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Study on the Fostering of Self-Educability in Technology Education

— A Consideration about Practical Teaching Materials in "Information Technology" Area —

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The purpose of this study was to obtain basic information for teaching materials to foster self-educability in Industrial Arts Education. An experimental lesson curriculum was conducted with practical teaching materials using five types of computer software in "Information Technology" Area at Junior High level Technology Education. From the results of the self-educability diagnosis and evaluation test after the lessons, the following conclusions were found in terms of fostering self-educability: (1) The lessons which applied practical teaching materials used in this study can possibly foster self-educability. (2) The experimental lessons which applied five types of practical teaching materials can efficiently enhance self-educability along with the progress of the study plan even though there were some differences in the results of each material. (3) The lessons which applied practical teaching materials used in this study can foster self-educability in both male and female students.

Key Words: self-educability, Technology Education, practical teaching material, computer, Information Technology

1. Introduction

Current advancement in communication technology are allowing for ever increasing access to information. This not only promises to change people's life styles, but also may change the value system of society itself. In such a "technological" society, those who can readily adjust to these changes into technology will do very well while those less able to adjust may be left behind in the information revolution. With this in mind, it is becoming even more apparent that improvements in self-education within the current school system are essential. However, in Japan, there are currently few researches working to develop study materials, curriculums, or self-education techniques that can be used in a practical environment. We believe that more studies should be conducted in this area.

In previous studies [1) 2) 3)] we have developed self-education evaluation tests and diagnosis techniques to determine the necessary factors for improving self-education in Industrial Arts Education. The purpose of this study was to obtain basic information for teaching materials to foster self-educability in Industrial Arts Education. An experimental lesson curriculum was conducted with practical teaching materials using five types of computer software in Information Technology at Junior High level Technology Education. After the experiment, a self-educability diagnosis and evaluation tests were performed to analyze the effects of this experimental study.

2. Methods of Study

Twenty-two ninth graders (13 male and 9 female students) from T Junior High School in Simane Prefecture, Japan, participated in this study. The students learned "usage of computer" in the Industrial Arts class. As instruction curriculum in "Information Technology (total 30 hours)" in Table 1, the lectures about usage of computer were conducted for the first 12 hours, and the practical lessons were offered for next 17 hours, then the lecture on the future of the Information society for the last hour. At the 13th to 29th hours, the following subjects were taught :Using Japanese word-processing software for two hours, inserting graphics into the documents and input of text for one hour, using graphic software and creating graphics about a floppy disk for two hours, BASIC programming such as operations in the text and graphics windows and BASIC commands such as CIRCLE or LINE including creating their own computer programs for 9 hours, using spread-sheet software such as input and calculating data for 2 hours, and using database software such as searching and sorting data or adding new records for 2hours. A self-educability diagnosis test was performed before and after the practical lessons prior to the 13th hour and after the 29th hour.

Table 1. Instruction Curriculum for "Information Technology" (Total 30 hours).

Hour	Teaching Items	Teaching Contents
1	History of the computer	History of the computer up to the modern society
12	Start/Exit and use of software	Learning basic computer operations and start/exit of software
13	Using Japanese word-processing software(1)	Embedding graphics and creating cover page of the file
14	Using Japanese word-processing software(2)	Learning input method and creating a document
15	Using graphic software (1)	Learning the functions of graphics software and creating graphics
16	Using graphic software (2)	Learning the functions of graphics software and creating graphics
17	BASIC programming (1)	Learning operation in text windows and student ID #, Name and Birth date
18	BASIC programming (2)	Learning operation in text windows and student ID #, Name and Birth date
19	BASIC programming (3)	Learning operation in graphic windows and drawing a rectangle with LINE command
20	BASIC programming (4)	Drawing a circle with CIRCLE command
21	BASIC programming (5)	Drawing repeated circles with FOR-NEXT command
22	BASIC programming (6)	Painting color on the graphics with PAINT command
23	BASIC programming (7)	Changing color in graphics with IF-THEN command
24	BASIC programming (8)	Creating assignment program with all commands learned before
25	BASIC programming (9)	Creating original program with all commands learned before
26	Using spreadsheet software (1)	Learning functions in spreadsheet software and input/calculation of data
27	Using spreadsheet software (2)	Creating chart with data input at 26th hour
28	Using database software (1)	Learning functions in database software and searching data
29	Using database software (2)	Sorting and adding data with data input at 28th hour
30	Information and our life	Roles and effects of the computer

A self-educability evaluation test was performed after each lesson of the practical sessions (total 17 hours).

3. Results and Discussions

The sum of average points from each factor in the results of the self-educability diagnosis test increased from 39.9 before the experiment to 44.0 after the experiment. Additionally, points from all factors also increased after the experiment test compared to thepre-experimental test. It can be said that the experimental teaching method using practical teaching materials was useful to foster self-educability in Industrial Arts Education.

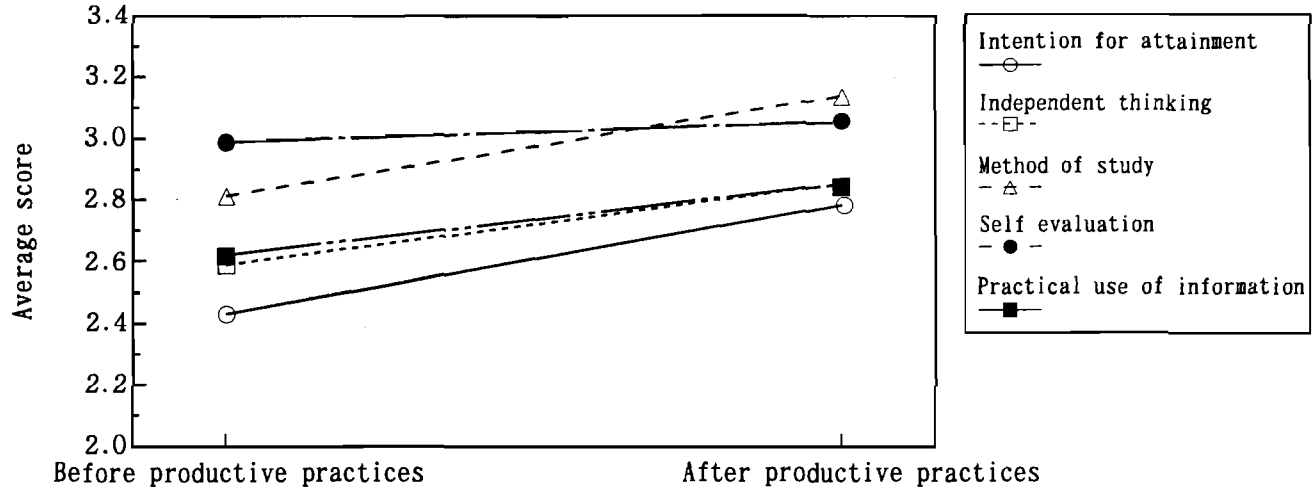
The changes in average points for each factor based on the results obtained from the self-educability test is indicated in Figure 1. The values of learning method of practical and experimental problem-solving factors were increased after the experiment. In these factors, "intention for attainment" and "method of study" showed significant changes compared to the results from the other factors. It can be said that the practical teaching materials used in this study can enhance the effect of the material efficiently in terms of these factors. Next, the values of volition of practical and experimental study were increased after the experiment. In these factors, the values in "achievement intention" and "independency" increased more significantly than the results in the other factors.

The practical teaching materials used in this study can increase efficiency in terms of "independency" and "achievement intention". Additionally, the value in "researching a way of life using technology" after the experiment was similar to or higher than the values prior to the experiment. The values in "correspondence of environmental protection" increased obviously compared to the results from the other factors.

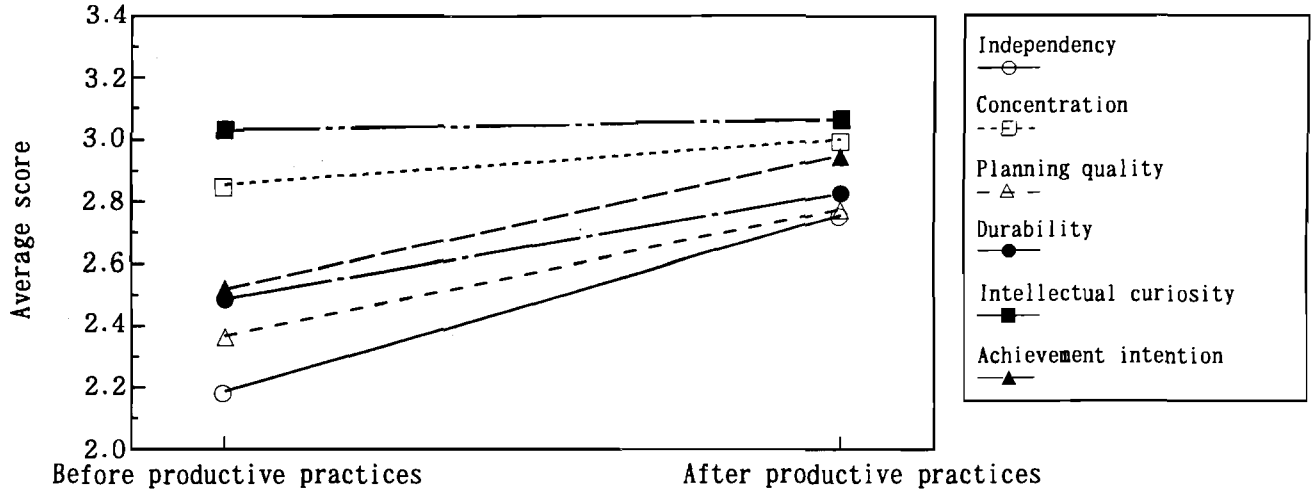
The change in average points in each of the factors based on the results obtained from the self-educability evaluation test is indicated in Figure 2. All factors in "learning method of practical and experimental problem-solving study" except for "independent thinking" increased their values from 2.4-2.9 at the 13th hour to 3.1-3.6 at the 16th hour in the lessons using Japanese word-processing and graphic software. These factors increased their values gradually from 2.4-3.4 at the 17th hour to 3.1-3.8 at the 25th hour where the students created their own computer programs. For using spreadsheet software at the 26 and 27th hours, "method of study" shown 3.7 and the values of the other factors had shown 2.6-3.1 at the 26th hours. At the 27th hour, the values in "self-evaluation" and "practical use of information" were increased while the values of other factors showed similar values before and after the experiment. For using database software at the 28 and 29th hours, all values showed 2.4-3.4 at the 28th hour, and were not changed or increased slightly at the 29th hour. In the lesson in which "independent thinking" value showed low score, the goal of the lessons was set for the students to learn the basic operation of the software so that the students may not be able to obtain complete knowledge to use software adequately by themselves.

All factors in "learning method of practical and experimental problem-solving study" in using Japanese word-processing and graphic software increased their values from 2.5-3.1 at the 13th hour to 2.8-3.6 at the 15th hour then showed similar values or decreasedat the 16th hour. At the 17th to 25th hours in the BASIC programming lessons, all factors except for "planning quality" demonstrated 3.2-3.3 in their average values and maintained high values then reached 3.2-3.6 at the 25th hour. At the 25 to 26th hours in the lessons using spreadsheet software, the values of all factors were similar or higher at the 27th hour while values of all factors were lower than before. At the 28 to 29th hours in the lessons using database software, the values of all factors demonstrated a high score, 3.1-3.3 at the 28th hour, and then maintained these values or increased slightly at the 29th hour. Even though there are different results in each study material, it may be true that self-ducability was developed along with the progress of the curriculum by using these five study materials.

The average points of the five materials in each factor based on the results obtained from the self-educability evaluation test to analyzed the characteristics of each study materials is indicated in Figure 3. Since the lessons using Japanese word-processing software was the first experience for the students to use computers, the value for "intention for attainment" was lower than the



(1) Factor of "Learning method of practical and experimental problem-solving study"



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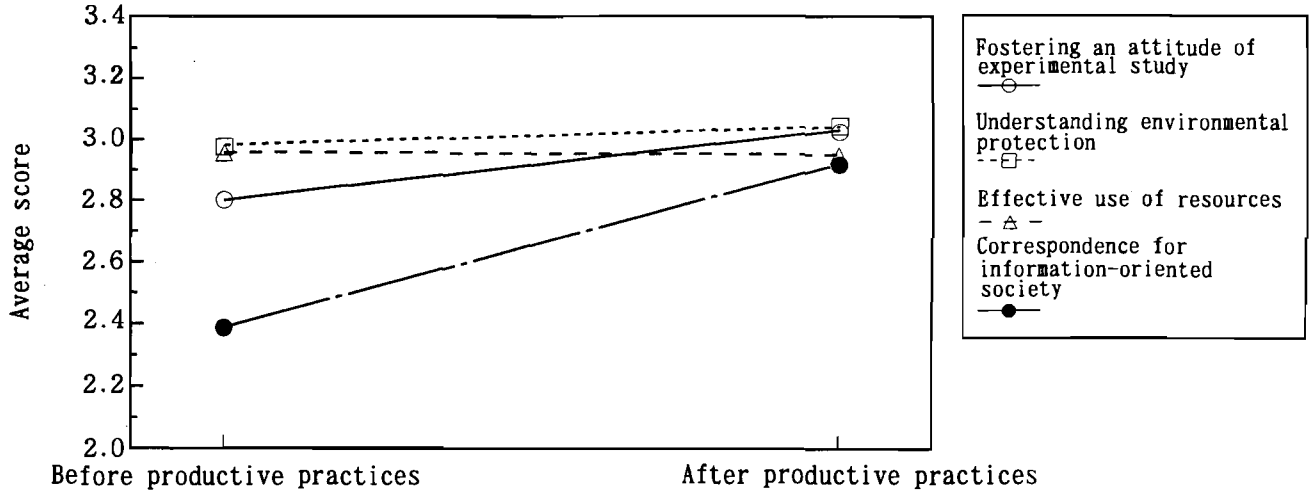
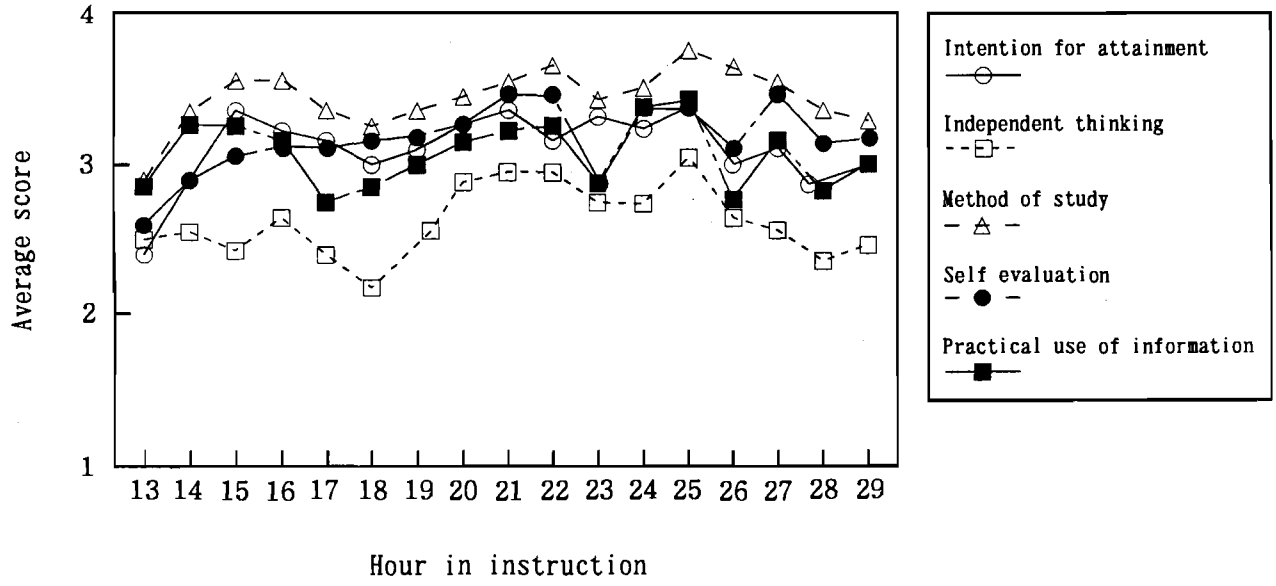
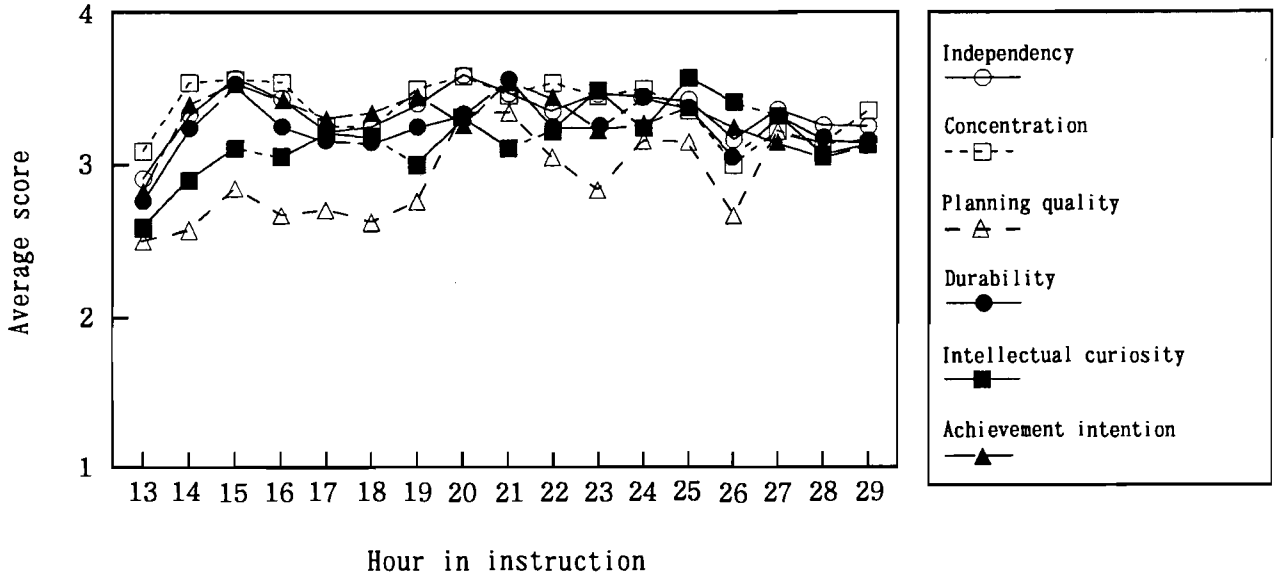


(3) Factor of "Researching a way of life using technology"

Figure 1. Change of average score.

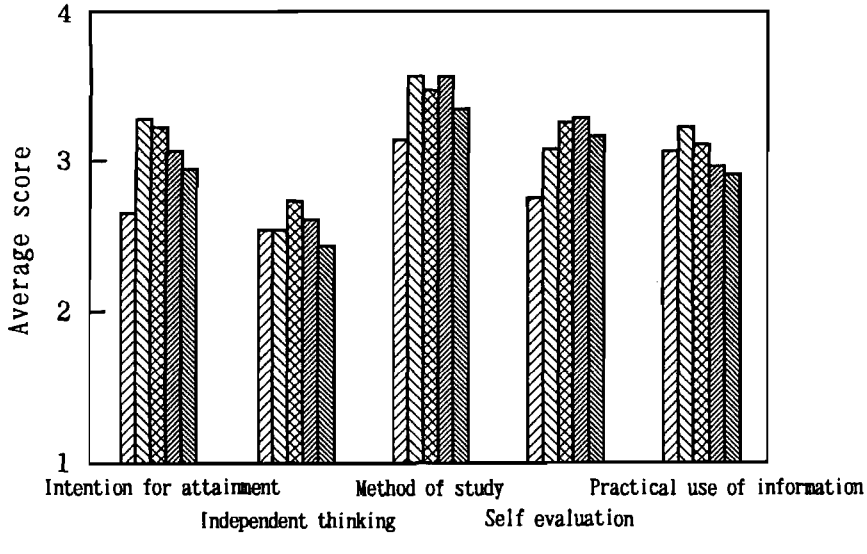


(1) Factor of "Learning method of practical and experimental problem-solving study"

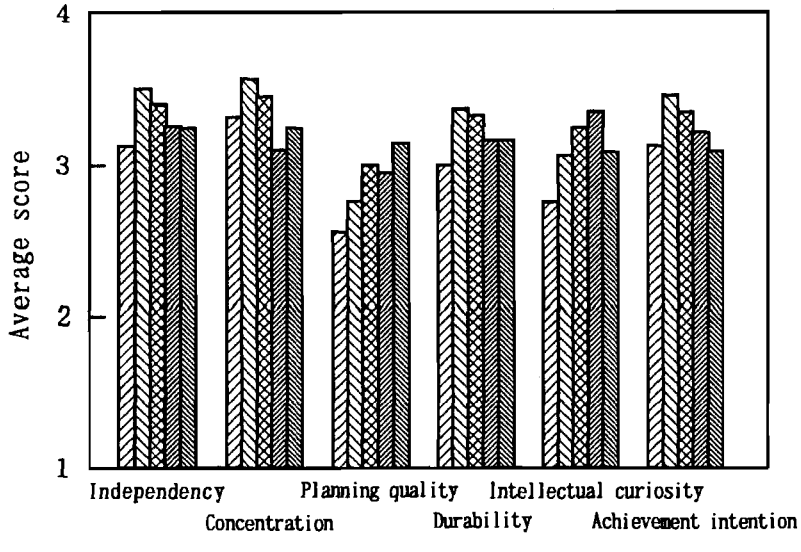


(2) Factor of "Volition of practical and experimental study"

Figure 2. Change of average score in instruction.



(1) Factor of "Learning method of practical and experimental problem-solving study"



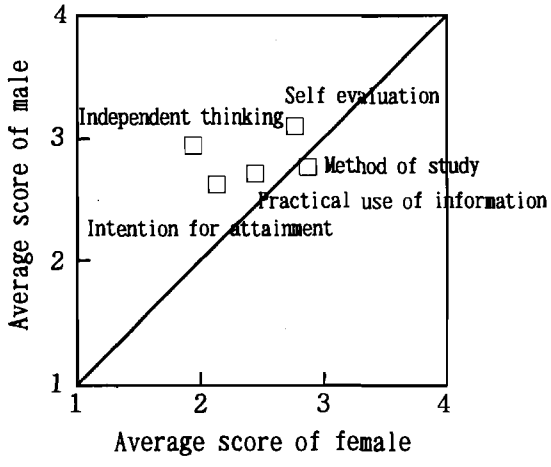
(2) Factor of "Volition of practical and experimental study"

Figure 3. Average scores of teaching materials.

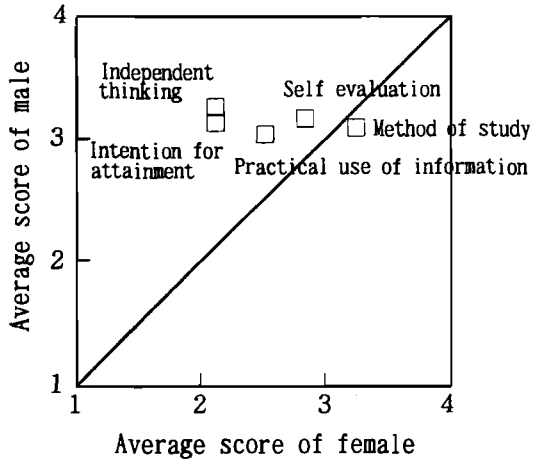
results in other study materials. The low value in this factor may affect the results in other factor values in this study material. For using graphic software, the values of "intention for attainment", "independency", "practical use of information technology", "concentration", "durability", and "achievement intention" showed the highest scores in the values of all study materials. From these results, using graphic software was possibly the best study material to foster self-educability in this study. In the BASIC programming material, the values of each factor were higher than the values in the other study materials, especially in "independent thinking". This results may confirm the high effect and efficient characteristics in this material to foster self-educability. In using spreadsheet software, the values of "intellectual curiosity" showed higher than the values in any other materials. It may be true that calculating data and creating charts enhanced students' sprit of inquiry in learning about computer. Finally, in using database software, "planning quality" had higher values than in the other materials. It is understandable for the students to improve computer skill along with progress of the lesson curriculum.

The results of the self-educability diagnosis test with average scores in each factor from male students in Y axis, and from female students in X axis to compare the difference between two genders are indicated in the Figure 4. Prior to the experiment, the values of all factors except for "method of study" and "fostering" were higher in male students than in female students. Other factors showed the higher values in male students than in female students. The distribution of the values in these factors was scattering. After the experiment, the values of all factors increased in both male and female students. The distribution of the values was focusing. From these results, it is possibly true that the experimental teaching curriculum applying the practical teaching materials used in this study can foster self-educability in both male and female students. However, the difference of the values between male and female students was more significant than in the previous studies. This may suggest that practical teaching material in "Information Technology" should be created keeping in mind the differences between male and female students.

The change in average scores for both male and female students in each lesson based on the results of self-educability evaluation test is indicated in Figure 5. All values were around 3.0 except for at the 16th, 17th, and 26th hours which showed significant difference, between male and female students. From these results, it is also found that the experimental teaching curriculum applying practical teaching materials used in this study can foster students self-educability. However, it is necessary that teaching items and content which had significant difference between male and female students such as beginning stage of the BASIC programming (16 to 17th hours), and data input and calculation in spreadsheet software (26th hour) should be discussed and re-built in the future.

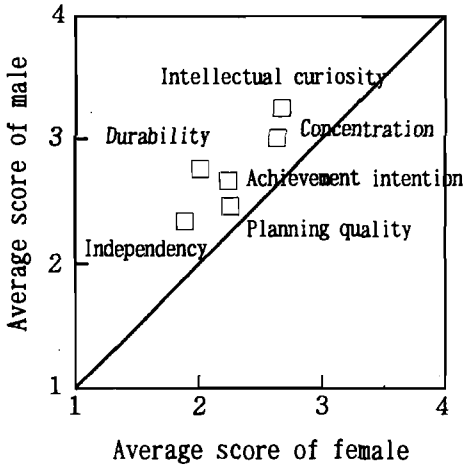


Before productive practices



After productive practices

(1) Factor of "Learning method of practical and experimental problem-solving study"



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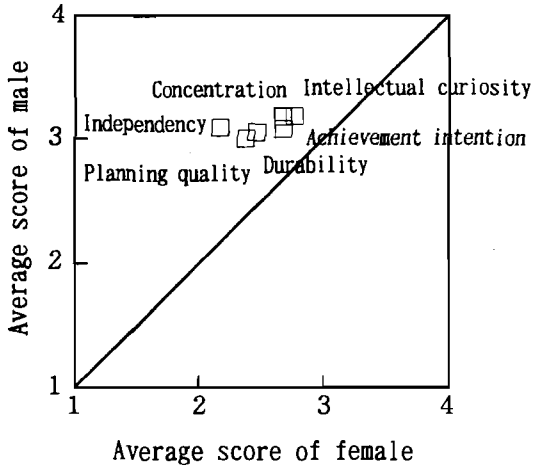
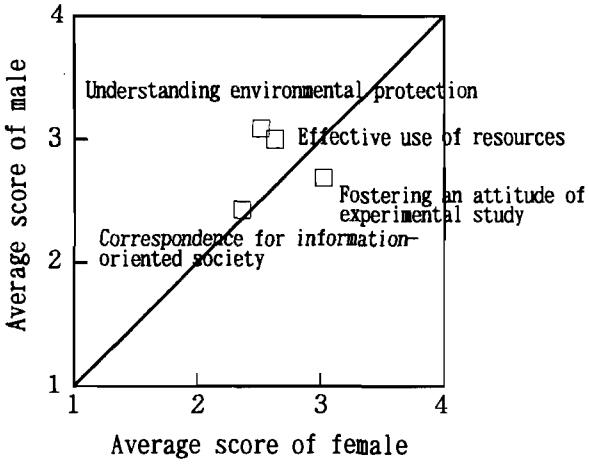
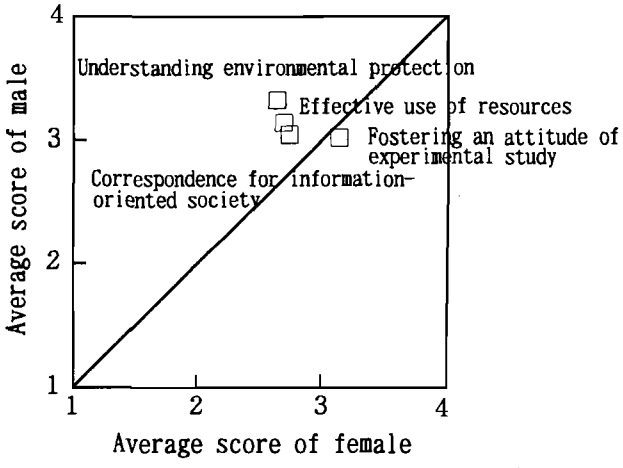


After productive practices

(2) Factor of "Volition of practical and experimental study"



Before productive practices



After productive practices

(3) Factor of "Researching a way of life using technology"

Figure 4. Average scores of male and female students in diagnosis test.

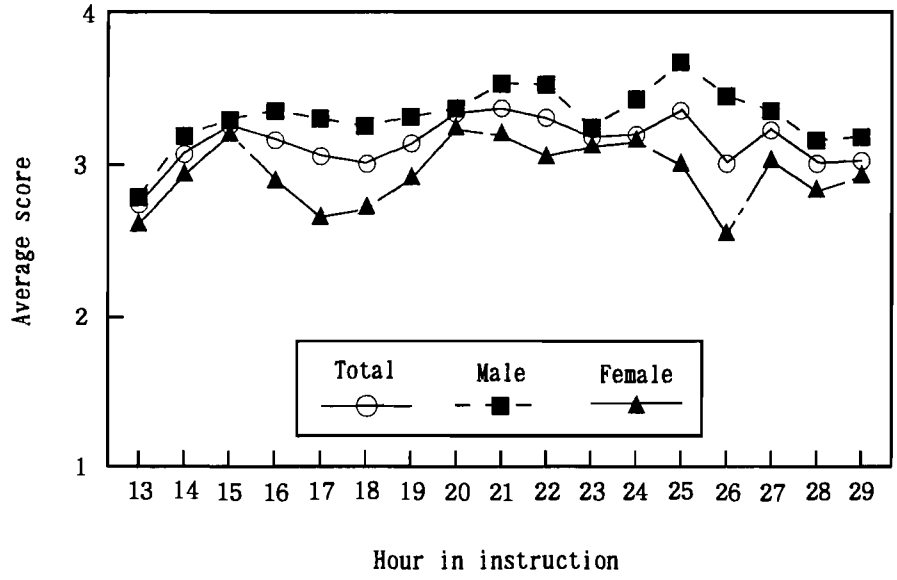


Figure 5. Average scores of male and female students in self-educability evaluation test.

4. Conclusions

From the results of the self-educability diagnosis and evaluation test after the lessons using five types of practical teaching materials in Technology Education, "Information Technology" at Junior High School, the following conclusions were found in terms of fostering self-educability.

1) The lessons which applied practical teaching materials used in this study can possibly foster self-educability.

2) The experimental lessons which applied five types of practical teaching materials can efficiently enhance self-educability along with the progress of the study plan even though there were some differences in the results of each material.

3) The lessons which applied practical teaching materials used in this study can foster self-educability in both male and female students.

Based on these conclusions, the future studies will be conducted to develop practical teaching materials for fostering self-educability more efficiently and teaching curriculum with these material.

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