are expected to live and from Takaragaike Pond where bluegills live. As a result, there was no reaction in the eDNA and no bluegill was found in the capture survey. According to a previous study, bluegills swim at a speed of 0.5 meters per second, and the Takano River, where we conducted this study, flows faster than that at many points, making it a difficult habitat. In addition, the number of native species in Takaragaike Pond, where bluegills have been confirmed to live, had decreased, while the capture survey in the Takano River showed no decrease in native species. Therefore, bluegills are not considered to be living in the area.

Keyword: eDNA, bluegill,

Go for Food Loss Zero in the School Cafeteria!

Mayu Hayashi, Sakiko Nishi, Risa Shirasawa

Abstract

Since food loss is often considered problematic these days, we decided to propose remedial measures to the school cafeteria in order to reduce food loss. We suspected high school students' consciousness about food loss is high, because many students knew the word "food loss" and wanted to avoid food loss according to our preliminary survey. Therefore, we considered raising awareness and working out improvement measures in the school cafeteria that will reduce food loss. First, we conducted a questionnaire on high school students to investigate their consciousness about food loss in the school cafeteria. Second, we did an interview survey with a worker for "Fujiya Shoji" which manages our school cafeteria and a worker for the school cafeteria to search for the school cafeteria's work against food loss. Our research shows that the percentage of students who have left food was 10%, but the number who have answered the way to dispose of the leftovers is to abandon them was 60%, and the biggest reason why students leave food is that the amount of food is too much. These results indicate the main cause of food loss is the way of disposal and the amount of food, so we think we can solve these problems by putting up posters and increasing the range of sizes and menus.

Keywords: **food loss, school cafeteria, Fujiya Shoji**

Let's Found The Ideal Food Delivery Company

Sakura Yasuno, Hina Yodoya

Abstract

Since COVID-19 has spread, going out has been regulated and the market of food delivery has suddenly expanded. On the other hand, take-out disposable containers lead to plastic waste problems, and this is controversial all over the world today. Thus, we try to continue the expansion of food delivery service market and solve environmental issues, like plastic waste. First, we had a questionnaire for Rakuhoku students to make the service more popular and useful. Second, we investigated features of some materials, such as heatproof temperature and the possibility of using microwaves and so on. Our results show that people request the quality control during driving and the mandatory training of delivery personnel and so on, and foamed polypropylene is the best material for containers. From our results, we consider that to control quality and solve the problem of plastic waste, collecting and reusing containers, and using containers made of foamed polypropylene designed to maintain the condition of food as they are cooked by the food delivery company and made of foamed polypropylene is ideal. Our ideal food delivery company has new systems and they will cost a lot of money, but as far as we calculate the cost, the ideal company will run.

Keywords: **food delivery, environment, plastic waste problem, foamed polypropylene, reusable containers**

A mask suitable for moisturizing the skin

-For better mask life-

Ayaka Ota, Ayami Tomioka

Abstract

Masks are causing problems such as rough skin and discomfort caused by putting them on. So, we wanted to find out which masks were suitable for the skin and mitigate this problem. We focused on the humidity and temperature inside the mask to find the cause of the problem. As a step to prevent rough skin caused by wearing a mask, we investigated which mask is suitable to prevent such rough skin. We did an experiment to measure the transition of humidity while wearing a mask in a heater(about 37℃) and refrigerator(about 0℃) that are close to summer and winter temperatures. Our results show that in the heater, the masks with a low rate of decrease in humidity were non-woven masks, and in the refrigerator, the masks with a low rate of decrease in humidity were cloth masks. From our results, we conclude that non-woven masks in summer and cloth masks in winter are suitable for moisturizing the skin.

Keywords: **humidity, a low rate of decrease in humidity, rough skin**

What's Your Favorite House?

～Enlightening Students about Energy-efficient Houses with a Puzzle Teaching Material～

Aoi Matsubara, Manami Narita

Abstract

Energy-efficient housing, such as Passive House in Germany, has been attracting attention globally. Despite its importance, it isn't known well in Japan now. We tried to enlighten high school students about energy-saving houses by creating a puzzle teaching material. First, we made pieces for the teaching material and evaluated each piece for insulation, cost, and other merits and demerits. Next, we made students play with the teaching materials and ask a few questions about it. Their answers were mostly positive. However, some said it didn't have enough explanations for each piece or it wasn't very enjoyable. Moreover, some suggested it might be better as reference material in a home exhibition center. This result suggests that our teaching material works to help students gain knowledge about and get interested in energy-saving houses. It seems to also be effective in helping people planning to buy a house to understand detailed information. We should survey the opinions of more players and improve the material for these uses.

Keywords: **energy-efficiency, housing design, teaching material, puzzle**

The Formula of Voice
~Impression survey using questionnaire and sound analysis experiment~

Jumon Ikeda, Shunsuke Kume, Yuto Shirai

Abstract

The most important aspect of human speech is whether or not it can be heard clearly, and the reference unit for this is called “intelligibility”. However, the exact level of intelligibility has not been quantified and defined. Therefore, we began our research with the first goal of examining appropriate ways of speaking in situations where information must be conveyed accurately and clearly, such as in a speech, and finding the elements necessary to establish them in a specific and concise manner, and the second goal of establishing a numerical standard for intelligibility. Two male and two female students were selected from the school's student body and asked to speak prepared sentences at three different speeds. After recording the speech, the recorded data was categorized by gender, and the different groups were compared and rated on a seven-point scale. The recorded data was analyzed using software that can analyze speech. In this questionnaire, the smaller the number, the higher the rating. For males, the voice with the highest rating was 2.725, which was relatively low-pitched and normal speed. The voice with the lowest rating was 5.225, which was relatively low-pitched and slow in speed. For females, the highest rated voice was 2.711, and this voice was of normal speed. The lowest rated voice was 5.053, which was a fast voice. Overall, fast voices were rated low. After this questionnaire, the audio was analyzed, and the results supported the trends seen in the questionnaire. From these results, we can conclude that taking care not to speak too slowly for men and too fast for women is an effective factor in establishing appropriate speech. Although we were not able to establish comprehensibility numerically, we can say that we have achieved our initial goal with this conclusion.

Keywords: **intelligibility, listening, pitch, speed, voice analysis**

The Number of How to Divide an Integer Rectangle into small Rectangle

Keita Kurokawa

I studied about the number to divide an integer rectangle (length"m" width"n") into k integer rectangles. (I call this number "the division number"). The theme about division of rectangles is very prominent in math study and "Squaring the square" is the most famous one. I found some preceding study, but it didn't consider how many to divide a rectangle, so I focused on this point. In my study, I made a recurrence formula and got some result of calculation, but it was difficult to acquire the general term of it, so I evaluated how fast the division number increases by using "big One notation." As a result, I proved $\mathrm{f}(n,k) = O(n^{k-1})$ regardless of "m". This suggests that the division number increases as fast as "n^{k-1}"when increasing "n".

In this study, I considered division in two dimensions, so, as a next assignment, I want to do it in three dimensions.

Keywords: **rectangle, division, recurrence formula, big One notation**

Classification of Pentagons by Japanese Theorem

Aya Hanada, Yoichi Tsujimoto

Abstract

According to Japanese theorem, if we divide a polygon which is inscribed into a circle in some triangles, by using the diagonals, the sum of the length of the radii of circles which are inscribed into the triangles is constant regardless of the way to divide. Based on the variance of the radii, we tried to classify pentagons. We made a unique index and get data from many pentagons. Researching the relation between the eccentricity of the quadratic curve, which is through the apex of the pentagon and the index, we found a positive correlation. Also, it is suggested that they have a positive correlation between the new index and how close the pentagon and circle are.

Keywords: **Japanese theorem, pentagon, triangles, polygon, classification**

Reproduction of movements of injured people

Harunari Kambe, Kazuhito Muramatsu

Abstract

When a disaster occurs in places people gather like amusement facilities, stagnation at a pathway, a flood of evacuees and so on may induce crowd collapses and crushes as well as delays of evacuation. In terms of prevention, it needs logical consideration to enable rapid, safe, and reasonable evacuation. Prior studies made a simplified model which represents crowd movements and we thought we could add the concept of speed. We dealt with this problem by introducing the concept of speed of evacuees to a simplified model which has been used in research, the Floor Field Model. Having done this, we were able to consider some people, as disabled or injured. We created cells that represent filed shape 12x12 square, and added 144 evacuees, and other rules followed as prior studies determined. We set the rules of "injured people" as that an evacuee can be an "injured person" with a 5% possibility when they are placed throughout the field. By making an algorithm that follows the model and rules, evacuees with "injured people" took 8% more time than evacuees without "injured people" did and there are 7.20 "injured people" on average.

We think we reproduced the real movements of "injured people", making bottlenecks and being left behind. We hope that our study becomes beneficial in future disaster prevention planning.

Keywords: **evacuation, floor filed, injured people**