THE ANNALS OF EDUCATIONAL RESEARCH
〈Vol.46 March 2019〉

Development of cross-sectional classes to express a secure house living space using various construction techniques

Futoshi Hattori, Yuka Yatsuhashi, Yuta Kawamura, Shoichiro Sendai, Atsushi Hikita

Abstract: In this research, we aim to foster the ability to propose a sustainable living environment in a three-dimensional space trying to organize a lesson in order to clarify the image of the child in the living space: "house". First, we revealed the change of the image of the "house" of the fourth graders through the model making: the children have become conscious of their own life on the durability of the house, or the attachment to the ground through the experience of model making. In addition, we found their interest to the exterior space.

1. Introduction

The authors have already planned a lesson plan for making a model of a house using the building method "tie" and "assemble", and devised various mechanisms for constructing classes. Though those techniques were almost established, on the other hand, children did not express the floor and windows because they focused on creating the structural model itself as the framework of the house itself in the classes. In addition, we could point out that unresolved problems remain in the subject matter of expressing it as a living space of the house.

Therefore, in this research project, we try to organize a class to clarify the image of the child in the living space called "house" and aims to foster the ability to propose sustainable living environment in 3 dimensional space.

2. Purpose and Method

In our previous studies, it was clear that the model making techniques influenced the model expression produced by children.

Therefore, in this research, in order to make a lesson composition focusing on clarifying the difference of the image of the "home" of the child before and after the model making, we will plan a workshop (WS) that can express living space by drawing "Own Home Plan", "Concept Plan", and "Completion Plan" in addition to the model making. Then we clarify the transformation of the image of the "house" of the child through these plans and report on the application in the social studies class based on the result.

In the WS of the year 2018, it is targeted to 4th grade children (32 persons).

In the WS, the children were divided into 6 groups (5 or 6 persons in one group), and 1 or 2 university students were accompanied by 2 groups. At the beginning of the WS, the children drew Concept Plans to explain the "house I want to make" and made the "house" model under the

conditions presented. In addition, they drew a completion plan at the end of WS as an explanation of "the house I created".

2.1 Home Plan: Questionnaire for children / parents

Before starting WS, we conducted a questionnaire on security to the children and parents. Within this questionnaire, they explained the secure place of the house actually living in the A3 paper Home Plan. In the Own House Plan, we analyze the form and living function of drawn houses.

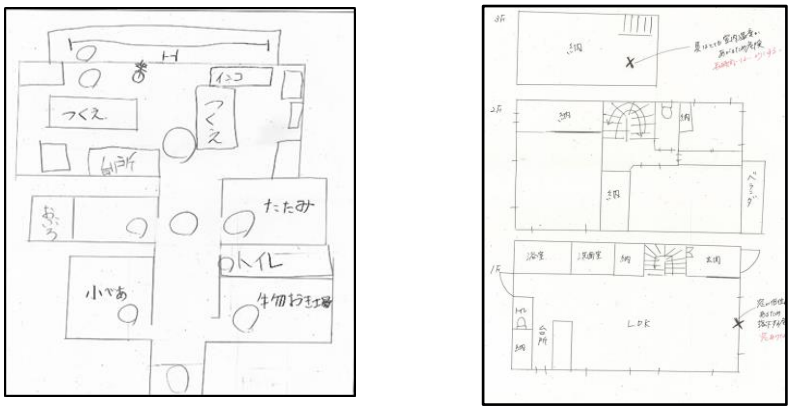

Fig. 1: Own House Plan (left: child, right: parent)

2.2 Concept Plan: Explanation of the model to be made

We distributed the Concept Plan at the start of WS. Based on the question "Please explain with a picture freely about the house you want to make," the children fill out the model to be made with aqueous pens on A3 paper. At this step, we do not set the condition of "house" to be made. In the Concept Plan, we analyze the form and living functions of depicted houses.

Also, in order to compare with the Concept Plan created by the children, their parents also drew the Concept Plan under the similar conditions.

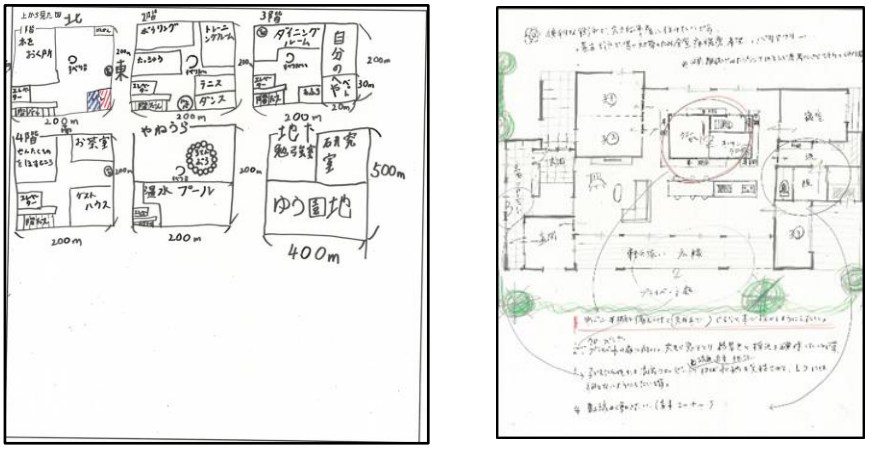

Fig. 2 Concept Plan (left: child, right: parent)

2.3 Imposing the construction conditions

Before the model making, we imposed the construction conditions. The construction conditions refers to restrictions on the site, natural environment and materials based on actual house making. The slides actually presented to the children are shown below. Basically, we decided to use the most primitive building methods ("tie" and "assemble") and materials (natural materials such as wood and grass) in the history of Japanese architecture.

2.4 Model making

In the model making WS, under these conditions, the children made "house I want to make" on a 1/20 scale (As preparations, we made a model of about 70 mm in size on a styrene board (70 mm x 40 mm x 5 mm) according to the average height of 4th grade children .) Children made models using A3 size styroform with a thickness of 15 mm as a ground, bamboo strip, balsa square material, toothpicks as members, cardboard as a plate material, and kitchen paper as a covering material. In the method of "tie", members are joined using cotton yarn, and in the method of "assemble", using a drill at the joining part, a hole is made in the square material and a bamboo strip is inserted and joined. In addition, we prepared bonds as supplementary joining members, but the supporters instructed the children to refrain from using bonds as much as possible.

When the children faced the difficult tasks such as disconnection of parts, the supporters recommended work with minimal assistance.

2.5 Completion Plan: Explanation of the complete model

At the end of the WS, we distributed A3 size Completed Plan form. Based on the question "Please describe the plan of the house you made freely, please explain it freely." Children drew the model they made with an aqueous pen (Completion Plan 1).

In addition, they filled in with a pencil afterwards, "I wanted to make but where I could not do" (Completion Plan 2). In the Completed Plan, we analyze the form and the living functions of the drawn house.

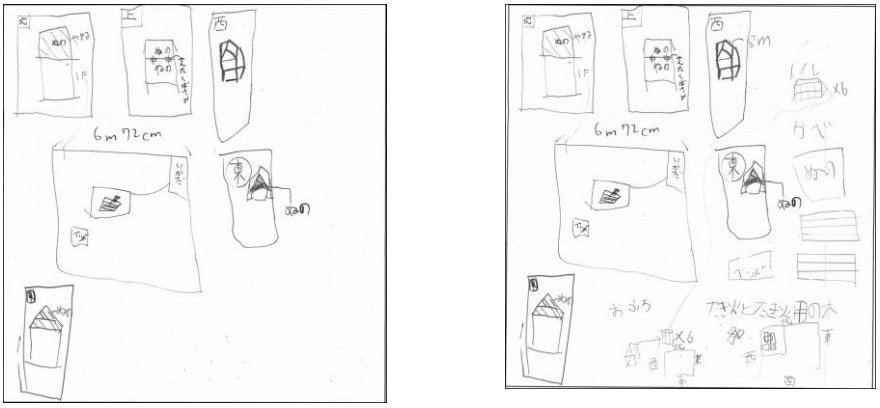

Fig. 3 Completion Plan 1 (left) and 2 (right)

2.6 Analysis method

Based on the hypothesis that what was expressed by the model is basically reflected in Completion Plan 1, in order to make the comparison target to the same level, we used Completion Plan instead of the model itself for the analysis.

2.6.1 Analysis of form

We classify the form of house depicted in each plan by three elements of floor height, main structure and opening.

2.6.2 Analysis of Living functions

We classify the living functions wrote in each plan into five categories: sleep, eat and drink, hygiene (physical condition management), activity, and others. The classification method and its outline are shown in the table below.

* About the own house plan, it would be analyzed only inside the house.

Then, in order to highlight the features of each sort of plan, we make a comparison with the drawing of their parents and the model made by the child (Completion Plan 1). Finally, we discuss the change of the image of the child's "house" in the process of Own House Plan, Concept Plan, and Completion Plan 2.

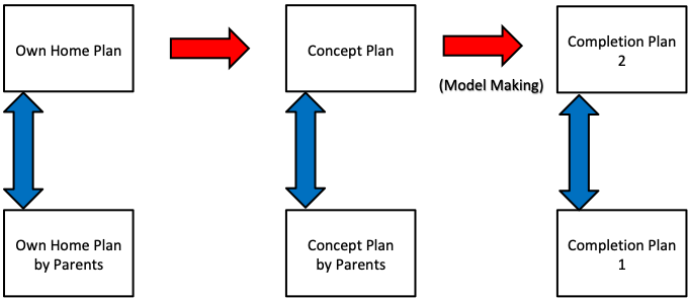

Fig. 4 Analysis of the image of "house"

3. Result

The results of the analysis of the Own House Plan, the Concept Plan, and the Completion Plan are below.

3.1 Form

(1) Floor Height

In the Own House Plan, 37.5% of the children drew high-floor houses, whereas in the Concept Plan all children drew the house with a high floor. From this, we can point out that children have a strong interest in high-floor houses, regardless of the height of the actual floor of the house they live in. Also, in the Completion Plan, 84.4% of the children drew low-floor houses. From this, we can point out that children tend to lose interest in high-floor houses from the Concept Plan to the Completion Plan.

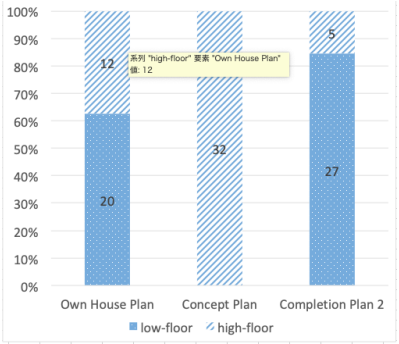

Fig. 5 Comparison of Floor Height

(Own House Plan - Concept Plan - Completion Plan 2)

(2) Structure

In the Concept Plan, all the children drew a house of the ramen type. In the Completion Plan, few children drew tent type houses in the Completion Plan.

(3) Opening

In the Own House Plan, only 15.6% of the children drew houses with openings whereas 61.5% of parents drew houses with openings. On the other hand, 37.5% of the children drew houses with openings in the Concept Plan, but the opening drawn in the child's Concept Plan is not aimed at day lighting or green scenery like the opening in the Concept Plan of their parents. From this, it can be

said that the child's interest in the openings is low in the Own House Plan / Concept Plan. Also, in the Completion Plan, the number of children who drew the house with openings was as low as 12.5%. 40.6% of the children made houses without coverings.

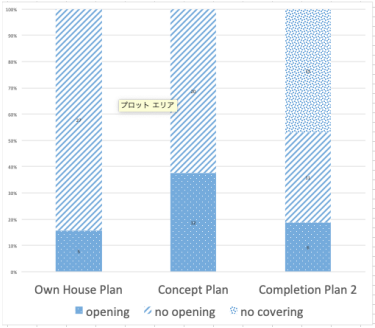

Fig. 6 Comparison of Opening
(Own House Plan - Concept Plan - Completion Plan 2)

3.2 Living functions

(1) Inside

From the home map to the Concept Plan, the ratios of sleep, eat and drink were decreasing, whereas the patios of activity and others were increasing. On the other hand, the percentages of sleep, eat and drink had greatly increased from the Concept Plan to the Completion Plan, whereas the ratios of activity and others were greatly reduced.

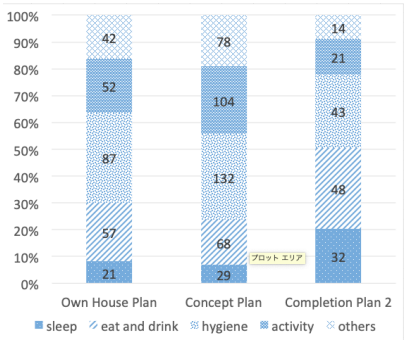

Fig. 7 Comparison of Living function (Inside)
(Own House Plan - Concept Plan - Completion Plan 2)

(2) Outside

It can be seen that the percentage of functions related to eat and drink, hygiene increased greatly from the Concept Plan to the Completion Plan, whereas the ratios of activity and others had decreased greatly. In particular, the increase in the ratio of hygiene was remarkable

4. About cross-subject approach

Next, I will report on social studies classes that apply the results of previous research.

4.1 About past cross-disciplinary approach

This research focuses on the concept of safety from fiscal 2015 and has been practiced. Inpractice, it has been conducted as a cross-disciplinary approach between social studies and modeling studies. In social studies, it was mainly responsible for learning about the natural conditions that threatened safety. After thinking about how to avoid and prevent natural conditions that threaten safety, I made a model of a safe house and space. Modeling of a safe house and space showed the

production technology in the modeling department. Next, the outline of what kind of cross-disciplinary approach has been taken since fiscal 2015 is described below.

2015 is the practice by the second grade. In this practice, we learned to create a safe house. A safe house is, in short, a house where you can live without exposing your life to danger. In this case, children especially considered disasters such as earthquakes, tsunamis, and typhoons. On a daily basis, wind and rain can also be a factor in exposing life to danger. In fiscal 2016, the second year, we worked on creating a safe house in the primitive age. The children who are building safe houses in the second grade work on building safe houses assuming severe natural conditions as well as disasters by assuming a primitive age.

In 2017, the third year, we worked to create a safe space. Of course the safe house, I was thinking about what kind of state around the house would be a safe space.

As described above, I thought about shifting the time base to the primitive age and thinking about extending the space axis around the house as to what should be the living space for people to live safely. Through three years of practice, children have been thinking about how secure homes and their surroundings can be secured. We show what kind of effect there was to learning of children by cross-subject approach.

year	subject	Social studies	Drawing and crfts
2015 (Second grade)	Building a safe house 【present day】	・Natural disasters such as earthquakes, tsunamis and typhoons threaten people's safe lives. ・Even the wind and rain that usually do not feel anything threatens people's safe lives.	・Draw a plan of a safe house. ・Cut and scrape chopsticks and bamboo chopsticks. ・Paste the cooking paper. ・Join with kite thread, rubber band, and enameled wire.
2016 (third grade)	Building a safe house 【Primitive age】	・Natural disasters such as earthquakes, tsunamis and typhoons threaten people's safe lives. ・The use of fire by people makes them more prone to fire. ・In the primordial age, the infestation of beasts can threaten safe lives.	・Draw a plan of a safe house. ・Join with kite yarn. ・Make a hole in the square rod or bamboo rod with a drill and join. ・Paste the cooking paper.
2017 (fourth	Safe living space 【Primitive age】	・Natural disasters such as earthquakes, tsunamis and	・Draw a plan of a safe house. ・Join with kite yarn or bond.

Fig.8 Previous learning and effects

As shown in the table, in the area of social studies, it is mainly learning to catch what kind of dangers exist in our lives. While thinking about how to eliminate or reduce the danger, in the Department of Design, we are drawing on the design of the house and the surroundings of the house, and making based on the design. The cross-subject approach is a flow of learning that specifically captures the concept of "safety" and how to create "safety." There is the following problem in the learning of the arts department that makes the model of the safe living space without learning that grasps the concept of "safety" in social studies.

First, the safety assumed by children is separated from the actual society. For example, it can not be said that the assumption of "if aliens invade the earth" or "in the world after 10,000 years" does not come out. It is necessary for children to assume an actual society and to express what is the concept of "safety" by the words of the children. Second, the safety assumed by children is that it is difficult to share them with each other. Each child has a different living environment. Therefore,

the assumed safety also differs depending on the individual. For example, there are the following assumptions: "Because there are a lot of car streets around the house and worry about getting involved in a traffic accident" and "We are on the first floor of the apartment, so worry about not getting in a thief".In this case, individual differences may deepen the understanding of things that prevent children from “safety”. However, the above-mentioned "traffic accident" and "the thief" are artificial. It does not always occur like natural conditions such as rain, wind and typhoons. In order for people to live safely, it is first necessary to eliminate or reduce the severity of natural conditions. About this necessity, it is important to aim at common understanding by learning of concept of "safety".

Then, if we did not learn to make a model of the safe living space of the arts department after grasping the concept of "safety" in social studies. There are also two problems in this case. First of all, children are only able to capture a safe living space, and can not confirm whether the safe living space they have actually considered can be realized. It becomes the state of the eyebrows drawn in the so-called picture. It is necessary to adjust to a safe house or living space with high possibility by drawing or creating a design drawing of a model of a safe house or living space.

Second, related to this issue, there is no opportunity to deepen the concept of "safety." By drawing and creating a plan of a model of a safe house and living space, "It is convenient for the area near the river to obtain drinking water and grow crops. However, there is also the danger of flooding. By going back and forth in social studies and modeling studies, you can deepen your understanding of "safety."

4.2 As a developmental cross-disciplinary approach-in the case of social studies-

One of the characteristics of this cross-subject approach in this research is that the concept of "safety" can be caught in social studies learning. By the concept of "safety" I caught, I was able to practice learning of the plastic arts department while assuming the actual society. In other words, it can be said that effective learning of the arts department can be performed depending on what kind of "safety" is caught in social studies. Therefore, in order to further develop cross-sectoral approaches, we considered what kind of "safety" concept can be captured in social studies learning as follows.

The concept of "safety" so far has been the way of thinking about how to guarantee security individually, such as a house or the surroundings of a house. However, in actual society, there are many cases where everyone secures security. In order to secure security not only for individuals but also for everyone, it is essential to create a functional town. It is also effective to take up the area where you live now about making a town conscious of safety. We can expect that we can grasp about "safety" of area where we live in in light of actual area and deepen understanding. For example, in the 4th grade, we take local fire brigade as a social event that everyone secures security and learn. We recognize that safe living space is made based on such people's work. We recognize that safe living space is made based on such people's work.

Not only the work of such people, but also the location conditions of the town are important. In other words, it is important to consider not only the work of people such as the fire brigade, but also what kind of land the town is made and how it is safe to maintain the town.

Based on the above, we deepened the concept of "safety" in social studies and developed a unit of "building a safe town" to be restructured.

By carrying out this unit, children are expected to develop learning activities of the modeling department of safe town development based on the concept of "safety" that has been deepened and restructured.

4.3 About development of class

This practice is scheduled to be implemented in the 4th grade social studies department at Hiroshima University attached elementary school. The development of business. In the fourth grade, there is a unit called "the work of the pioneers who did their best in the development of the area".

In this unit, we will take the forerunners who have contributed to the development of the region, such as flood control, industry, and culture, and deepen the awareness about the region. The learning proposed in this research will make it possible to grasp how the predecessors kept safety in mind when creating a town.

The subject of this unit is Ikujiro Wada. Ikujiro Wada is a person from Hiroshima City who was active in the Meiji period. 1884, he led 25 Hiroshima people and pioneered Kitahiroshima village (now Kitahiroshima City) over Hokkaido. Kitahiroshima village at that time was an unexplored land, and forests and wilderness had spread. It was necessary to clear up such land as a land where agriculture can be done. In the case of Kitahiroshima village reclamation, natural conditions such as snowfall and cold winter peculiar to Hokkaido were also dangerous for Ikujiro Wada who spent in warm Hiroshima prefecture. In addition, around undeveloped Kitahiroshima village, animals such as a brown bear and a wolf were dangerous beings. In order to overcome the harshness of nature and the harm caused by animals, it was necessary not only for all the villagers to work together but also for the planning of the village. When designing a village, it was necessary to give the function for group acquisition of "safety" as well as for village creation for agriculture

4.4 Class structure

(1)Unit "Making the Ikujiro Wada's village"

(2)Goals

・Through the Hokkaido reclamation project by Ikujiro Wada from Hiroshima City, it is possible to know that people who were involved in Hokkaido reclamation in the early Meiji period had made a pioneering spot in Hokkaido.

・Ikujiro Wada and others can learn that they have overcome the harsh natural environment of Hokkaido and are devising ways to live safely

・You can find out the origin of Kitahiroshima City from the relationship with Ikujiro Wada.

・You can think about the devices that Ikujiro Wada. Have done to overcome and live in Hokkaido's harsh natural environment.

・We can think about improvement points from the current point of view about the safe life that Ikujiro Wada.

・They are interested and interested in Hokkaido's reclamation of Ikujiro Wada. And they can try to actively know and think about Kitahiroshima City.

(3) Unit plan (7 hours completed)

The first ...Ikujiro Wada and Kitahiroshima village 3

The second ... Development of Kitahiroshima village 2

The third ... Making "safety" of Kitahiroshima village ... 2 (this 1/2)

(4) Real time goal

・We can read what kind of danger there was in Kitahiroshima village before reclamation based on document.

・In order to overcome dangerous situations, we can think about the creation of a safe village that Ikujiro Wada.

・You can think about the idea for living a safer life about the safe village creation that Ikujiro Wada Considered.

(5) True development

Learning activities	Expected child reaction	Intention and hand of instruction	Document
1. It is predicted what kind of danger was in Kitahiroshima village (Hokkaido) at the time. (10 minutes)	・It seems that a lot of snow falls and the cold is severe. ・If there are brown bears and wolves, I can not walk outside safely.	・Based on the data, let you read that there were natural wonders unique to Kitahiroshima village such as heavy snowfall and cold winter in Kitahiroshima village (Hokkaido) at that time, and beast harm by animals such as brown bear and wolf.	・Photograph "Kitahiroshima village"
2 . Think about the issue. (15 minutes)			
What sort of device was used to create the “safety” of Ikujiro Wada and others?			
(1) Think about how you can say "safe". (2) Discuss the "safety" of Kitahiroshima village.	・ There is a need to reduce the risk from natural conditions and animals. ・ Ikujiro Wada had to protect the life of the villagers as a village chief. ・ Everybody's house is set in the center of the village. ・ I think that it is related to farming work, but I am making a village in a place away from the forest where animals live.	・Make sure that the natural conditions and the dangers from animals are large and it was necessary to remove some of them. ・As the head of the village, Ikujiro Wada complements the need to work on the creation of a village to guarantee the security of the villagers. ・ From the data, it is read that Kitahiroshima village had various devices to create "safety". ・ We read that house of pioneer of Kitahiroshima village is built solid in center of village. ・ Read that the village is built in a place far from the forest. ・ As a measure to the cold, I notice that I have built a thick roof.	・ Photograph "Brown, wolf" ・Topographical map "Kitahiroshima village" ・ Map, photograph "Kitahiroshima village" ・ Photograph “The house of Ikujiro Wada ”
3. Discuss how to improve the "security" of Kitahiroshima village at that time. (15 minutes)	・ Can we really ensure "safety" only by creating these villages?	・ Additionally, even with these measures, "safety" can not be completely secured. ・ We will discuss what is necessary as an idea for each group in order to raise the “safety” of Kitahiroshima village.	・Topographical map "Kitahiroshima village" ・ Document “A sketch of Ikujiro Wada ”
4. Summarize the time. (5 minutes)	・ Kitahiroshima village was going to create "safety" in a group.	・ Ikujiro Wada tried to secure the “safety” of Kitahiroshima village as a group. However, sometimes it was not enough from the situation.	

5 Conclusion

In the analysis of the form, from the Concept Plan to the Completion Plan, the children's house have become low-floor houses. In the analysis of living functions, the ratios of living functions related to the body such as sleep, eat and drink, hygiene have risen from the Concept Plan to the Completion Plan. Based on their experience of the model making, it is thought that children have become aware of the security of their life in the durable house and the body management.

In addition, the children were always conscious of the inside the Own House Plan / Concept Plan, and were not conscious of the relationship between the inside and the outside compared to the parents. However, due to having given the site of the model in model making, the some parts of the living functions inside the house have moved to the outside in the Completion Plan. The inside and the outside of the house seems to be connected seamlessly, the outside is not the aesthetic view from the inside for the children, but the place of the living function and the inside was considered equivalent.

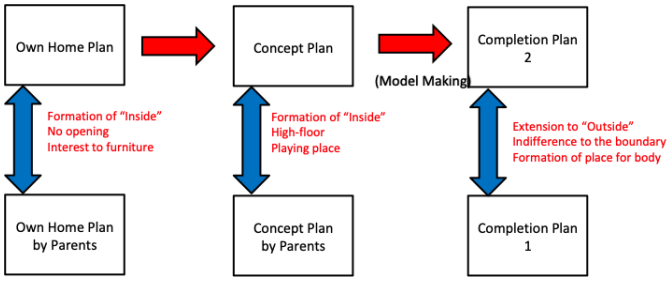

Fig. 9 change process of "house" by children

In addition, it can be said that the following points were effective by tackling across the subjects.

First of all, I was able to do learning that could not be achieved only with social studies and modeling arts. Even if you have learned about the concept of "safety" only with social studies, if there is no activity of the modeling department who designed and produced about "safety" houses and villages, actually thinking about a model about "safety" There is no "safety" concept.In addition, it is effective to intensify the desires and wishes for children's "safety" by actually making them.

Second, by learning about the concept of "safety" in Social Studies and making them in the Arts department, it became an opportunity to review everyday life from their own learning activities, "Is this really safe?" It is.

It is thought that the awareness of "safety" has risen only because we have continuously learned about "safety."

References

Okinishi, K. et al. (2017). Lesson Program for Spatial Composition of "House" with Different Structural Methods by Third Graders of Primary School. *The Annuals of Educational Research 45*, pp.43-51

Okinishi, K. et al. (2016). Lesson Program for Understanding the Maintainable Environment Through Making "Secure Base". *The Annuals of Educational Research 44*, pp.27-34

Okinishi, K. et al. (2015). The Attempt to Lesson Constitute for Proposing Independently of "safe environment" by Elementary School Student. *The Annuals of Educational Research 43*, pp.61-67