

A STUDY ON EFFECTIVE STATISTICS TEACHING USING SAS PROGRAM

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ABSTRACT. As students with low basic knowledge of mathematics increase, they have had difficulties in studying statistics theory class. By using recent students' characteristics which prefer seeing directly and checking to thinking logically, we try to change the teaching method into teaching in the computer lab(SAS program). We investigate whether changing the teaching method has effects on students' achievements and interests or not. The purpose of this study is to grope for a better teaching and develop mathematics education's satisfaction and qualification.

1. Introduction

As education policy and entrance examination system change, students' mathematical levels become low and so the number of students with little understanding on statistics class contents gradually increases. In fact, the percentage of special selection (vocational high school expectant graduates' selection) gradually increases(it is over 50% when entering into school and it is higher than that of general selection). Students with low basic knowledge of mathematics increase and they have had difficulties in studying statistics theory class. General high school graduates also feel probability and statistics units more difficult than other units [1].

It is necessary to make efficient use of computer in order to be able to learn statistics easily and interestingly. By using recent students' characteristics which prefer executing directly and checking to thinking

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logically, we try to make efficient use of SAS program in teaching statistics. By using SAS program, students learn statistics in the computer lab and learn fundamental concepts related to theory.

We compare the achievement of the year which teaches only theory to that of the year which carries out the lab at the same time. Through students' interests and class attitude observation, we analyze what positive results it brought in mathematics educational aspects and we try to look for a good class's direction.

This study does not aim at generalizing the result of study but analyzing respective situations. The purpose of this study is to grope for a better class and develop education's satisfaction and qualification.

2. Theoretical background

Since mathematics educators believed that in the course of mathematics teaching-learning to make into certain form and provide in order to look directly at abstract mathematical concept unseen is to help to learn mathematics effectively, they were interested in visual expressions of mathematical concepts. They also said visualization in other learning except mathematics has a critical effect on the learning [5]. Visual image plays a role of important connection ring between mathematical model and actual phenomenon. In the general viewpoint of visualization, complicated and abstract mathematical idea can be easily introduced through visualization, and concrete and intuitive manipulation on visualized mathematical idea helps the learning of such idea [4].

In the meantime, mathematics education neglected the visual aspect. But students who grow up in the various media become to feel information obtained through visual image more familiarly than algebraic expressions and visual images help to make students have interests about mathematics learning. Development of computer widely expands the range of visualizing in mathematics education. As students by themselves manipulate, visual data of computer software that can infer mathematics contents becomes the important means of mathematics learning. [2] said as follows.

Various functions which computer has can not only instruct to visualize abstract mathematics contents but also relieve the difficulty of mathematics learning in respect that the visualization can be accomplished

through students' direct experience and control. Especially, before formal conceptual learning, students' initiative, intuitive, and investigative activity through graphic, animation, and simulation can highlight dynamic and genetic aspect of mathematics.

3. Related study

Freshmen are not interested in statistics which they learn and they think statistics is highly imposed burden on them. The number of students who fall asleep when I teach the theory is gradually increasing. For the sake of solution for this kind of problem, we try to use SAS program.

There is a SAS program which is a statistics analysis software. The percentage of using this program is gradually increasing in statistics. SAS starts to be developed by A. J. Barr who is a graduate student in the University of North Carolina in U.S.A. in 1966 with the purpose of analyzing data easily.

Many students recognized the need and importance of statistics, while they considered statistics as a difficult subject to learn. It is because statistics is hard to understand and needs the complicated calculations and so it takes much time and efforts to make efficient use of it.

Considering this point, we decrease to explain complicated theory as much as possible. We try to make them use the computer when they accomplish the complicated calculations in order to know the basic concept of statistics more easily. Here, they can use SAS program to do the complicated calculations easily and quickly and understand the basic concepts of statistics easily. SAS program makes students participate in the class actively and have the interests in the statistics class. And so it tries to help to develop the mathematical qualities.

While we use only the brief data when we teach the theory, it is possible to apply to a real life in computer lab by using practical data. If we teach with computer, we can increase the number of iteration easily and decrease the uncertainty and variation of the result and find new kinds of patterns. The data gained through trial experiment supplies the opportunity for data analysis. If we change the hypothesis of model and continue the experiment, it is possible to do wide experiments which change method analyzing formed data [3].

Year	Statistics record	
	2006	2007
Score(point) (100 point full)	76.56	79.68

TABLE 1. Comparison of statistics records

4. Study method

4.1. The subject of study.

The subjects of this study are 135 students who entered in 2006 and 128 students who entered in 2007. They all are the students in the department of computer information at my school. Students who entered in 2006 took lessons in statistics theory 3 hours a week. And students who entered in 2007 took lessons in statistics theory 2 hours a week and in lab 1 hour a week. They took lessons in introduction of SAS and how to use SAS 1 hour each week for one semester in order to use related contents which comprise from design of program to data summary, result analysis, and printout.

4.2. Study process.

Experiment 1:

First, we compared statistics records of students who entered in 2006 to those of students who entered in 2007 to analyze the result of this study. These records are the records of 135 students who entered in 2006 and 128 students who entered in 2007. And they consist of the midterm exam scores, final exam scores, presence scores, and report scores.

The average of statistics records of students who entered in 2006 was 76.56 points and that of students who entered in 2007 was 79.68 points. This represented that the average of students who entered in 2007 was improved as much as 4.08%. Table and figure for these are shown in Table 1 and Figure 1, respectively.

Judging from the records of low level students who don't concentrate on the class and don't adapt themselves to the class, the students who entered in 2006 was 15.03% but the students who entered in 2007 was 13.1%. This fact represented low level students decreased as 1.93% than 2006.

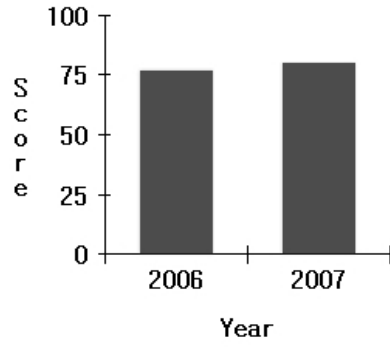


FIGURE 1. Comparison of statistics records

	Low level(D,F)	
Year	2006	2007
Percentage(%)	15.03	13.1

TABLE 2. The percentage of low level students

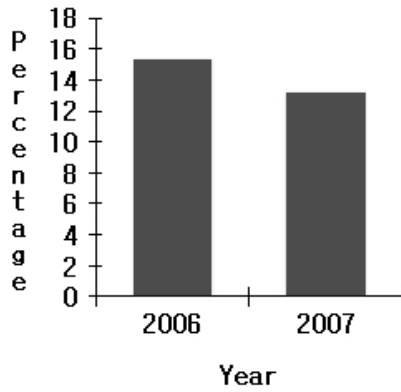


FIGURE 2. The percentage of low level students

Item	Faithfulness	Preparation	Efficiency	Average
Percentage(%)	7.87	6.09	7.67	8.31

TABLE 3. Improvement percentage of lecture items

Item	Preparation	Understanding	Interest
Average score (point)	1.2	3.75	4.37

TABLE 4. Reaction of students who entered in 2007

Experiment 2:

Secondly, interest survey on statistics was carried out to students who entered in 2006 and 2007. Survey method is through questionnaires. There are two kinds of questionnaires. One is questionnaire which provided by me and the other is teaching evaluation carried out at my school.

Questionnaires which provided by me and teaching evaluation were applied to students who entered in 2007 and only teaching evaluation was applied to those who entered in 2006. The items I provided are about students' preparation, understanding, and interest. The related items with this study among teaching evaluation items are faithfulness of lecture activity, preparation of lecture, and efficiency of lecture contents.

Students who entered in 2007 got 1.2 points, 3.75 points, and 4.37 points (on the basis of 5 points), respectively about preparation of class, understanding, and interest. Students who entered in 2007 gave 7.87%, 6.09%, and 7.67%, respectively higher than those who entered in 2006 about faithfulness of lecture activity, preparation of lecture, and efficiency of lecture contents and so total evaluation points were upgraded as much as 8.31%.

Only 24% of students who entered in 2007 answered that they for themselves prepared the class but 87.35% of them answered that the lecture using SAS led students to have interests. Percentage of right answers of mathematical knowledge on probability and statistics of mathematics teachers carried out by [1] is shown in Table 5.

The chapter which they felt difficult to teach was statistics and the percentage was 39%, which was the highest percentage among any other chapters. Because students who entered in 2006 learned from the teacher who has been short of statistics knowledge, their scores went down still

Item	Percentage of right answer (%)
Measure of center	
Mean	98.3
Median	57.7
Mode	61.5
Measure of variation	
Range	52.0
Variance and standard deviation	92.0

TABLE 5. Percentage of right answers on probability and statistics of mathematics teachers

more in the faithfulness(7.87%) and the efficiency(7.67%). Students considered statistics as hard because teachers seemed diffident to teach it. Students who entered in 2007 had similar environments to those who entered in 2006 but by the effect of SAS program the item of interest was represented relatively high points as 4.37 points.

Experiment 3:

Thirdly, we observed students' class attitude. Students who entered in 2006 learned only statistics theory and many of students in middle low rank slept and they were not interested in the class when hard contents were appeared. But in the case of those who entered in 2007, not only those in middle low rank but also those in low rank were interested in the lab and concentrated on the class. Appearance of students who looked dark became cheerful and the number of students who were waiting for lab increased. But students didn't try to know relation between theory and practice and many of them were satisfied with the result of the program that came out without errors.

5. Study result

Result of Experiment 1:

We observed the achievement of statistics as Experiment 1. This showed that records of students who entered in 2007 and used SAS program, were improved as much as 4.08% than those of students who entered in 2006. This is a small increasing rate but this means that

lab class has good effects on achievements. This is because the number of vocational high school students increased in 2007 and students with lower basic ability than 2006 increased and so it was a hard situation to teach but records were improved than 2006.

Experiment 1 showed that the number of students of low level(D, F) decreased as much 1.93% from 15.03% to 13.1%. At that time students with low records entered into school in 2007, the number of students with low rank without basic ability increased but on the contrary the percentage of students with lower records decreased in 2007. This showed that total records in statistics were improved. And this is a strong piece of evidence that new lecture method have had good effects on students with low records.

Result of Experiment 2:

Students who entered in 2007 and used SAS lab gave better scores than those who entered in 2006. The result of the data of teaching evaluation which carried out secondarily represented that students were satisfied with the lecture in 2007 in the faithfulness of lecture activity, preparation, and efficiency when we compare to the items in 2006. Those who entered in 2007 said that they had effects on qualitative aspects such as the preparation, understanding, and interest. Most of them said lab class was interesting. Because they learned in the lab only 1 hour per week, there were many students who felt lack of time. And they hoped that more time was replaced by lab class rather than theory class.

Result of Experiment 3:

The result of experiment on class attitude showed that even though students who entered in 2007 was behind those who entered in 2006 in basic ability, there was surely a change of class attitude.

Watching while the theory class dealt mainly just simple calculations, through the lab complicated calculations were easily calculated, students wondered and felt the need of lab class. They have to know properly relation between lab and theory and need the concept development of statistics. But it doesn't look possible to all the students. Many students partly understood the concepts through SAS package but concept development could not be obtained without their own understanding.

6. Conclusion

The basic ability of mathematics in my school goes down and the number of vocational high school students increases. My school tries to make statistics class interesting. We keenly feel the struggle that many students don't give up and participate in the class.

The efforts which increase the interest of statistics class through SAS lab and the quality of the class are gradually needed. The result of this study shows that SAS lab helps to give the motive to meaningful statistics and understand the mathematical relation. In fact, students who are bored and have low concentration and have the headache in theory class wondered and feel happy with SAS lab by checking the results directly in the computer display and observing calculations become simple.

It is necessary teacher's efforts as well as students' own efforts in order to feel not only external pleasure that answers can be easily obtained through computer lab but also internal pleasure that realizes the mathematical concepts through program input and execution.

However, students had the level differences not only in theory class but also in computer lab. It is necessary to present the project with distinction to students doing expertly or to organize groups and be volunteers in the groups in order to perform a voluntary and active learning. Then they will help each other and make efforts. The number of students who fall behind will decrease and students doing expertly will have more confidence and interests and participate in the computer lab actively.

Since SAS program is high-priced, it can't be used at home but just at school. It is necessary to use low-priced software in order to investigate by themselves and study not only at school but also at home by using low-priced software.

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