Students' Concentration on Woodworking in Japanese Technology Education - Planning chopsticks as an introductory work of technology education

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Abstract- The purpose of this study is to make clear the formation of students' concentration on woodworking in Japanese technology education at secondary school. We conducted a main study on a total number of 59 eighth grade students, and assigned a work of carving wooden chopsticks as an introductory work of technology education. In order to assess how students' concentration will be formed on the woodworking instruction of this study, we prepared questionnaire items and a free description. The results are as following;

1) The first hypothesis of this study is presumed from ANOVA results that students formed the 1st factor; *concentration toward working* through the woodworking and instruction on the upper and the lower group students.

2) The second hypothesis of this study is presumed partially from ANOVA results on the upper group students. But it was not presumed on the lower group students.

3) The lower group students declined the 3rd factor; *flow concentration* toward lower level due to their anxiety and nervousness about the woodworking and instruction.

Keywords – Concentration, woodworking, Japanese Technology Education

I. INTRODUCTION

Japanese technology education consists of technology of material and processing, technology of energy conversion, technology of nurturing living things and technology of information.

It is important that students form concentration themselves through the assignment in a class. Also we think that we could assist students to form their concentration through a suitable set of instruction according to students' ability and attitude.

Concentration could be defined as "the ability to direct all your effort and attention on one thing, without thinking of other things" [1]. In this study, we refer that "one thing" means the learning of the woodworking. Also we refer that students' keeping up concentration is a status of concentration, and students' having good feelings about the status of concentration is the formation of concentration.

TAKENO and MAMORITA conducted a study of structures of students' concentration on woodworking [2]. They investigated the consciousness difference of the status of students' concentration. The results of the factor analysis showed three main factors, namely *concentration toward working*, the 1st factor, *concentration toward thinking*, the 2nd factor, and *flow concentration*, the 3rd factor. Also they assumed that it is easier to be conscious of the 1st factor than the 3rd factor. In addition, they assumed that the closeness of the 1st factor; *concentration toward working* and the 2nd factor; *concentration toward thinking* is confirmed and students constructed the 3rd factor; *flow concentration* by reaching the other concentration factors.

On the other hand, that leading study argued it is important to begin with a concrete and an easy introduction work in order to suitably form the status of students' concentration on woodworking [2]. IKETANI and ITOI commented that someone could make high concentration levels and high feeling, while they start to do something [3]. KODAMA suggests a method that to improve one's concentration, which is to devote you to simple work [4]. Therefore we could think that it is effective to begin with the work by hands and visible activity on a simple work for formation of students' concentration.

The purpose of this study is to make clear the formation of students' concentration on woodworking in technology education. We think it is important that students could form concentration themselves through the woodworking in Japanese Technology Education on Secondary school. In order to make clear how students form status of concentration, we made hypotheses for this study as following. The first hypothesis is if students begin with a simple and visible work by hands then they could form the 1st factor; *concentration toward working*. The second hypothesis is if students form the 1st factor; *concentration toward working* firstly, then they could form the 2nd factor; *concentration toward thinking*, and the 3rd factor; *flow concentration* gradually.

II. PROPOSED ALGORITHM

A. Outline of the instruction of woodworking –

We assigned a work of carving wooden chopsticks as an introductory work on Japanese Technology Education (see Table -1 and Figure 1). Using wooden chopsticks is a part of daily life in Japan. That means chopsticks are familiar with students to learn about the production on technology. Also, the making process and structure of chopsticks are simple for students. In addition, the processes from "marking" to "coating" could be covered in a short amount of time relatively as an introductory work.

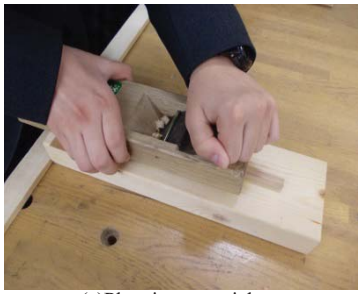
This learning instruction was designed to be 150 minutes duration. Also in order to form students of concentration, we conducted instructions about the factors of concentration. The wood of the cherry tree is an easy and commonly used material for the production of chopsticks. Therefore, we prepared cherry wood (8mm[thickness] ×8mm[width]×270mm[length]) as the materials to be used by the students for the work.

Table -1 Instruction plan for making chopsticks

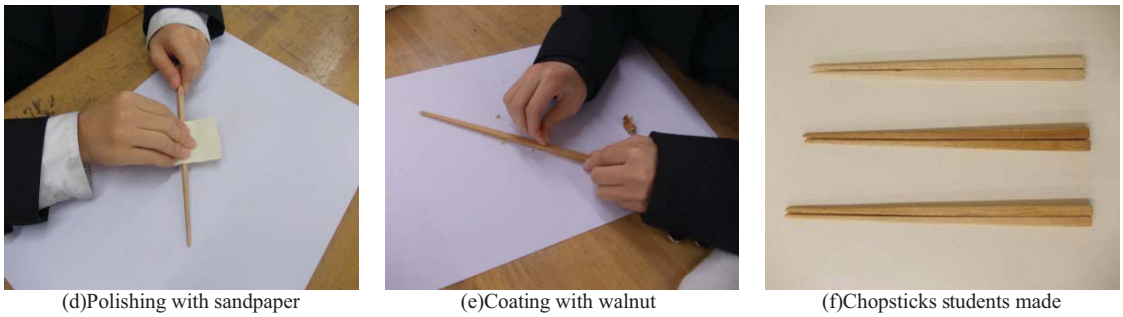
Process	Learning contents	Students' activities	Teachers' support	Learning target	Evaluation	Support to formation of students' concentration
Introduction (25min.)	**Pretest**	Response the pretest	Distribute the pretest.			
	Explanation	The origin of a word, history and culture of chopsticks.	Showing slides and woods for chopsticks.	Student could be interested in making chopsticks.	Is a student interested in making chopsticks?	**The 2nd factor;** explanation a work process visually, so that students could imagine the finish goods and something to happen from now.
Development (100min.)	**Design** **Marking**	Deciding length of chopsticks Marking lines on material.	Explanation how to decide the length of the chopsticks. If a student does not understand the length of chopsticks, then teacher measures length.			**The 2nd factor;** explanation a work process visually, so that students could imagine the finish goods and something to happen from now.
	Sawing	Cutting the unnecessary part of material.	Explanation about sawing and taking care of lines. If a student does not understand how to cut the material, then teacher demonstrates.			**The 1st factor;** explanation about taking care of line for sawing, and sawing seriously. **The 3rd factor;** if a student has the flow condition, then teacher takes care of keeping him or her on.
	Planning	Planning material.	Explanation how to use the plane for the grain of wood. If a student does not understand how to use the plane , then teacher demonstrates.	Student could work safely while taking care of the grain.	Is a student able to plane along with the grain?	**The 1st factor;** explanation about taking care of the grain, and planning seriously. **The 1st factor;** explanation working safety for protecting injuy with the edge of plane and so on. **The 3rd factor;** if a student has the flow condition, then teacher takes care of keeping him or her on.
	Polishing	Polishing with sandpaper.	Explanation the difference of coarseness of sandpaper. Explanation polishing the surface of material along with grain. Distribute some sandpapers.			**The 1st factor;** explanation how to make surface with sandpaper along with grain. **The 3rd factor;** if a student has the flow condition, then teacher takes care of keeping him or her on.
	Coating	Coating with walnut.	Explanation how to coat with walnut. Distribute some cloths to wipe the walnut oil.	Student can finish a better work.	Is a student able to check out the surface of wood and coat smoothly?	**The 3rd factor;** if a student has the flow condition, then teacher takes care of keeping him or her on.
Conclusion (25min.)	**Conclusion** **Posttest**	Knobing beans is practiced using the chopsticks they made. Looking back upon the learning. Response the posttest and free description.	Distribute some beans. Explaination about learning points. Distribute the posttest and free description.			

(a)Marking lines on material

(b)Cutting the unnecessary part of material



(c)Planning material



(d)Polishing with sandpaper (e)Coating with walnut (f)Chopsticks students made

Figure 1. (a)Marking lines on material (b)Cutting the unnecessary part of material (c)Planning material (d)Polishing with sandpaper (e)Coating with walnut (f)Chopsticks students made

B. Assessment of a status of concentration –

In order to assess how students' concentration will be formed on the woodworking and instruction of this study, we prepared questionnaire items and an inquiry of a free description against this work. These questionnaire items were tested as the pretest and posttest on working. Also these questionnaire items consist of the 1st factor; *concentration toward working*, the 2nd factor; *concentration toward thinking*, and the 3rd factor; *flow concentration* (see Table -2) [2]. Each of the items required students to choose between "I think so", "I think a little", "I do not think a little", "I do not think so", and students' responses were scored on the four-affair method. Also the concentration scores were summed, as the higher scores were positive responses. Furthermore a free description is inquired after the woodworking of this study.

The inquiry time took place in June 2011. This assessment was conducted on a total number of 59 eighth grade students (22 boys, 37 girls) of one secondary school.

Table -2 Questionnaire items of students' concentration

Items for the pretest and posttest
The 1st factor ; Concentration Toward Working
When you are in a state of concentration, you are absorbed in a working.
When you are in a state of concentration, you are enjoying a working.
When you are in a state of concentration, you are facing a working seriously.
When you are in a state of concentration, you are working carefully.
When you are in a state of concentration, you are continuing the working well.
The 2nd factor ; Concentration Toward Thinking
When you are in a state of concentration, you are imaging the completion.
When you are in a state of concentration, you have an acute sense.
When you are in a state of concentration, you are controling the consciousness of expansion and distractions.
When you are in a state of concentration, you are imaging what something will happen.
When you are in a state of concentration, you have a sharp nerve.
The 3rd factor ; Flow concentration
When you are in a state of concentration, you do not notice even if someone speak to you.
When you are in a state of concentration, you do not feel emotions.
When you are in a state of concentration, you can only see what you are doing.
When you are in a state of concentration, you are not worried about your feelings.
When you are in a state of concentration, you are facing yourself with silence.

III. Experiment and Result

A. Outline of students' concentration score –

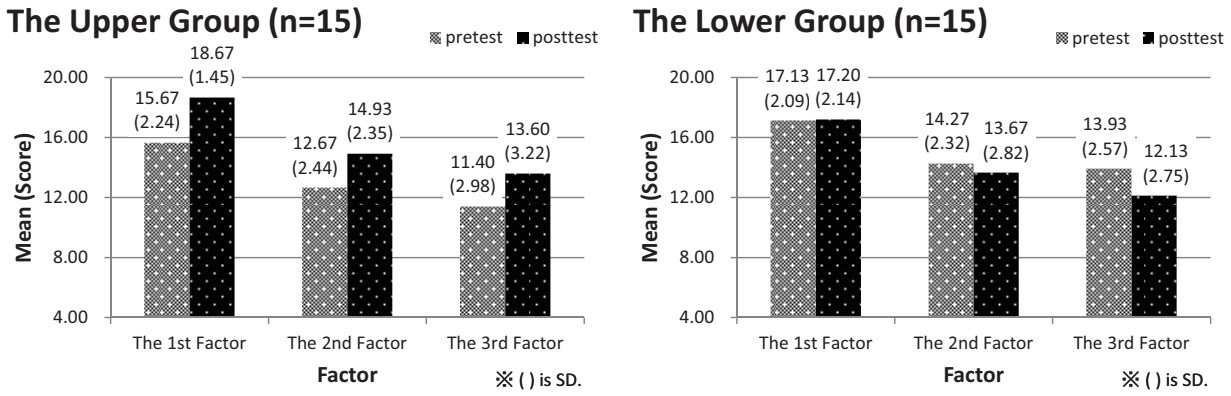
Students' responses to the questionnaire were analyzed as scores of students' concentration. The total concentration scores are shown as Means and SDs at pretest and posttest (see Table -3). T-test revealed there was a significant difference in the total concentration scores of between the pretest and posttest ($t(58)=4.96$, $p<.01$). This result indicated that students formed concentration through the instruction of woodworking.

Table -3 Means and SDs at pretest and posttest

	n	Mean	SD
pretest	59	42.92	6.06
posttest	59	45.47	5.95

B. Concentration factors –

Firstly, the students' group was divided into the upper group (n=15) and lower group (n=15) based on students' concentration scores. Also the questionnaire items of concentration have 3 factors. And then Means and SDs of the total scores of 3 factors on the upper and the lower group at pretest and posttest were shown in Figure 2(a) and Figure 2(b). The data of Figure 2(a) and Figure 2(b) were analyzed with ANOVA on each group.



(a) (b)

Figure 2. (a)Means and SDs of students' concentration scores of the 3 factors on the upper group students (b)Means and SDs of students' concentration scores of the 3 factors on the lower group students

On the upper group students, ANOVA results showed pre-post test and factor variance in Table -4(a). The results revealed no significant difference on the interaction of the pre-post test and factors, but there were significant difference on simple main effect of the pre-post test cases ($F(1,14)=202.79$, $p<.01$) and on simple main effect of the factors cases ($F(2,28)=22.28$, $p<.01$). Furthermore, differences in means were analyzed with the multiple comparison procedure. The results showed a significant difference between the 1st factor; *concentration toward working* and the 2nd factor; *concentration toward thinking*, and between the 1st factor; *concentration toward working* and the 3rd factor; *flow condition* ($Mse=7.81$, $p<.05$).

On the lower group students, ANOVA results revealed a significant difference on the interaction of pre-post test and factor ($F(2,28)=6.71$, $p<.05$). And then ANOVA was analyzed details more as Table -4(b). The result of this analysis revealed significant difference on simple main effect of pre-post test cases at the 3rd factor; *flow condition* ($F(1,14)=19.78$, $p<.01$), on simple main effect of factor cases at the pretest ($F(2,28)=14.26$, $p<.01$) and on simple main effect of factor cases at the posttest ($F(2,28)=24.99$, $p<.01$). Furthermore, differences in means at the pretest were analyzed with the multiple comparison procedure. The results showed a significant difference between the 1st factor and the 2nd factor, and between the 1st factor and the 3rd factor at the pretest ($Mse=3.26$, $p<.05$). Also differences in means at posttest were analyzed with the multiple comparison procedure. The results showed a significant difference among all of the 3 factors ($Mse=4.05$, $p<.05$).

As a result, we confirmed that it is easier to form the 1st factor of concentration than the other 2 factors through the woodworking and instruction of this study.

Table -4 (a) Analysis of variance of pre-post test and factors on the upper group students (b) Analysis of variance of pre-post test and factors on the lower group students

Source	SS	df	MS	F	p
S	290.82	14	20.77		
Pre-Post(A)	139.38	1	139.38	202.79	**
S×A	9.62	14	0.69		
factor(B)	348.02	2	174.01	22.28	**
S×B	218.64	28	7.81		
A×B	2.96	2	1.48	0.84	
S×A×B	49.04	28	1.75		
Total	1058.49	89			

**p<.01

(a)

Source	SS	df	Mse	F	p
Pre-Post(A) at The 1st Factor(B①)	0.03	1	0.03	0.03	
(S×A at B①)	17.47	14	1.25		
A at The 2nd Factor(B②)	2.70	1	2.70	1.41	
(S×A at B②)	26.80	14	1.91		
A at The 3rd Factor(B③)	24.30	1	24.30	19.78	**
(S×A at B③)	17.20	14	1.23		
Factor(B) at Pre(A①)	92.84	2	46.42	14.26	**
(S×B at A①)	91.16	28	3.26		
B at Post(A②)	202.53	2	101.27	24.99	**
(S×B at A②)	113.47	28	4.05		

**p<.01

(b)

Therefore, in order to form students' concentration, it is important that the 1st factor is concerned with suitable instruction firstly. Also then the first hypothesis of this study could be presumed from ANOVA results that both of the upper and the lower group students formed the 1st factor through the woodworking and instruction.

Additionally, the upper group students formed a high level of all the factors. But the lower group students declined the 2nd factor and the 3rd factor toward lower level. The second hypothesis of this study could be presumed partially from ANOVA results on the upper group students. But it was not presumed in the lower group students. We have to study more about formation of concentration in the lower group students.

C. Free description –

Students' responses of the inquiry of a free description were analyzed as the case study using their comments.

In the upper group students on concentration scores, there were some positive comments about the factors of concentration. For example of the 1st factor; *concentration toward working*, that was "I had a concentration when I fixed the shape with a plane and I coated".

At the 2nd factor; *concentration toward thinking*, that was "I enjoyed while imaging the figure of completion". Also of the 3rd factor; *flow condition*, that was "I could absorb in this working". These comments were positive comments about the formation of the concentration. Therefore, we could state that the upper group students formed the concentration through the woodworking and instruction on analysis of a free description too.

In the lower group students on concentration score, students made comments about their nervousness before the working and feelings of difficulty for the working. For example, those were "I was afraid whether I could really make chopsticks before the working", and "I thought it is very easy to carve wood with a plane before the working, but it seemed to me to be difficult unexpectedly when I did it". Also there was negative comment about the 2nd factor. For example, that was "I could not work how I have just imaged before the working".

These comments were negative comments. Therefore, it is necessary that the lower group of students were more concerned with suitable instruction.

Csikszentmihalyi explained about theory of flow that balance of "challenge" and "ability" lead someone to growth and finding [5]. According to this theory, he argued if someone felt nervousness in a challenge, then he or she will have a non-flow condition. Also in technology education, OTA and ANDO explained if unskilled students are assigned a new working like a cutting wooden material, then they feel anxiety because of their "challenge" level does not match their "ability", and then they will have a non-flow [6]. Therefore, the lower group students in this study declined the 3rd factor; *flow concentration* toward a lower level because of their anxiety and nervousness about the woodworking and instruction.

In this study, students could form their own concentration though the woodworking and the instruction. Also students formed the 1st factor; *concentration toward working* easily rather than others; *concentration toward thinking*, and *flow condition*. This result indicates that it is effective to begin with a simple and visible working. If a student begins with a simple and visible working, then he or she could form the 1st factor easily. In addition, if a student could image a working process beforehand, it is possible to form the 2nd factor; *concentration toward thinking.*

The lower group students could not form concentration rather than the group of upper students. On a free description, the lower group students made comments about anxiety and nervousness on the woodworking and instruction. In this case, Teachers should consider students' statue of feelings and skills. If they have technical anxiety, we could prepare the practical material for practicing beforehand and instruct more simply and visibly.

Kraepelin clarified to promote a working, and the factors of this promotion are beginning effort, ending effort, tired effort, adaptation and practical effect. Also, he clarified that to be fatigued restrains someone from working [7]. On this report, he suggested that it is helpful for promoting a working to prepare the data from analysis of a working process, and knowledge of fatigue and practical effect. And then we could decide the length of a work time and the length of a rest time and the insertion method, and the practical method and so on.

We could apply the Kraepelins' suggestions to the instruction of the concentration on woodworking. When teachers instruct to the upper group students, they could make them self-education of learner to teach the practical effect for taking care of the lower group students more. Also, when teachers instruct to the lower group students, they could analyze the status of students' concentration concerning their fatigue and anxiety. And then they could control the work time and insert the rest time and practical method.

IV.CONCLUSION

The purpose of this study is to make clear the formation of students' concentration on woodworking in Japanese technology education at secondary school. We conducted a main study on the total number of 59 eighth grade students, and assigned a work of carving wooden chopsticks as an introductory work of technology education. In order to assess how students' concentration to be formed on the woodworking instruction of this study, we prepared questionnaire items and the free description. The results are as following;

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3) The lower group students declined the 3rd factor; flow concentration toward a lower level due to for their anxiety and nervousness about the woodworking and instruction.

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