

SOME INTERESTING FEATURES OF AN "IMPROMPTU TEST" SET UP TO EVALUATE THE MINIMUM LEVEL OF COMPETENCE IN MATHEMATICAL MANIPULATION.

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Abstract

This paper essentially examines the predictive nature of an "impromptu test" in respect of future performance in Physics at the B.Sc. (B.S.) degree.

Key Words: Impromptu Test, Competence.

1. Introduction

At the commencement of a multidisciplinary extension course (Diploma Course in Optometry) which was taken by a student group that was heterogeneous in terms of educational standards and educational background, a test was hurriedly and arbitrarily put together to evaluate how much mathematics they should be taught as a prerequisite. This same test was later administered to regular First Year students on their first day in University.

It was observed, over a period of several years, that there seemed to be an interesting relationship between the performance at the "impromptu test" and in Physics as a subject in the three year B.Sc. degree course. The B.Sc. examination required sitting for six three hour theory papers and three six hour laboratory examinations, under rigidly supervised conditions.

A cursory glance at the respective mark columns of different years seemed to indicate that the "impromptu test" mark yielded a fair prediction of the final examination performance.

2. Procedure

Table (-1) which is without the necessary diagrams-conveys some idea of the nature, standard and the essential content of the test.

The performance of different student batches is given in Table (2) and the performance is indicated by the rank. The left hand column gives the rank at the "impromptu test" and the right hand column the rank at the B.Sc. degree.

The correlation table is given in Table. (3) for six student batches.

3. Discussion

(a) The t values in the correlation table indicates that the correlation coefficients p have a confidence limit around 94%. Further, that there exists a statistically significant correlation between a student's "Impromptu Test" performance and his B.Sc degree Physics performance.

(b) The non correlation of the 1979 MPC tests and the general decline in correlation as the identical test is being repeated year after year, indicates that the *impromptu character* is a vital ingredient of the test. The 1979 impromptu test was set at the beginning of the Second Year unlike in the other years when it was administered on the first day of the first year. In 1979 the students had sufficient familiarity to anticipate and even be coached for the test by their seniors, since they had spent a full year at the University. Hence the poor correlation.

(c) The inspection of the performance table shows that there are individual anticorrelations that fall into the two categories Impromptu Bad/B.Sc Physics-Good: Impromptu Good/B.Sc Physics-Bad. The examination of the records of the second category indicated that most of them had opted for extramural activities as sport, student activities, political activism etc. In a system, where due to lack of resources-manpower, funds equipment etc. time table rigidity is unavoidable and students with wider interests cannot be accommodated and academic performance is a casualty. This is more so for a subject like Physics with a heavy laboratory content.

In the second category most of the good students whose performance was poor at the Impromptu test were likely victims of the unsettled conditions of an unfamiliar surroundings, perhaps aggravated by the traumas freshmen are subjected to as part of initiation ceremonies.

(d) It is noteworthy that the "Impromptu test" was taken by students who had one year of relaxation from high pressure study for the High School terminal examination conducted at a national level (G.C.E. Advance Level), leaving them sufficient time to forget all but the basics. The "Impromptu Test" therefore measures the ability to store basics and retrieve efficiently when the occasion demands.

(ii) A possible use of the "Impromptu test" would be in the early selection of students for specialisation in Physics, which is necessary in Universities that cannot afford Course Unit systems or continuous assessment and have large student numbers. A combination of the "impromptu test" and the First Year Examination (which assesses potential and achievement) could then be used in the selection.

THE TEST CONTENT

Answer as many questions as you can within one hour

ALGEBRA

1. (i) Determine x in the following equations
 $3x + 4y + 5 = 0$; $ax^2 + bx + c = 0$; $\exp.x = 2$; $\ln = 2$; $\log_{10}x = 3.405$
 $2x - y + 6 = 0$
- (ii) If $\log_{10} A = a$, $\log_{10} B = b$, $\log_{10} C = c$ determine in terms of a, b, c
 $\log_{10} AB/C$; $\log_{10} A^n B$
- (iii) Expand $(a+x)^n$ sum to infinity $1 + 1/2 + 1/4 + 1/8 + \dots$
 sum $1 + 3 + 9 + 27 + \dots + 2187$

GEOMETRY

2. (i) Find AE in fig. 1 if AC is $8''$; (ii) Find EF, OT, OC, CF in fig. 2 if $OA = 4\text{cm.}$, $AB = 1\text{ cm.}$ and $OF = 2\text{cm.}$, (iii) Find CB in fig. 3 if $OA = 4\text{cm.}$ and $DE = 2\text{cm.}$ (iv) Find angles C and B in fig. 4 if angle $CAB = 30^\circ$ (v) Find angles DCA and ABC in the quadrilateral of fig. 5

TRIGONOMETRY

3. (i) Express in terms of a, b, c $\sin A, \cos A, \tan A, \cot A, \sec A, \operatorname{cosec} A$, $\sin(180-A)$, $\cos(180-A)$, $\tan(180-A)$, $\sin(-A)$, $\cos(-A)$, $\cos(90+A)$ and $\cos(90-A)$ and $\tan(90+A)$ for a triangle ABC ; A, B, C representing its angles and a, b, c representing its sides.
- (ii) Express in terms of A, B or its \sin, \cos, \tan, \cot functions $\sin(A+B)$, $\sin(A-B)$, $\cos(A+B)$, $\cos(A-B)$, $\tan(A+B)$, $\tan(A-B)$, $\sin A + \sin B$, $\cos A + \cos B$, $\sin A - \sin B$, $\cos A - \cos B$, $\sin^2 A$, $\cos A$, $\sin^2 A$, $\operatorname{cosec} A$, $\sec^2 A$.
- (iii) $a / \sin A, \cos A$ in terms of a, b, c, A, B, C .
- (iv) radians $\langle \dots \rangle$ degrees.

CALCULUS

4. (i) Differentiate $ax^3 + bx^2 + cx + d + e^x$; $\sin x, \cos x, \tan x, \cot x$; $u(x)/v(x)$
 $u(x) \cdot v(x), \exp(ax), \ln(x), \log(x)$.
- (ii) Integrate $4x^3 + 5x^2 + 6x + 7 + 8x^{-9}$, $\sin x, \cos x, \tan x, \cot x, \sin x$
 $\cos x, \exp.x + \exp. 2x + \exp^{-2}$

CONICS

5. (i) If straight line $y=mx+c$ passes through point 2,3 and 5,7 find m and c ,
 (ii) In the cartesian coordinate system with axes Ox and Oy write out the equations for a circle with radius a , a parabola whose focus lies at (O,a) and an ellipse whose major axis is "a" and minor axis is "b".

NUMERICAL COMPUTATION

- 6 Evaluate using logarithmic tables, slide rule and pocket calculator
 $857 \times 0.0023 \times 3.22 / [981 \times 3759(0.000072)^2]$

PERFORMANCE TABLE

1976		1976		1977		1979		1979		1980	
MPC		MPB		MPC		MPC		MPB		MPC	
1	1	8	12	4	2	1	4	10	2	30	19
12	14	5	4	9	6	5	22	1	5	22	14
11	13	10	10	1	8	6	9	2	9	32	19
6	9	12	10	2	14	22	4	6	7	4	19
16	11	8	4	2	7	2	1	3	4	19	2
9	2	3	6	5	10	3	13	4	1	3	29
5	14	7	3	6	4	4	4	4	10	13	29
9	14	1	6	6	10	6	4	7	6	8	3
12	5	2	1	11	8	6	17	8	10	27	9
15	12	11	13	8	1	6	22	9	12	17	23
12	4	13	9	13	17	6	19	11	12	26	27
6	7	5	2	13	10	11	22	13	8	17	4
4	8	3	8	17	15	11	19	14	5	27	16
2	5			10	13	13	17	15	12	8	19
8	3			12	15	16	3			8	12
				13	2	16	10			1	8
				19	19	18	19			8	5
				16	18	18	2			25	16
						20	15			5	1
						20	12			22	9
						23	14			15	5
						24	4			29	7
						13	15			2	2
										13	27
										7	12
										15	23
										31	25
										12	9
										5	18
										24	29
										7	29

MPC-Mathematics, Physics, Chemistry Students

MPB-Mathematics, Physics, Biology Students

Table 2. Performance of the students.

STATISTICAL CORRELATION SUMMARY

BATCH	NUMBER	CORR:p	$t = \frac{p(N-1)^{1/2}}$	CORR:p*	t*	COMMENT
1976 MPC	16	0.33	1.28	0.50	1.87	M to S
1976 MPB	13	0.61	2.20	0.69	2.89	S to Ma.
1977 MPC	19	0.39	1.65	0.56	2.24	M to S
1979 MPC	24	-0.06	-0.30	0.06	0.26	N
1979 MPB	15	0.22	0.82	0.38	1.30	L to M
1980 MPC	32	0.20	1.11	0.27	1.45	L

CORRELATION COMMENT

Ma-Marked; S-Substantial; M-Moderate; L-Low but definite; N-No

P* is the correlation coefficient calculated with two pairs of extreme anticorrelations being excluded (bold type in the PERFORMANCE TABLE)