

Verification of Motivation to Learn and Self-Efficacy in Junior High School Learning of Production (monodukuri)

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Abstract- We examined, analyzed and verified how much motivation for learning and self-awareness of skills for using a saw junior high school students have in learning production (monodukuri) in technology education, as well as how much experience of production they had at primary school and at home before entering junior high school. The response to students' questionnaires shows that, in terms of the motivation to learn production, first-grade students scored higher than second-grade students, and thus significant differences were seen in the factors of motivation to learn about production. Further, regarding self-efficacy in production practice and self-awareness of skills for using a saw, second-grade students had a stronger feeling of competence than first-grade students, and a significant difference was seen in almost every category.

Keywords – Production (monodukuri), Motivation to learn, Self-efficacy, Using tools, Self-awareness of Skills.

I. INTRODUCTION

Since the academic year of 2012, the Curriculum Guidelines for Japanese Junior High School have been fully implemented, and technology and home economics education (hereinafter referred to as “technology education”) have consisted of four compulsory subjects: materials and processing, energy conversion, biological cultivation, and information. In technology education, education in production was planned and designed based on scientific and other knowledge and has been carried out in such forms as the creation of specific products by the use of physical and other skills.^[1] (Hereinafter, education in the design and production of products by the use of wood, metals, plastics, etc. is defined as “education in production” in a narrow sense.)

Education in production has been carried out, centering on “A. technology of materials and processing.” It can be inferred that the first-grade junior high school students, who study production formally for the first time, might feel competent, anxious or afraid when using a saw.

During the preceding study, research and analyses were carried out to ascertain how first-grade junior high school students' experience in learning production before entering junior high school affects their motivation for learning and their self-awareness of skills for using tools in technology classes. According to the results, with respect to motivation for learning production, it was indicated that female students tend to want friends and teachers to be involved with them during learning of production. As for self-awareness of skills for using tools, it was found that female students have a strong sense of fear or weakness towards saws, hammers, and drills. It was also found that experience in using tools at home or at primary school before entering junior high school is a factor for reducing fear or anxiety. This indicated that proper demonstrations on how to use the tools and devising guidance that reduces students' anxiety are important for the learning of production.^[2]

Therefore, to understand the students' actual situation more clearly, we think it is important for the learning of production in technology education that teachers have a clear understanding of what experiences their students have

already had before entering junior high school, their motivation for learning and their awareness of the skills for using a saw.

For the research on the motivation to learn in technology education, Higa has been studying the factorial structure that heightens motivation to learn in technology education classes through a survey conducted on the teachers of technology education.^[3] Kato et al. have also clarified the structure of students' motivation to learn technology education in general,^[4] and Okuni et al. have focused on relating the motivation to dynamics.^[5] Further, Moriyama has studied the structure of students' motivation to learn in the field of metalworking and attempts to utilize the structure in improving the quality of classes.^[6] In order to have a clear understanding of the motivation to learn in the technology education classes, we have up to now constructed criteria for use in technology education classes, analyzed the changes and characteristics of the motivation to learn, and considered the methods employed for instructing students.^{[7][8]}

In addition, in the study on self-efficacy, Yata et al. have researched and analyzed the relationship between students' thoughts on learning production and self-efficacy.^[9] Moreover, Yamao et al. have analyzed the technical high school students' sense of occupational self-efficacy.^[10]

However, each one of these studies was only conducted on the students' motivation to learn production or their motivation in the technology education classes and their sense of self-efficacy, but did not clarify the students' experiences in production or motivation to learn production before entering junior high school, the relationship between motivation and self-awareness of skills for using a saw, or other aspects.

For this study, we conducted research on the level of experience in learning production that first- and second-grade junior high school students had when in primary school or at home before entering junior high school. Furthermore, we analyzed and considered how the students' previous experience in production affected their motivation to learn about production, their self-efficacy in production practice, or their feelings toward tools, taking into consideration relations and background in terms of grade and sex.

II. RESEARCH CONDUCTED

A. *Research target and when it was conducted* –

Target: 101 fifth-grade children and 79 sixth-grade children, a total of 180 children (95 boys, 85 girls) from three public primary schools in Hiroshima Prefecture; 118 first-grade students (55 boys, 63 girls) and 133 second-grade students (62 boys, 71 girls), a total of 251 students (117 boys, 134 girls) from a junior high school in Kyoto City; period: May-June 2012

B. *Research method* –

Children and students wrote their answers in the questionnaire sheet that they received. Prior to conducting the survey on the junior high school students, the questions were recorded on a recording medium. The recording was used every time the survey was conducted, with the students writing their answers in response to the recording so as to pursue a high degree of uniformity throughout the survey, which was performed in units of one class.

C. *Contents of the research*–

Survey on primary school children

To research junior high school students' self-awareness of skills in using tools, we thought it necessary to narrow down the types of tools to be used. For this purpose, a survey was conducted on fifth- and sixth-grade primary school children, adopting the tools specified in two publishers' technology textbooks^{[11][12]} and those specified in the national guidelines for the curriculum on technology / home economics education as the choices. Moreover, to research what tools the primary school children are familiar with other than those listed in the questionnaire, a column for free writing was set up to research the level of the primary school children's knowledge about the tools used for learning production in technology education.^[13]

Survey on junior high school students

The content of the research on the motivation to learn technology and self-efficacy before learning production is as follows:

- 1) Motivation for learning production in technology education
- 2) Self-efficacy in production practice
- 3) Level of awareness for production practice

- 4) Self-awareness of skills for using a saw
- 5) Experience of production at school or at home.

Answers to the questions relating to the above content were selected from among choices.

1) To identify trends in the students' motivation for learning in production classes, a survey was conducted by the use of a questionnaire on motivation for learning in production education prepared by us.^[14] With respect to the factors of the questionnaire on motivation for learning in production education, the first factor was the scaling factor of production desire, because many items concerning the desire of students to create their own products in technology classes were included, such as "When I am at last able to produce a product I want to make." The second factor was the measurement scale of support requests, because its content concerns requests to teachers and friends for support and encouragement, such as "When I was encouraged by the teacher or a friend." The third factor was challenging thinking, because its content concerns the desire to improve oneself

or overcome difficulties, such as "When I want to take on a difficult piece of work." The fourth factor was cognitive conflict, because many items concern surprise or novelty, such as "When something was unexpected or surprised me"

Questionnaires about 2) Self-efficacy during production practice, 3) Level of awareness for production practice, 4) Self-awareness of skills for using a saw, and 5) experience of production at school or at home were prepared by reference to the survey items concerning the measurement of behavioral regulation factors in home economics education by Nakai et al. and the measurement scale of self-efficacy during cooking practice.^{[15][16]} As for item 2), upon actually learning production, we aimed to measure how competent the students felt and how strong the feeling was. Therefore, with reference to preceding surveys, we divided the degree of feeling competent into ten levels so that the students could visualize their feeling numerically. After conducting the survey for item 2) of self-efficacy during production practice, we set a scale from ten points to one point corresponding to the ten levels of intensity of feeling competent.

With respect to the questionnaires for 2) to 4), we prepared 4-choice answers, and after the survey, we converted the choices into numbers: If the answer to a question was "Yes, I think so," it was allocated 4 points; "I rather think so:" three points; "I rather think not:" two points; and "I do not think so:" one point. Moreover, with respect to 5), to ascertain whether experience at home affects the formation of self-efficacy in using a saw, questions were set up concerning students' experience in using a saw or other such tool at home and family members' evaluation, and an answer to each question was selected from four levels: "Frequently experienced," "Experienced," "Not very experienced," and "No experience."

Three teachers who had more than 20 years of teaching experience in technology education carefully considered the appropriateness of the above items and their quantification, made questions, compiled the answers, and repeatedly analyzed and discussed the results.

III. RESEARCH RESULTS

A. *Level of familiarity with tools among 5th and 6th grade primary school children –*

Research was conducted on the level of familiarity that the 5th and 6th grade primary school children had gained through previous experience with tools used for the learning of production specified in the technology textbooks. The results of the research indicate that the 5th and 6th grade students (180 students) were familiar with a saw and that most of them (174 students) were familiar with a hammer.

Although the correlation between experience in using a saw at home and the level of self-efficacy was not high, a correlation with self-efficacy was found in such items as "Did you do handicrafts when you were little?," "Did you help your family members to make things?," and "Are your family members pleased if you help?"

A correlation is seen between the level of self-efficacy and experience of having an interest in using tools when seeing family members enjoying using a saw, learning how to use a saw and its dangers when learning production from family members, and the rapport with family members while learning production.

In addition, it can be considered that self-efficacy is elevated through successful experiences, seeing family members or neighbors using tools dexterously, and being encouraged to use tools. This can be thought to support the theory that self-efficacy is formed by direct experience, vicarious experience, and persuasion.^[17]

Based on these results, we think that what is necessary for production is guidance that appropriately incorporates effective information for increasing children’s confidence, such as close cooperation with their family members, concentration of children’s interest in learning tasks, focusing on each child’s past experience related to learning tasks – especially successful experiences – and enhancement of empathy and elimination of anxiety through instruction from people around them.

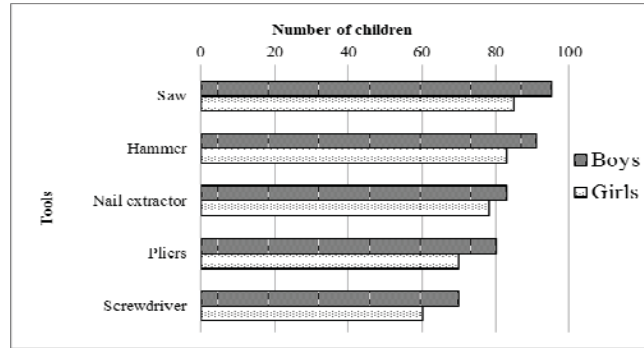


Figure 1. Primary school children’s level of familiarity with tools

B. Motivation to learn production

Although no significant difference in the motivation to learn production can be discerned between boys and girls, as seen in Table 1, girls score higher with respect to all the factors. Moreover, as seen in Table 2, a significant difference between grades is discernible: the first-grade students score higher than the second-grade students.

Table 1 Motivation for learning of production (by sex)

Factors	Boys		Girls		t-Value
	Average	Deviation	Average	Deviation	
Production desire	3.20	0.62	3.26	0.61	0.68
Support requests	2.67	0.65	2.82	0.62	1.90
Challenging thinking	2.31	0.62	2.36	0.67	0.66
Cognitive conflict	2.75	0.67	2.79	0.68	0.42

Table 2 Motivation for learning of production (by grade)

Factors	first-grade		second-grade		t-Value
	Average	Deviation	Average	Deviation	
Production desire	3.36	0.58	3.12	0.62	3.25 **
Support requests	2.86	0.60	2.63	0.64	3.28 **
Challenging thinking	2.43	0.67	2.25	0.62	2.30 *
Cognitive conflict	2.88	0.68	2.67	0.66	2.49 *

(1) Evaluation of the measurement scale

Table 1 shows the categories, average points, standard deviations, and correlation coefficients between each category and the whole. The average for each category is between 2.78 and 7.36. The standard deviation is in the range of 2.14 to 5.50. The correlation coefficient between each category and the whole (r) is within the range of 0.56 to 0.84. All the figures show a significant difference, and therefore, all 12 categories were adopted as scales to measure self-efficacy in production practice.

Table 3 Self-efficacy in production practice

NO	Categories	Average	Deviation	I-T Correlation
1	Able to cite the procedures for carrying out a task	3.10	2.27	0.56
2	Able to choose tools and machines that are pertinent to the task	4.24	2.44	0.68
3	Able to use a saw and do vertical and horizontal pulling against the direction of the wood grain	3.89	2.76	0.73
4	Able to fix materials and cut them using a saw	5.11	2.75	0.81
5	Able to use a saw from a position to see the straight line of the saw’s top edge	4.86	2.73	0.82
6	Able to cut materials by pulling a saw	5.92	3.05	0.77
7	Willing to work with a saw	5.58	2.81	0.78
8	Able to push the gimlet downward and make a hole by rotating the gimlet in the palms of both hands	5.89	2.81	0.71
9	Able to use a hammer with the elbow as the fulcrum, not by using the power of the wrist	5.23	2.79	0.77
10	Able to distinguish the flat side and the round side of a hammer and drive in a nail by making use of the different sides of the hammer	5.62	3.05	0.76
11	Able to cooperate with others and work safely	7.09	2.41	0.66
12	Able to put away the tools and materials that were used	7.56	2.35	0.61

(2) Results obtained using the measurement scales

As Figure 2 indicates, boys score higher in self-efficacy in the production practice. As seen in Figure 3, when the students are divided into a higher group (G) and a lower group (P), according to the points scored in the category of “experience in production through school or home,” the higher group (G) scores more points in all categories, and significant differences can be recognized.

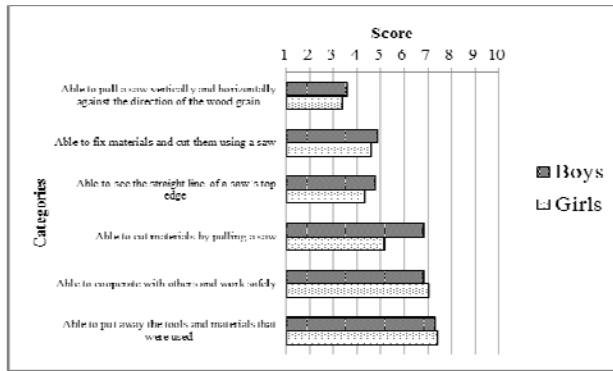


Figure 2. Self-efficacy in production practice (level of confidence)

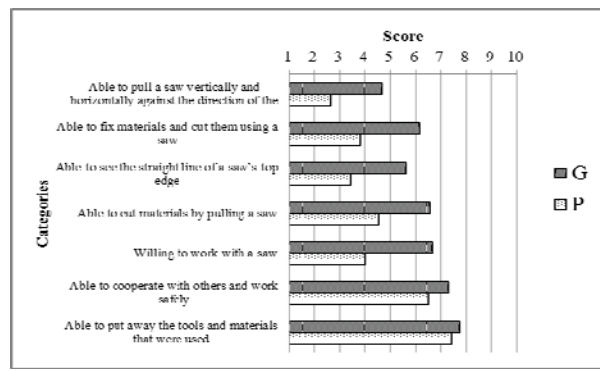


Figure 3. Self-efficacy in production practice (level of confidence)

D. Consciousness to learn production

As Figure 4 indicates, for the students' level of awareness for learning production, the first-grade students score higher, and significant differences can be seen in the categories of “Cooperating with friends is fun,” “I can create a work procedure and work accordingly,” “The practice starts at preparation and ends at clearing up,” and “I will make use of the practice in my future life.” In one of the preceding researches, Taura surveyed the students' attitude toward the technology education classes and pointed out that the second-grade students were found to be slacking and losing interest in overall school life.^[18] From this research, we conclude that there is a tendency for motivation, attitude and other emotional aspects to result in a low score for second-grade students.

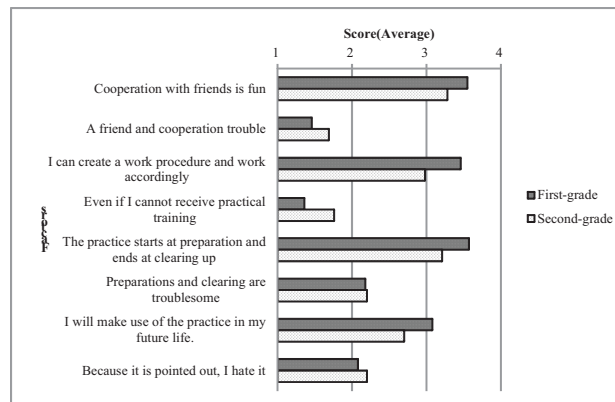


Figure 4. Level of awareness for production practice

E. Self-awareness of skills for using a saw

As Figure 5 indicates, the second-grade students score higher than the first-grade students, and a significant difference is discernible in almost every category. The results show that the second-grade students have stronger feelings of “being competent” in the use of tools.

A correlation between the feelings for a saw and self-efficacy in the production practice can be observed.

F. Experience of production through school or home

As Figure 6 indicates, both first- and second-grade students score high in “having much experience in production in childhood” and “having experience of failure,” and it can be seen that the students had much experience in production, such as making handicrafts, before entering junior high school. On the other hand, “Often taught about production by family” and “Welcomed to help the family with production” are scored low. It can be speculated that there is little family contact through production.

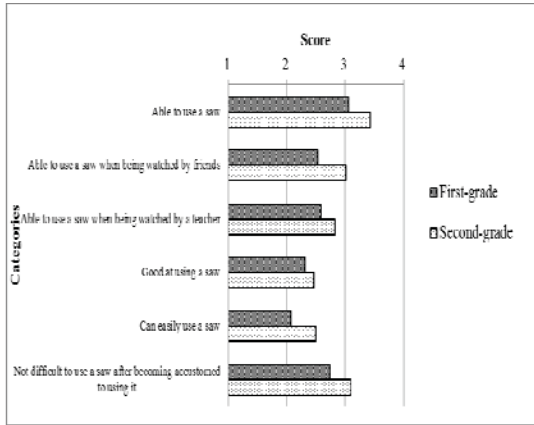


Figure 5. Self-awareness of skills in using a saw (by grade)

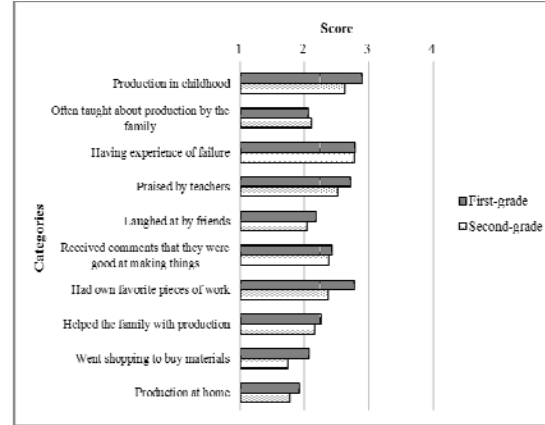


Figure 6. Experience at school or at home (by grade)

IV. CONCLUSION

In this study, we analyzed and considered relations and backgrounds in terms of grade and by sex with respect to how experience in learning production has affected the students’ motivation for learning, their self-efficacy in production practice, and their feelings towards the use of tools.

According to the results, the first-grade students scored higher in having much experience of production in childhood. In contrast, the second-grade students scored high points for self-efficacy in production practice. It was deduced from this that the learning experience of using tools and other things the second-grade students gained in the technology classes gave them knowledge and skills and subsequently led to their high self-efficacy in production practice.

In addition, it was evident that there were differences between the sexes and grades in terms of the motivation to learn production and self-efficacy in technology education. These results suggest it is possible to comprehend students’ attitudes from a psychological perspective when using tools for learning production and serve as basic knowledge for the development of education in production

In the future, we will conduct a study that focuses on characteristic students and carry out more detailed research on guidance for using tools for learning production. In addition, it is necessary to carry out research in several junior high schools so that we can gain sufficient data to generalize this study. We would like to tackle these issues in the future.

Furthermore, follow-up research is scheduled when the first-grade students complete their course of production practice, in order to quantitatively analyse and verify the changes they went through during the course.

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