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Study on the Fostering of Creativity in Technology Education

— A Consideration about the Productive Practices in "Woodworking" Area —

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The present study deals with basic information for fostering creativity in Technology Education. The creativity diagnosis tests in an experimental lesson curriculum were conducted before and after the practices in "Woodworking" area at a junior high school. (1)The values of "creativity" as a whole tend to increase after productive practices though slightly. Among the three structures constituting "creativity," the structure "creative attitude" has higher values than other two structures both before and after productive practices. (2)When the components for fostering creativity are classified in accordance with their average scores, the components (A) which have high values of average scores both before and after productive practices are "memory," "divergent thinking," "self-evaluation," "observation," "persistence," "openness" and "impulsiveness," the components (B) which show almost the same values as the mean value both before and after productive practices are "cognition of problems," "expression," "planning," "information collection" and "curiosity" and the component (C) which has low values both before and after productive practices is "convergent thinking."

Key words: creativity, Technology Education, Industrial Arts Education, productive practices, Woodworking

1. Introduction

Technology Education in Japan is given in Industrial Arts and Homemaking Course in junior high schools, and the objectives of this course are defined by the Course of Study of the Ministry of Education as follows [1) 2)].

•*OVERALL OBJECTIVES:*

To make students acquire fundamental knowledge and skills necessary in life, thereby increasing their understanding on the relationship between life and skill in home and society, and to develop an ability to devise and create willingly and an attitude to practice.

As shown in the definition above, the fostering of creativity is emphasized in the goals, which show the value of existence of this course. In this course, "Woodworking" area to be given to the first-grade students is considered to be an important, especially leading area.

•*Woodworking／Objectives:*

To make students understand the relationship between the properties of wood and ways of working through the design and production activities of simple wood product, and to develop an ability to produce accordingly with the purpose and condition of usage.

•*Contents:*

1) To give instruction on the following in regard to the designing of wood product.

a.To know the function and structure of the product in accordance with the purpose and condition of usage.

b.To know how to present ideas of the product, and to be able to make an idea sketch and a plan for production.

c.To know the process of production and the procedures of working.

2) To give instruction on the following in regard to the material necessary in production activities of wood product.

a.To know the features and proper usage of wood materials.

b.To know the features and proper usage of adhesive and jointing materials.

c.To know the features and the proper usage of painting materials.

3) To give instruction on the following in regard to the usage of tools and machines for woodworking.

a.To know the composition and proper usage of tools and machines for woodworking.

b.To be able to mark and cut and plane the wood

materials through the proper use of tools for woodworking.

c.To be able to cut and plane the wood materials through the proper use of machines for woodworking.

d.To be able to assemble adequately following:the idea sketch, and the plan for production.

e.To be able to paint adequately depending on the usage of the finished product.

4) To make students examine the role of wood in daily life and industry.

This indicates the objectives and contents of "Woodworking" area. Through these concrete objectives and contents, students' creativity is to be fostered, as described above. Instruction processes in Technology Education can be roughly classified into two types of lessons: sedentary learning and productive practices. The latter type is considered to be an especially important instruction process for achieving the fostering of creativity, one of the objectives of this course.

In this study, as a continuous report of the previous paper, the creativity in Technology Education is considered to be "an ability and attitude toward creating the most valuable thing, concept and solving method for the individual to solve technological problems" [3) 4) 5)] . The productive practices as a process of the whole instruction plan in "Woodworking" area are chosen and the purpose of the study is to clarify the relations between the productive practices and the fostering of creativity.

2. Methods of study

The methods of this study are basically the same as used with the previous study. Since the name of the journal has changed according to the reorganization of the institution, the method is rewritten as follows.

For understanding the conditions of the fostering of creativity concretely, we have examined the structures of the fostering of creativity in Technology Education in view of the formation of creativity based on a general educational concept and the objectives and contents of Industrial Arts and Homemaking Course, established the structures and components shown in Appendix 1 and made the creativity diagnosis tests shown in Appendix 2. In making the creativity diagnosis tests, we have prepared, in principle, three questions each for one component, nine and five questions for components "expression" and "planning" respectively, and thus made 50 questions in total in order to understand the conditions of creative activities of each learning content easily. The reason why the number of questions for "expression" and "planning" is increased is that we considered these two components as particularly important learning contents in working materials in order to complete the product following the expected conception. Evaluation for each question is made in four stages: A(4 points), B(3 points), C(2 points) and D(1 point). This study intended to examine the conditions of fostering creativity in the productive practices by using these creativity diagnosis tests.

The lessons in which the creativity diagnosis tests were conducted were productive practices in "Woodworking" area with 103 students: 57 male and 46 female students at 1, 2, and 3 classes of the first grade in Satsukino Junior High School, Osaka Prefecture. The total instruction plan is 35 hours. Through the 1st to the 19th hours are for sedentary learning, then through the 20th to the 34th hours are for productive practices and the 35th hour is for sedentary learning again. The creativity diagnosis tests were conducted immediately before the productive practices (immediately before the start of the 20th hour) and immediately after them (immediately after the end of the 34th hour).

3. Results and Discussions

In the results of the creativity diagnosis tests, the value which simply averaged the total scores of whole students is held to be an average score, which is compared before and after productive practices. In comparing the values before and after productive practices, for examining the significant differences between the average scores, a t-test (both-side test) was conducted at the significance level of 5%. Since the extent of variance could not be considered homogeneous, a t-test in accordance with the Welch method was conducted. In figures indicating the results, the average values before productive practices and after productive practices are shown on the axis of abscissa and on the axis of ordinate respectively.

3.1 Average scores of creativity as a whole and the three structures

Average scores of "creativity" as a whole and the three structures of "creative thinking," "creative skills" and "creative attitude" before and after productive practices are shown in Figure 1.

Values of average scores of "creativity" as a whole are 2.57 points before productive practices and 2.59 points after productive practices, both of which exceed the mean value of 2.5 points. This result indicates that the values of "creativity" are comparatively high both before and after productive practices in the "Woodworking" area and shows a slight increase after productive practices, which suggests growth of "creativity."

Next, as for values of average scores of the three structures of "creative thinking," "creative skills" and "creative attitude," the values before productive practices are 2.54, 2.53 and 2.67 points respectively, while those after productive practices are 2.59, 2.55 and 2.66 points respectively. The values of the all three structures are higher than the mean value of 2.5 points both before and after productive practices, and the values after productive practices increase for the former 2 structures and decrease for the latter one. As a result of a t-test conducted for average scores before and after productive practices, there was no significant difference between the average scores before and after productive practices.

In brief, it is found that the values of "creative attitude" are high both before and after productive practices and those of "creative thinking" and "creative skills" show some increase after productive practices.

3.2 Average scores of components

We concretely examined average scores of components for the three structures of "creative thinking," "creative skills" and "creative attitude".

At first, values of average scores of "cognition of problems," "memory," "divergent thinking," "convergent thinking" and self-evaluation" which are components concerning "creative thinking" are 2.48, 2.65, 2.79, 2.25 and 2.52 points respectively before productive practices, as shown in Figure 2, while the values after productive practices are 2.58, 2.66, 2.68, 2.35 and 2.65 points respectively. The components which have higher values than the mean value 2.5 points both before and after productive practices are "memory," "divergent thinking" and "self-evaluation," the component which has lower values than the mean value of 2.5 points both before and after productive practices is "convergent thinking," and the component which has a lower value than the mean value of 2.5 points before productive practices and a higher value after those practices is "cognition of problems". In view of the increase or the decrease of the value after productive practices, the components whose values increase after productive practices are "cognition of problems," "memory," "convergent thinking" and "self-evaluation," while the component whose value decreases is "divergent thinking."

From these results, it is found that the values of "memory" and "divergent thinking" are high in productive practices and the value of "convergent thinking" is low and that the values of "self-evaluation" and "cognition of problems" in productive practices have a tendency to grow. Ideally, the values of "convergent thinking" and "divergent thinking" should be close to each other at a high level. Accordingly, it is necessary to intensify "convergent thinking" in the first stage of productive practices.

Values of average scores of "expression," "planning," "information collection" and "observation" which are components concerning "creative skills" are, as shown in Figure 3, 2.55, 2.41, 2.49 and 2.71 points respectively before productive practices and are 2.59, 2.45, 2.43 and 2.72 points respectively after productive practices. The components which have higher values than the mean value of 2.5 points both before and after productive practices are "expression" and "observation," while the components which have lower values than the mean value of 2.5 points both before and after productive practices are "planning" and "information collection." In view of the increase or decrease of the values after productive practices, the components whose values increase are "expression," "planning" and "observation," and the component whose value decreases is "information collection."

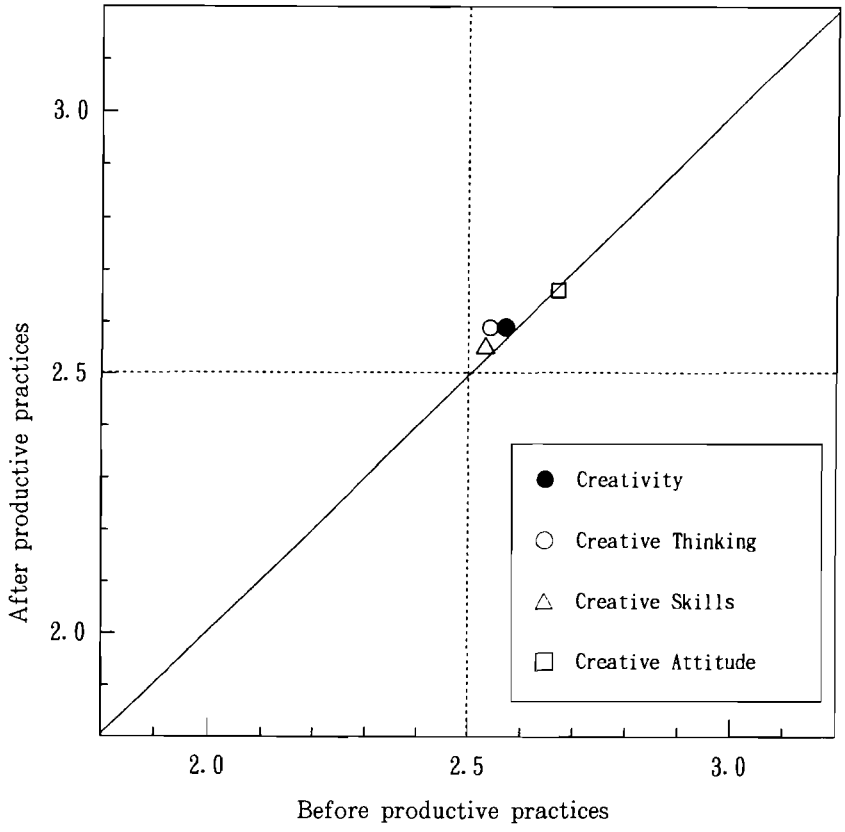

Figure 1 Average scores of "Creativity" as a whole and "the three structures."

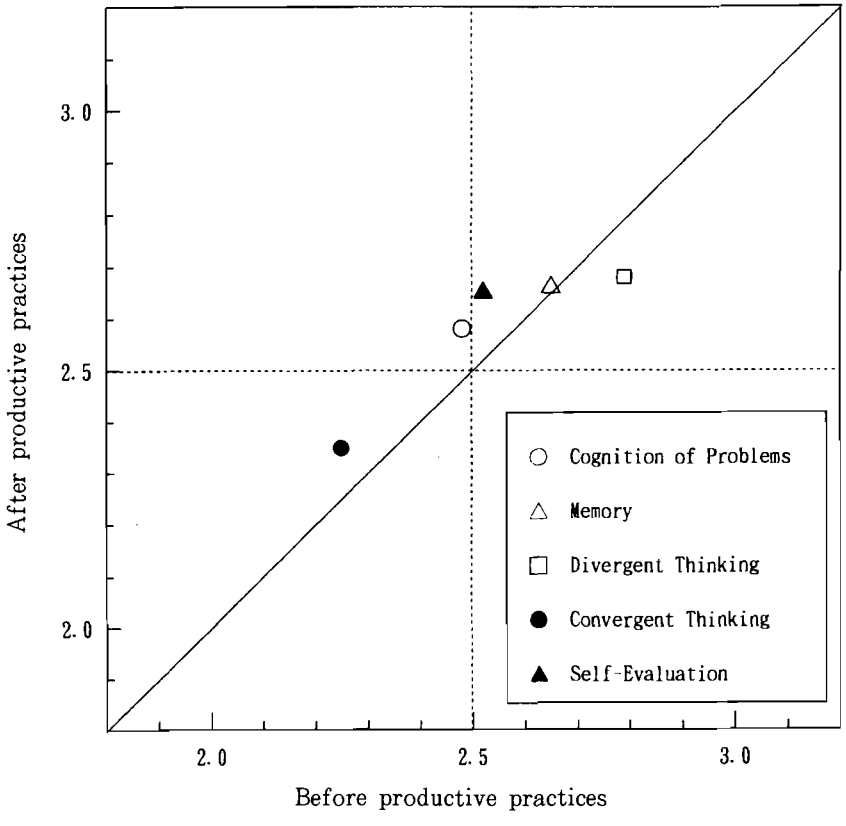

Figure 2 Average scores of components of "Creative Thinking."

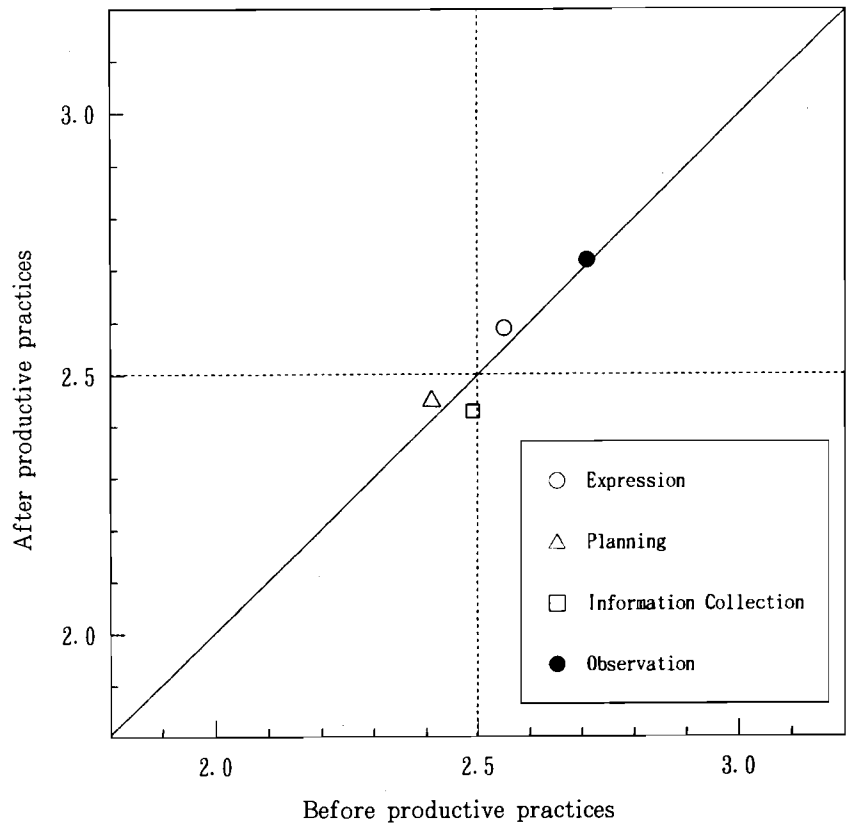

Figure 3 Average scores of components of "Creative Skills."

It is found from these results that the component "observation" has high values both before and after productive practices, the components "expression" and "planning" tend to have higher values after productive practices, while "information collection" has a tendency to have slightly lower value after productive practices. Since "information collection" is important for creatively exerting skills of students in productive practices, it is necessary to enhance the values of this component.

The components "independence," "curiosity," "persistence," "openness" and "impulsiveness" concerning "creative attitude" have values of average scores 2.63, 2.54, 2.65, 2.88 and 2.63 points respectively before productive practices, while they have the values of 2.59, 2.45, 2.68, 2.87 and 2.72 points respectively after productive practices as shown in Figure 4. Those components which have higher values than the mean value of 2.5 points both before and after productive practices are "independence," "persistence," "openness" and "impulsiveness," and the component which has a higher value than the mean value of 2.5 points before productive practices and a lower value after productive practices is "curiosity." In view of the increase or decrease of the values after productive practices, the components whose values increase are "persistence" and "impulsiveness," while the components whose values decrease are "independence," "curiosity" and "openness."

It is found from these results that the components "persistence," "openness" and "impulsiveness" have high values both before and after productive practices, while the value of "independence" slightly decreases and that of "curiosity" also decreases after productive practices.

Since productive practices are individual activities to precisely complete students' products individually, "curiosity" is indispensable for performing the practices creatively. For this reason, designs of contents, deployment of

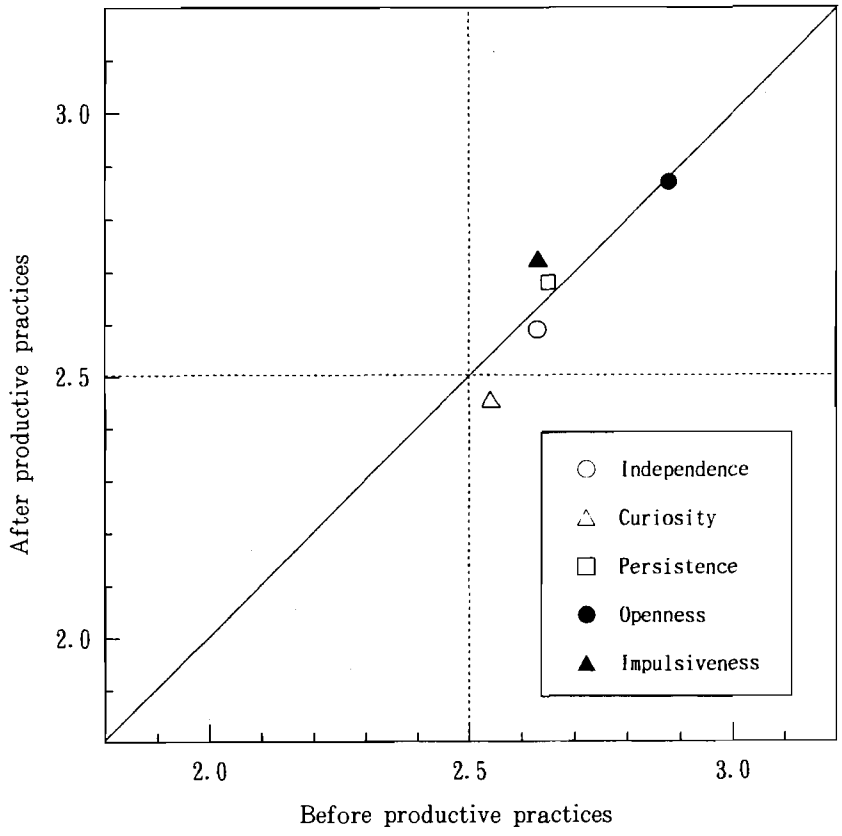

Figure 4 Average scores of components of "Creative Attitude."

instruction and utilization of teaching materials and aids are necessary for increasing the values of this component for individual students.

4. Conclusion

As an example of a lesson of productive practices in "Woodworking" area, creativity diagnosis tests were conducted before and after the practices and the following are found on the relationship between the fostering of creativity and productive practices.

(1) The values of "creativity" as a whole tend to increase after productive practices though slightly. Among the three structures constituting "creativity," the structure "creative attitude" has higher values than other two structures both before and after productive practices.

(2) When the components for fostering creativity are classified in accordance with their average scores, the components (A) which have high values of average scores both before and after productive practices are "memory," "divergent thinking," "self-evaluation," "observation," "persistence," "openness" and "impulsiveness," the components (B) which show almost the same values as the mean value both before and after productive practices are "cognition of problems," "expression," "planning," "information collection" and "curiosity" and the component (C) which has low values both before and after productive practices is "convergent thinking." The components (A) are considered to play a comparatively important role in fostering creativity, the components (C) are those which require support to increase creativity in the future and the components (B) are positioned in between (A) and (C).

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