ESTIMATION OF STUDENTS' PERFORMANCE FROM CHRACTERISTICS OF SELF-EVALUATION –APPLYING T(TAGUCHI) METHOD TO UNIVERSITY STUDENTS –

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ABSTRACT: This paper gives application of T (Taguchi) method to the relationship between students' performance and characteristics. So, I selected the characteristics data researched when students entered the university ,and 2 kinds of performance data of 2nd grade each quarters ,that is, numbers of acquired study-units and GPA value. The results show that good performance factors are serious, hard, dream . There is different results acquired units and GPA is appropriate indicator for evaluation.

KEYWORDS: T(1) method, unit norm(space), performance, total acquired study-units, GPA(Grade Point Average), student characteristics, MT system, MT distance

1. BACKGROUND AND OBJECTIVE

If students' performances can be estimated from their human characteristics of self—evaluation, we may find the difficult student quickly.

So, we choose the average performance students as unit norm (space), we can analyze the performance by T methods.

The students self-evaluation of characteristics may have intentional factors ,but it will be converged to the average from many data. I guess this characteristics is not real characteristics ,but their favorable word of characteristics.

This time I tried the students of management faculty.

2. METHODOLOGY

Taguchi's T(1) method is applied. This method is developed by Dr. Genichi Taguchi from late 1970. This method is applying to the wide areas , such as medical diagnosis, price of real estate and land , company management ,process engineering etc. T method has 3 types , T(1), T(2), T(3).and MT system has MT, MTA, TS, and T methods. T(1) method 's steps are as follows.

- (1) Definition of unit norm(space) ,and calculation of members average.
- (2) Definition of signal data

- (3) Normalization of signal data
- (4) Proportional constant β are calculated
- (5) Total estimation of each members output calculation
- (6) Total estimation of SN ratio
- (7) Evaluation of importance of items by using orthogonal array table (so called item selection)
- (8) Total estimate for unknown data calculation
- (9) Total estimate calculation

3. UNIT NORM(SPACE) AND SIGNAL DATA

The concept of unit norm and signal data is shown in Fig.3-1. Unit norm is not extraordinary data. So unit norm is thought as average data.

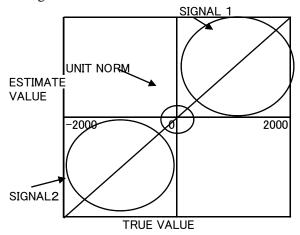


Fig.3-1CONCEPT OF UNIT NORM AND SIGNAL

Objective total sample is 390 as quarter series data per student.

Unit norm is average of performance data

4. STUDENTS AND CHARACTERISTICS WORDS

The performance data are from 1 to 2nd half grade, and characteristics data from 1st grade student self-evaluation. Human characteristics are 12 items. Each item are graded from 1 to 5.

- 1) Have will (volition)(aggressive, enthusiasm)
- 2) Have physical power
- 3) Have communication ability (can explain to others)
- 4) Have dream or target
- 5) Gentle & mild
- 6) Serious (grave & steady)

- 7) Gentle to others
- 8) Keep one's promise
- 9) Polite or courteous
- 10) Self-confidence
- 11) Cooperative (conciliatory)

And, 12 gender(male) ,13 grade(each quarter) are added.

The total sample no. is 390, as 6 quarter series data per student. Unit norm is average performance data 22.

5. EVALUATION OF TOTAL ACQUIRED STUDY-UNITS BY T METHOD

After normalization of unit norm ,and subtraction the unit norm ,data are recalculated as shown Table5-1. Total acquired study-units' factor-effect diagram and gain of SN ratio are shown in Fig.5-1, Table5-2.

Table 5-1. Input data of total acquired study-units, 14 factors

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O A A A A A A A A A A	0.400000 -1.50000 -0.500000 1.400000 0.400000 1.400000 1.400000 1.400000 0.400000 0.400000 0.4000000 0.40000000000	0.400001 0.400001 0.4000001 0.4000001 0.4000001 1.4000001 0.4000001 0.400001 1.4000001 1.4000001	-0.13636 -1.13636 -2.13636 -0.13636	1.646466 -1.46466 -1.46466 -1.46466 -1.46466 -1.46466 -1.46466 -1.46466 -1.46466 -1.46466 -1.46466 -1.46466		2 40000 1 2 40000 1 2 40000 1 0 40000 1 1 40000 1 0 40000 1	0.800000 0.800000 0.800000 0.800000 0.800000 0.800000 0.800000 0.800000 0.800000 0.800000 0.800000 0.800000 0.800000	1 636 364 1 636 364 0 636 364 -0 36 364 -0 36 364 -0 36 364 1 636 364 -0 36 36 -0 36 -0 36 36 -0 36	0.80000 0.80000 0.80000 0.80000 0.80000 0.80000	0.5 0.5 0.5 0.5	0.00 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	-0.78787 0.878787 0.878787 -0.78787 -0.78787 -0.78787 -0.78787 -0.78787 -0.978787	0.307787 0.447787 0.447787 0.647787 0.647787 0.647787 0.647787 0.647787	36.81818 36.81818 37.81818 37.81818 37.81818
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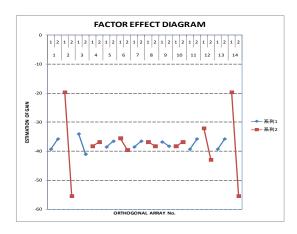


Fig.5-1 FACTOR EFFECT DAIGRAM

Table5-2 SN RATIO GAIN SEQUENCE OF TOTAL ACQUIRED UNITS

GAIN SEQUENCE	SORT RESULT	GAIN	FACTOR
1	2	35.67709	PHYSICA L POWER
2	14	35.67709	YEAR GRADE
3	12	10.85514	COOPERA TIVE
4	3	7.015512	COMMUNI CATION
5	6	4.047887	SERIOUS
6	9	1.461465	PROMISE
7	8	1.459946	GENTLE TO OTHERS
8	10	-1.45991	POLITE
9	4	-1.46148	DREAM
10	7	-1.9896	HARD
11	5	-1.98965	GENTLE &MILD
12	13	-3.51233	GENDER(MAEL)
13	1	-3.51233	WILL
14	11	-3.51532	SELF- CONFIDE NT

The factors of plus gain is 2,14,12,3,6,9,8 and these are effective, and minus gain 1s 10,4,7,5,13,1,11, and those are not effective.

The estimation of true value is done by using 7 plus factors in Table 5-2. The results are shown as Fig.5-2.

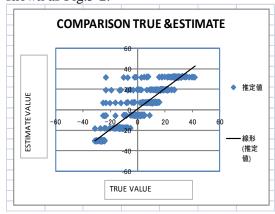


Fig.5-2 PERFORMANCE COMPARISON OF TRUE VALUE AND ESTIMATE

From factor item selection, performance equation is calculated, and the coefficient of equation and unit norm's constant are shown in Table 5-3.

Table5-3 CHARACTERISTICS FACTOR ,GAIN, AND ESTIMATION EQUATION'S COEFFICIENT AND CONSTANT

FACTOR	GAIN	COEFFICI ENT	CONSTA NT OF UNIT NORM
WILL	-3.51233	0	3.181818
PHYSICA L POWER	35.67709	-0.16075	2.590909
COMMUNI CATION	7.015512	-0.26827	2.590909
DREAM	-1.46148	0	3.136364
GENTLE &MILD	-1.98965	0	3.454545
SERIOUS	4.047887	0.047097	3.272727
HARD	-1.9896	0	2.590909
GENTLE TO OTHERS	1.459946	0	3.409091
PROMISE	1.461465	0	3.363636
POLITE	-1.45991	0	3.409091
SELF- CONFIDE NT	-3.51532	0	2.5
COOPERA TIVE	10.85514	0	3.318182
GENDER(MAEL)	-3.51233	0	0.727273
YEAR GRADE	35.67709	49.65684	0.852273
			32.18182

From these data, condition S β —VE \geq 0 applied , many factors are omitted.

The plus coefficient factor is 6 serious. The 2 physical power and 3 communication ability have reverse relation with total acquired units. Study-units are proportional with grade, and coefficient is 49.8 near 48 limit maximum attainable units per year grade.

Enterprises evaluate generally the communication ability at entrance examination . But communication ability is reciprocal with performance.

Enterprises look for the compatibility of the different characters of students.

6. EVALUATION OF GPA GRADE BY T METHOD

After normalization of unit norm ,and subtraction the unit norm ,data are recalculated as shown Table6-1. GPA factor-effect diagram and gain of SN ratio are shown in Fig.6-1, Table6-2.

Table 6-1. INPUT DATA OF GPA,14 FACTORS

-0 8484	3 -1,88787 -8,04848 -1, 5 -2,88787 -1,04848 -1, 6 -2,8787 -1,04848 -1, 6 -2,8787 -1,884848 -1,6 6 -2,88787 -1,884848		727 O.136364 -O.13636 727 -1.86364 -1.13636	-1.13a14 -0.8 - 1.48 -0.8 - 1.48 -0.8 - 1.48 -0.8 - 1.48 -0.8 - 1.48 -0.8 - 1.48 -0.8 - 1.48 -0.8 - 1.48 -0.8 - 1.48 -0.8 - 1.48 -0.8 - 1.48 -0.8 - 1.48 -0.8 - 1.48 -0.8 - 1.48 -0.8 - 1.48 -0.8 - 1.48 -0.8 -0.8 - 1.48 -0.8 -0.8 - 1.48 -0.8 -0.8 -0.8 -0.8 -0.8 -0.8 -0.8 -0.	Gasala
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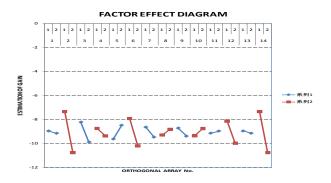


Fig.6-1 FACTOR EFFECT DAIGRAM OF GPA Table6-2 SN RATIO GAIN SEQUENCE OF GPA

GAIN SEQUENC E	SORT RESULT	GAIN	FACTOR
1	2	3.391375	PHYSICA L POWER
2	14	3.391375	YEAR GRADE
3	6	2.261729	SERIOUS
4	12	1.835994	COOPERA TIVE
5	3	1.64163	COMMUNI CATION
6	7	0.825113	HARD
7	9	0.665717	PROMISE
8	4	0.61592	DREAM
9	13	0.187156	GENDER(MAEL)
10	1	0.187156	WILL
11	11	-0.17263	SELF- CONFIDE NT
12	8	-0.48495	GENTLE TO OTHERS
13	10	-0.58922	POLITE
14	5	-1.13218	GENTLE &MILD

The factors of plus gain is 2,14,12,3,6,9,8 ,1,7,13,and these are effective and minus gain 1s 10,8,5, 11,and those are not effective. The estimation of true value is done by using 10 plus factors in Table 6-2. The results are shown as Fig.6-2.

Fig.6-2 PERFORMANCE COMPARISON OF TRUE VALUE AND ESTIMATE OF GPA

From factor item selection, performance equation is calculated, and the coefficient of equation and unit norm's constant are shown in Table 6-3.

Table6-3 CHARACTERISTICS FACTOR ,GAIN, AND ESTIMATION EQUATION'S COEFFICIENT AND CONSTANT OF GPA

FACTOR	GAIN	COEFFICI ENT	CONSTA NT OF UNIT NORM
WILL	0.187156	-0.54212	3.545455
PHYSICA L POWER	3.391375	-0.84372	3.045455
COMMUNI CATION	1.64163	-0.87414	2.909091
DREAM	0.61592	0.346675	3.227273
GENTLE &MILD	-1.13218	0	3.045455
SERIOUS	2.261729	0.942631	3.318182
HARD	0.825113	0.519374	3.090909
GENTLE TO OTHERS	-0.48495	0	3.727273
PROMISE	0.665717	0	3.863636
POLITE	-0.58922	0	4.136364
SELF- CONFIDE NT	-0.17263	0	2.136364
COOPERA TIVE	1.835994	0	3.5
GENDER(MAEL)	0.187156	-0.71479	0.636364
YEAR GRADE	3.391375	-1.8957	1.022727
			2.122727

From these data, condition $S \beta - VE \ge 0$ applied , some factors are omitted.

The plus coefficient factors are 6 serious, 7 hard, 4 dream. The 2 physical power, 3 communication ability and 1 will have reverse relation with GPA. GPA is reciprocal with grade.

Enterprises evaluate generally the communication ability at entrance examination . But communication ability is reciprocal with performance.

Enterprises look for the compatibility of the different characters of students.

7. RESULT OF PERFORMANCE AND CHARACTERISTICS

I got some knowledge between performance and characteristics by application of T method.

The conclusion and future issue are as follows.

- In comparing total acquired study-units and GPA, GPA is good indicator related the characteristics, because acquired units are graduation condition, that is 124 units, are same case, but acquired level are different such as A,B,C, that is, different capability and different efforts.
- 2) The 4 dream, 6 serious, 7 hard, are plus factors for performance.
- 3) The 1 will, 2 physical power ,3 communication ability ,are minus factors for performance.
- 4) The 5 gentle, 8 gentle to others, 9 promise, 10 polite ,11 self-confident ,12 cooperate do not affect to performance.
- 5) The 13 gender (male), 14 year grade are minus effect to GPA, but gender do not affect acquired study-units. The year grade affects plus to acquired study-units.

Future issues are as follows.

- Data's variation is large from the personal self-evaluation, because students have 2 kinds tendency to seem high level person, and low level person. There are difference of standard of level.
- 2) The general relation is found from the estimate equation of T method. Future issues are applications to different faculties ,and different year grade students.
- 3) The real problematic students' behavior are not coming to university, not deliver of home work. So, we can find these special students, but it is difficult to recover to study.

8. CONCLUSIONS AND SUMMARY

I understand dummy factors ,such as 1 or 0, are useful to analyze.

I thank to the cooperation of the students.

I would like to understand this method deeply. I would like to use this method as teaching tool of management education.

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