THE EFFECT OF USING “STANAVI”

- Web Based Learning System About Official Statistics

ONODERA, Tsuyoshi

Center for Statistics and Information, Rikkyo University, Tokyo, Japan

Introduction

- In statistical education in Japanese universities, it is necessary for students to acquire comprehensive knowledge and skills in survey methods, data processing, and statistical analysis.
- To deal with this need, Center for Statistics and Information (CSI) was established at Rikkyo University in Japan, and started from March 1st 2010 for supporting statistical education.
- The CSI consists of three research sections; Social Research and Statistical Education, **and Official Statistics**.
- The Official Statistics section is **responsible for providing support for students to utilize the official statistics.**

What　is “STANAVI”

- Our center provided a web based learning system for our students to study about official statistics.
- This learning system is named “Official Statistics Navigator. We　call it **‘STANAVI’** .
  (The name of this mascot character is　"すたなび"　in Japanese)

- The STANAVI is a guide for all kinds of the official statistics produced by Statistics Bureau (in the Ministry of Internal Affairs and Communication in Japan).

Contents of STANAVI

- the basic knowledge about statistics, statistics guide, basic excercise, and so on.

- It has been fixed to be able to be accessed from the outside of our University.

Basic knowledge about statistics

使い方 | 統　計 | 基礎知識 | 基本問題 | 分析事例 | 匿名データ

統計調査事務：　統計調査の企画・設計に関する主な知識
【標本設計と調査地域の選定】

Lesson 21　集落抽出法　cluster sampling

母集団の構成単位である一部の集まり，すなわち調査対象の集まりを「集落」として束ね，これを単位として抽出する方法である。集落抽出法においては，抽出単位が集落であるため，抽出の枠は集落で構成されることになる。例えば，人や世帯，事業所などを調査するに当たって，調査区を設定して調査区のリストを作成し，調査区を抽出単位として抽出し，その中に所在する世帯や事業所などをすべて調べる方法は，集落抽出法である。

この集落抽出法は，広い地域に散在する調査単位について地域を絞って調査するため，調査の効率が上がり，経費も少なくてすむという利点がある。しかし，次のような問題もある。理論上は，集落間のばらつきが小さければ，どの集落を選択しても結果に大きな振れが出ないため，精度が良くなるように思われるが，実際は集落を作るときに集落間のばらつきを縮小するのは難しいため，選択した集落が持つ性質が強く現れて精度が低下することもある。

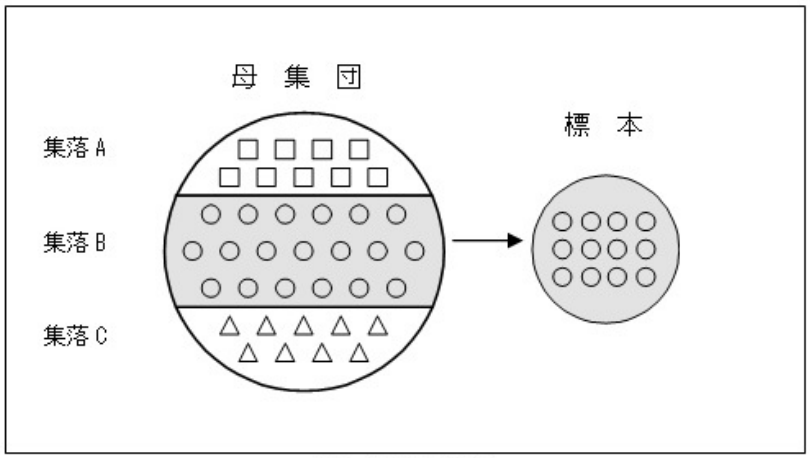


図1　集落抽出法

（出典）「統計実務基礎知識 ―平成22年2月改訂」総務省政策統括官（統計基準担当）

Basic exercise

使い方 | 統　計 | 基礎知識 | 基本問題 | 分析事例 | 匿名データ

家計調査

○ 2　✕ 8　答え合わせ　クリア

【調査・用語に関する問題】

［1］家計調査はどのような統計調査か。

What kind of statistics is family income and expenditure survey?

○ ［解答欄］
- A）基幹統計（全数調査）
- B）基幹統計（標本調査）
- C）一般統計（標本調査）
- D）業務統計
- E）加工統計

［2］家計調査の調査時期と公表について，正しいものはどれか。

調べたい人は　http://www.stat.go.jp/data/kakei/1.htm#5

○ ［解答欄］
- A）調査は毎週実施されており，結果の公表は，週，月，年，四半期ごとに行われる。
- B）調査は毎月実施されており，結果の公表は，月，年，四半期ごとに行われる。
- C）調査は毎年実施されており，結果の公表は，年ごとに行われる。
- D）調査は5年ごとに実施されており，結果の公表は5年ごとに行われる。

［3］可処分所得とは，どのような収入か。

調べたい人は　家計調査　用語の解説

By repeating reading textbook parts and doing exercises parts, students learns Statistics and Official Statistics.

Points of this Work

- Purpose:
  Inspection of the ***use effect*** of "STANAVI"
- We think using STANAVI have at least 2effects.
  - 1) Effect on **Understanding about statistics**
    - a) Effect as the textbook
    - b) Effect as the exercise book
  - 2) c) Effect on **students' Impression for statistics**

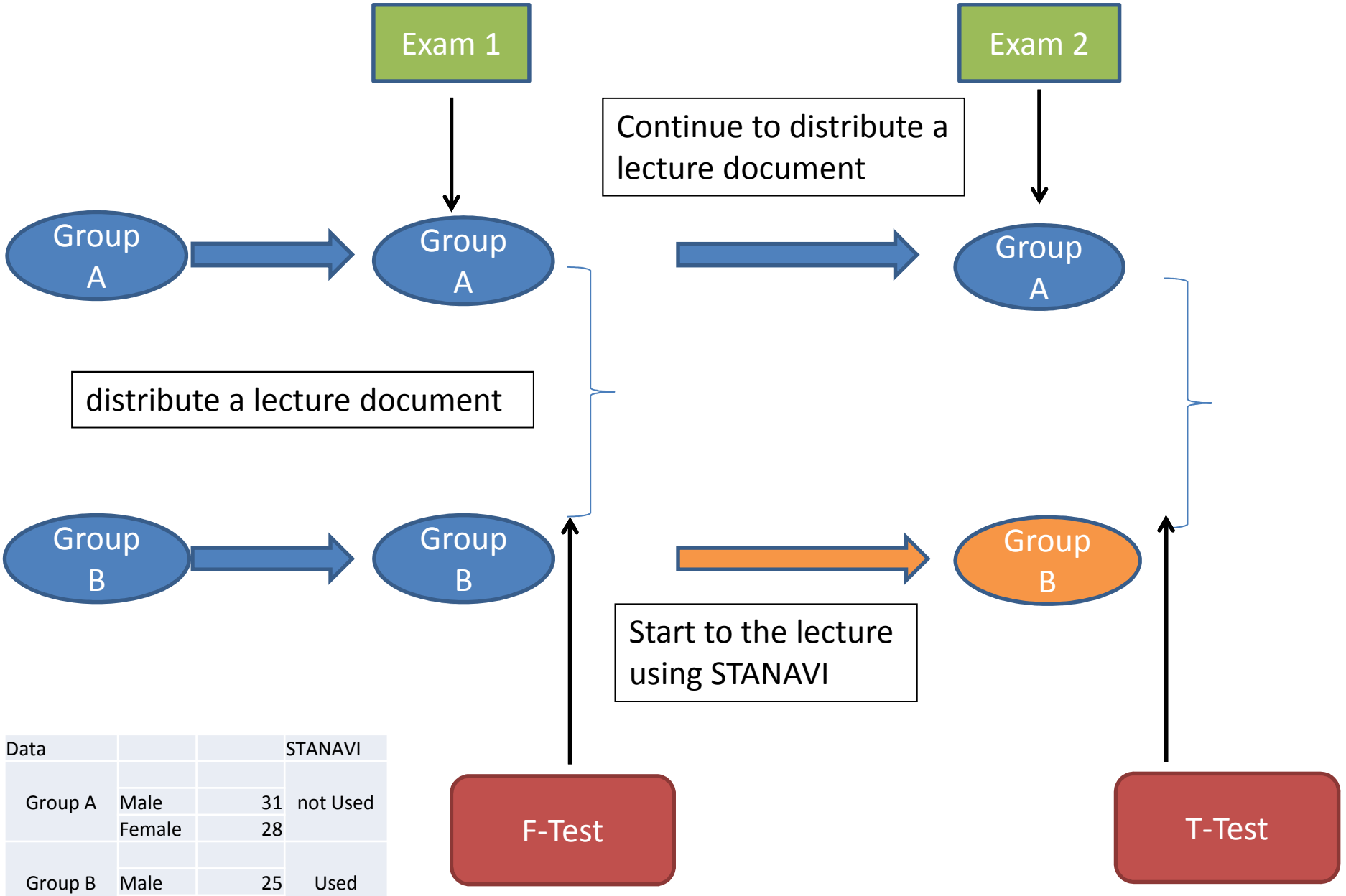
*For example, after using STANAVI, some students think that Statistics is not so difficult, or feel more familiar than before.

(I'm sorry but this point is at another opportunity.)

Adopted Test Method

- For this kind of study, the **pretest - post-test method** is the standard method to measure a learning effect.
- This method needs just one sample and the **same test** before and after the addition of the new learning method.

- But in this study, I adopted **2-sample t-test (parametric test)** .
  - This is the method to compare two independent means from the data of the different individuals.



Data			STANAVI
Group A	Male	31	not Used
	Female	28	
Group B	Male	25	Used
	Female	22	

Procedure of lectures and the exam.

- I distribute a lecture document to all students.
- After 3times lecture, they takes a test about the contents of a lecture till then.
  - This exam is done in order to check the equal ability for understanding about statistics between 2 groups.

- After that exam, For Group A, it is continued to distribute a summary at the lectures.
- For Group B, the use of STANAVI is started.

- After several lecture, we do the second exam for both groups.
  - This exam is done in order to measure the effect on using STANAVI.

Making of the sample groups

- We choose two classes where a student size is about 100.(the same university, the same department, the same course)
- The same test is carried out for all students equally, but we pull out **only first graders' results** and use those for this analysis.
- The student who was absent from the lecture or the exam also at once is removed from a sample.

Exam1 , Exam 2

- Exam 1
  - Question A-1 ~ A-5
  - Question B-1 ~ B-5
- Exam 2
  - Question A-1 ~ A-10
  - Question B-1 ~ B-10
  - Questionnaire (1~5)※

Question a)	Question from Basic Knowledge
	write the answer
Question b)	Question from Exercise
	choose the answer **among five**
Questionnaire	Answer by Four choices
	(Strongly Agree, Agree, Not Agree, Strongly not Agree)

※Questionnaire

1. The interest for statistics increased
2. The impression that the statistics had difficult softened
3. I think that I took time for the review of the class well
4. I concentrated on it and was able to learn it efficiently
5. I think that I was able to make the knowledge about statistics clear.

Exam 1 and F-Test

- Student's t-test **needs the equal variance** in two samples.
- So, we carried out the first examination **to check the equal variance** in two samples, and the F-test was carried out.

H_0: suppose that the variance between two groups does not have a difference

H_1: suppose that the variance between two groups have a difference

Results of F-Test

	Group	n	Mean	sd	F	d.f.	$F_{0.05}$(df=30,24)
Male	A	31	5.278	1.283	1.117	30	1.938
	B	25	5.500	1.213		24	
Female	A	28	4.944	1.311	1.289	27	$F_{0.05}$(df=27,21)
	B	22	5.333	1.155		21	2.029

$$F = \frac{sd_A}{sd_B}$$

(For example of Male)

- F=1.283/1.213=1.117 < $F_{0.05}$=1.938
  - →P > 0.05, the null hypothesis **is not rejected**
  - → the variance between two groups does not have a difference

- By this result, the following T-test became meaningful.

Exam2 and T-test

- We want to measure the effect on using STANAVI by Student's T-Test.

H_0 : Between two classes, an understanding degree about statistics does not have the difference

H_1:There are a certain difference

$$S = \sqrt{\frac{sd_A{}^2(n_A - 1) + sd_B{}^2(n_B - 1)}{n_A + n_B - 2}}$$

$$t = \frac{Mean_A - Mean_B}{S \cdot \sqrt{\frac{1}{n_A} + \frac{1}{n_B}}}$$

- If $|t| > t_{0.05}$, $P < \alpha$, then the null hypothesis is rejected.

Question a) Male		
	Group B	Group A
n	25	31
Mean	5.111	4.333
sd	1.242	1.247
Variance	1.543	1.556
S=	1.245	
t=	**-2.324**	
t0.05(df=54) two-sided	2.005	

Question b) Male		
	Group B	Group A
n	25	31
Mean	8.278	5.722
sd	1.557	1.446
Variance	2.423	2.090
S=	1.496	
t=	**-6.355**	
t0.05(df=54) two-sided	2.005	

Question a) Female		
	Group B	Group A
n	22	28
Mean	5.500	4.833
sd	1.258	1.067
Variance	1.583	1.139
S=	1.155	
t=	**-2.026**	
t0.05(df=40) two-sided	2.021	

Question b) Female		
	Group B	Group A
n	22	28
Mean	7.889	5.778
sd	1.560	1.272
Variance	2.432	1.617
S=	1.405	
t=	**-5.274**	
t0.05(df=40) two-sided	2.021	

Example for Question a) Male

$$S = \sqrt{\frac{1.556 * 30 + 1.543 * 24}{31 + 25 - 2}}$$

$$t = \frac{4.333 - 5.111}{1.2450 \cdot \sqrt{\frac{1}{31} + \frac{1}{25}}}$$

T-Test and Results

(example for question a, male)

- |t- value| =2.324 ＞$t_{0.05}$=2.005

  → P＜0.05 the null hypothesis **is rejected**.

  （It is similar in other cases)

Therefore,

- Between two classes, an understanding degree about statistics have the difference

→We may think that it is effective in statistics learning to utilize STANAVI.

About Cohen's ***d*** (effect size)

- Cohen's ***d*** (Effect Size) shows a size of the degree of the gap between null hypothesis and the alternative hypothesis.

$$d = \frac{Mean_A - Mean_B}{\sqrt{\frac{{sd_A}^2 + {sd_B}^2}{2}}}$$

- In the case the means of two groups are greatly different, they say that "the Effect Size is large", and) Cohen's ***d*** should be scored as above 0.75.

Measurement of Cohen's ***d***

(Example for Question b), Male)

- $|d| = \frac{5.722 - 8.278}{\sqrt{\frac{2.090 + 2.423}{2}}} = 0.5020$

→ Therefore, it is recognizable that there is a Medium Effect for using STANAVI.

		Cohen's d
Question a)	Male	0.3240
	Female	0.3599
Question b)	Male	0.5020
	Female	0.5150

Relative Size of Cohen's d	
small effect	0.15=<d<0.4
medium effect	0.4=<d<0.75
large effect	0.75=<d<1.10
very large effect	1.10=<d<1.45
huge effect	1.45=<d

Conclusions

- From the result of this experiment, it may be said that the use of STANAVI is effective for statistics learning.
- For students, using STANAVI is effective more as the exercise book than as the textbook for study statistics.
  - Because of the difference between results of the Effect size for question A and question B.