CHAPTER VII

VALIDITY

7.1 A little theory to begin with

English and English define validity as "a property of... the test instrument, that insures that the obtained test scores correctly measure the variable they are supposed to measure; the property of the measuring process that makes the obtained scores useful in predicting a given variable."[1] A validity coefficient is likewise defined as, "an estimate of the degree to which a test measures what it is suggested to measure."[2]

The term 'validity' was first used in a technical article by Freeman in 1914.[3] It was a natural corollary of the measurement activity; the interest in testing also led to the interest in testing the accuracy of the tools. Travers[4] gives a brief sketch of the historical development of the interest in testing followed by the interest in validity. He shows how the American

1. English and English, Dictionary of Psychology and Psychological Terms, p. 574.
2. ibid., p. 575.
3. quoted by Travers, An Int. to Educl. Research, p. 193.
4. ibid.,

Psychological Association was interested in testing from 1895 and appointed several committees to give directions to this activity.[1]

It is ture that for a test to be valid, it must be reliable. Validity is a function of reliability. Although reliability is general, and an intrinsic property of the test itself, validity is specific for certain named criterion. A test valid for prediction of success in clerical ability need not necessarily be useful for prediction in other spheres, say mechanical aptitude. "In this sense, a test has a great many validities.[2] It may change from time to time and school to school. "In other words, validity can not be regarded as a fixed or unitary characteristic of a test.[3]

There was lot of vague thinking as to the exact nature of validity, and how to measure it, which gave rise to the concept of 'validity coefficients' in 1940. This was possible due to the existence of an improved psychometrics and correlation methodology. Still the confusion about exact nature of validity remained. Travers[4] cites Mosier who stated that the term validity was used in reference to 4 distinct concepts: (a) Validity by assumption, (b) by definition, (c) Face validity and (d) validity by hypothesis.

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1. Travers, op. cit., p. 191.
2. Harold Gulliksen, Theory of Mental Tests, p. 88.
3. Gulliksen, loc. cit.
4. Travers, op. cit., p. 195.

This lack of definitions led the American Psychological Association to organise a Committee on Test standards in 1949. In its recommendations, it suggested 4 kinds of validities: (1) Predictive, (2) Concurrent, (3) Content and (4) Construct, of which the first two are empirical validities inasmuch as the tool is correlated with some external criterion. Content validity is the adequate coverage of the content or the subject area tested. As is evident, this is the most important type of validity for achievement tests. Construct validity is the correspondence of the subject matter of the test with a theory. Factorial validity is a form of such construct validity. Some scholars, e.g. Travers,[1] consider this as most important type of validity-the actual validity. According to him, this is the 'intrinsic validity' of Bowrers, and the validity by hypothesis of Mosier.[2]

Predictive validity, however, is probably the most important property of a test, especially for an aptitude test. For any aptitude test, the constructor's chief interest is in the prediction of success of an individual's performance in some career of course. According to Freeman, "the study of predictive validity is essential, even if other validities are computed, as this is the main purpose of a test...Predictive validity of a test is most important characteristic."[3]

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1. Travers, op. cit., p. 199.
2. ibid.,
3. Freeman, Theory and Practice of Psychological Testing, p. 99.

English and English have defined validity as, " the property of the measuring process that makes the obtained scores useful in predicting a given variable."[1] As far back as in 1928, Hull wrote, that "the ultimate purpose of using aptitude tests is to estimate or forecast aptitudes from test scores."[2] The authors of the DAT battery have also stressed the usefulness of the predictive validity for an aptitude test. For them the usefulness of any test ultimately depends on the extent to which it will predict the performance of the persons tested. Excellence in other characteristics of a test, such as format, reliability, norms, and scoring method, is wasted unless the test results have a consistent relationship with the performance to be predicted and "coefficients based on a simultaneous measurement (i.e. concurrent validity) may be of descriptive value, but no prediction is involved."[3] They further state that, " the accepted method of determining the predictive value of a test is first to administer it to an adequate number of persons who are about to begin a new job or a particular type of educational course. When sufficient time has elapsed so that their success in the job or course can be reasonably well assessed, a criterion measure is obtained."[4]

The main purpose of the present investigation was to

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1. English and English, loc. cit.,
2. C.L.Hull, quoted in Cronbach and Glaser, Psychological Tests and Personnel Decisions, p. 1.
3. G.K.Bennett et al, Manual, p. 35.
4. ibid.,

develop suitable tools to predict success in school courses. If the studies would indicate an adequate validity with marks, then the DAT tests, administered earlier, could predict the students' later success. This would, thus, help the officials to determine with a reasonable certainty, the appropriate careers, or courses of the students which they may follow at a later period. The course of study could, then, be so planned that the talents of pupils are properly expressed and utilised.

7.2 Sampling

The sample used was the same as the one on which the reliability was studied. This has been described in Chapter V and VII Out of 170 students taken for the study of reliability, some irregular answersheets had to be rejected, such as those which contained ambiguous names or other personal informations. These made exact identification impossible. It was decided to eliminate such cases from the study in order to avoid possibility of an incorrect identification. In addition to such cases, there were some shose examination results were withheld, due to some official reasons, such as non-appearance, copying etc.

Table 29 shows the schoolwise break up and the total number of student's comprising the validity sample.

TABLE 29

Schoolwise break up of the Validity Sample

Test	School* (a)	(b)	(c)	(d)	N
Verbal Reasoning	71	28	26	18	143
Abstract Reasoning	74	26	25	15	140
Mechanical Reasoning	74	26	25	15	140
Space Relations	71	24	31	17	143
Numerical Ability	71	24	31	17	143
Clerical Speed and Accuracy**	77	-	-	15	92
Language Usage-sp	72	26	27	19	144
Language Usage	72	26	27	19	144

* * The schools represented by the letters a, b, c, d are the same as explained on p.

** As stated in the previous chapter, two schools-school (b) and (c) were disregarded in case of the CSA, as, it was discovered later, the students had faked and not observed the exact time-limit.

7.3 Criterion

As already mentioned earlier, the aim of this study was to help prediction of school success and the classification of students in various diversified courses in class IX. To achieve this purpose, a suitable criterion was needed. After much consideration, the criterion of final examination marks was selected for the present validation study. This was most suitable for the immediate purpose of the investigation viz, to help prediction of success in various school courses by

the placement on the DAT battery. It was at the same time most convenient. Concurrent validational studies were not planned due to the absence of any well-prepared Differential Aptitude Tests battery. Administration of any intelligence test, however, was probable but not convenient as the administration of DAT battery itself took much time and any additional testing might have been resented by school authorities.

The annual examinations were held in the month of April, 1964, and the results were announced during the 1st week of May 1964. The tests were administered during the 1st fortnight of January 1964 in various schools. Thus, there was an interval of about 3 months between testing and the examination. Inasmuch as there was time interval, between testing and the examination, it could very well serve the purpose of a design for a prediction experiment. The essence, as Doppelt says is that "results (be) hidden away until criterion ratings can be secured, say three, six or twelve months later."[1]

The correlation coefficients between test scores and subject marks earned in the annual examination were calculated and were also averaged[2] for each school. It is not ordinarily adequate to combine several heterogenous groups for calculation

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1. J.E.Doppelt and H.G.Seashore, "How Effective are your Tests?," Test Service Bulletin no. 36-40, (1948-1950), p.7

2. The averaging of correlation was done by the method of the conversion of correlation to weighted Z scores and their reconversion to correlation coefficients.

of correlation coefficients.[1] This may give rise to several inaccuracies, as the scale of marking or assessment may not be same in each school. The inaccuracies may also be due to different scores, and different syllabi.

The chief defect of the internal marking is that the assessment is not objective. It may be responsible for the wide divergence between the correlation coefficients found in various schools. In the original study too, the validity coefficients were studied for each school. In their study, various validity coefficients for schools were spread in a broad range. An important reason ascribed by the authors for this phenomenon, is that "similar or identical course titles do not guarantee uniformity of course content...further more grades are on different bases in various schools."[2] This is more in India, where such wide divergence in internal assessment (by ordinary examinations) of schools is also due to the several intellectual, cultural, emotional and environmental factors, in addition to the factors already analysed by several writers.[3]

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1. H.Walker, Elementary Statistics, p. 166.
2. G.K.Bennett et al, Manual, p. 36.
3. An elaborate discussion among several others, on the unreliability of examination marks is presented in R.L.Ebel and D.E.Damrin, "Tests and Examination," in Harris, Encyclopeadia of Educational Research, pp. 1502-17. He quotesstudies by Starch and Elliott who uncovered an amazing lack of agreement among teachers in grading essay-type tests papers in a variety of high school subjects." (p. 1502). Some of the important Indian studies, among the several reported, are D.P.Agrawal, "A Study of the Validity of the School Entrance Examination", Jour. of Educ. and Voc. Guid., 10;56-60(May 1964), and Salamatullah, Examinations in India-their Defects and Remedies, and Gayen et al, Measurement of Achievement in English pp. 65-71.

Tables 30 to 37 on the following pages show the various validity coefficients obtained for each school, between the different tests of the DAT (Hindi) battery and annual examination marks of class IX. In reading the tables, it may be noted that,

a. where no figure is written under either N or r, indicate that there was no student of that school in the sample taken. Where a figure appears for N, but none in the 'r' column, the validity coefficient was not computed due to the extremely small N.

b. The words (a), (b), (c) and (d) for the four schools denote the schools in that order, as explained on p. 126. In all the tables that follows the words (a), (b), (c) and (d) always would denote the same schools in that order.

TABLE 30

Schoolwise Correlation Coefficients of Scores in VERBAL REASONING with School Subjects

Subject	Schools							
	(a)		(b)		(c)		(d)	
	N	r	N	r	N	r	N	r
English	71	.34**	28	.13	26	.41	18	-.19
Mathematics	59	.25*	28	.36	27	.32	6	-
Physics	18	.16	28	.24	26	.24	-	-
Chemistry	18	.22	28	-.33	26	.41*	-	-
Biology	-	-	13	-.02	11	.57	-	-
Drawing	17	.11	15	.46	15	-.02	-	-
Hindi	53	.40**	-	-	-	-	18	-.32
Economics	52	-.14	-	-	-	-	12	-.29
Commerce	43	-.13	-	-	-	-	-	-
Civics	11	.34	-	-	-	-	18	-.39
History	11	.24	-	-	-	-	18	-.35
Aggregate Marks	71	.23	28	.24	26	.68	18	-.48*

* Significant at 5% level of confidence.

** Significant at 1% level of confidence.

TABLE 31

Schoolwise Correlation Coefficients of Scores in ABSTRACT REASONING with School Subjects

Subjects	Schools							
	(a)		(b)		(c)		(d)	
	N	r	N	r	N	r	N	r
English	74	.19	26	.11	25	.11	15	-.32
Mathematics	57	.28*	26	-.09	25	.14	5	-
Physics	20	.28	26	-.02	25	-.04	-	-
Chemistry	20	-.14	26	-.17	25	.12	-	-
Biology	-	-	12	-.23	8	.09	-	-
Drawing	19	.27	14	.42	16	.06	-	-
Hindi	54	.12	-	-	-	-	15	-.13
Economics	54	.10	-	-	-	-	10	.50
Commerce	42	.05	-	-	-	-	-	-
Civics	12	-.17	-	-	-	-	15	-.11
History	12	.10	-	-	-	-	15	-.13
Aggregate Marks	74	.20	26	.09	25	.02	15	.42

* Significant at 5% level of confidence.

TABLE 32

Schoolwise Correlation Coefficients of Scores in MECHANICAL REASONING with School Subjects

Subjects	Schools							
	(a)		(b)		(c)		(d)	
	N	r	N	r	N	r	N	r
English	74	.04	26	-.12	25	.58**	15	-.23
Mathematics	57	.05	26	.33	25	.61**	5	-
Physics	20	-.30	26	-.34	25	.55**	-	-
Chemistry	20	-.30	26	-.37	25	.39*	-	-
Biology	-	-	12	.14	8	.35	-	-
Drawing	19	.22	14	-.05	16	.68**	-	-
Hindi	54	.07	-	-	-	-	15	-.10
Economics	54	-.01	-	-	-	-	10	-.54
Commerce	42	-.02	-	-	-	-	-	-
Civics	12	-.26	-	-	-	-	15	-.09
History	12	.58**	-	-	-	-	15	-.30
Aggregate Marks	74	0	26	-.25	25	.62**	15	-.26

* Significant at 5% level of confidence.

** Significant at 1% level of confidence.

TABLE 33

Schoolwise Correlation Coefficients of Scores in SPACE RELATIONS with School Subjects

Subjects	Schools							
	(a)		(b)		(c)		(d)	
	N	r	N	r	N	r	N	r
English	71	-.08	24	.01	31	.23	17	.34
Mathematics	58	.00	24	.06	31	.33	3	-
Physics	14	-.04	24	-.01	31	.02	-	-
Chemistry	14	-.19	24	-.13	31	-.03	-	-
Biology	-	-	11	.04	11	.37	-	--
Drawing	14	-.01	13	.38	19	.07	-	-
Hindi	58	.06	-	-	-	-	17	.47
Economics	57	-.06	-	-	-	-	13	.69
Commerce	48	.10	-	-	-	-	-	-
Civics	11	.17	-	-	-	-	17	.26
History	11	-.34	-	-	-	-	17	-.01
Aggregate Marks	71	-.06	24	.11	31	.06	17	.31

** Significant at 1% level of confidence.

TABLE 34

Schoolwise Correlation Coefficients of Scores in CLERICAL SPEED AND ACCURACY with School Subjects

Subjects	Schools							
	(a)		(b)+		(c)+		(d)	
	N	r	N	r	N	r	N	r
English	77	.35**	-	-	-	-	15	-.14
Mathematics	58	.18	-	-	-	-	2	-
Physics	16	.20	-	-	-	-	-	-
Chemistry	16	.04	-	-	-	-	-	-
Biology	-	-	-	-	-	-	-	-
Drawing	16	.15	-	-	-	-	-	-
Hindi	61	.42**	-	-	-	-	15	.00
Economics	60	.24	-	-	-	-	13	-.02
Commerce	48	.33*	-	-	-	-	-	-
Civics	14	.58*	-	-	-	-	15	-.34
History	14	.09	-	-	-	-	15	-.09
Aggregate Marks	77	.30**	-	-	-	-	15	-.11

* Significant at 5% level of confidence.

** Significant at 1% level of confidence.

+ See foot note on p.

TABLE 35

Schoolwise Correlation Coefficients of Scores in NUMERICAL ABILITY with School Subjects

	Schools							
	(a)		(b)		(c)		(d)	
	N	r	N	r	N	r	N	r
English	71	.22	24	.24	31	.38	17	-.30
Mathematics	58	.46**	24	.56**	31	.46**	3	-
Physics	14	-.15	24	.37	31	.42**	-	-
Chemistry	14	-.12	24	.40*	31	.48**	-	-
Biology	-	-	11	.05	11	.57	-	-
Drawing	14	.23	13	.12	19	.34	-	-
Hindi	58	.26*	-	-	-	-	17	-.02
Economics	57	.21	-	-	-	-	13	-.17
Commerce	48	.10	-	-	-	-	-	-
Civics	11	.74**	-	-	-	-	17	-.25
History	11	.49	-	-	-	-	17	-.05
Aggregate Marks	71	.33**	24	.39	31	.44	17	-.15

* Significant at 5% level of confidence.

** Significant at 1% level of confidence.

TABLE 36

Schoolwise Correlation Coefficients of Scores in LANGUAGE USAGE-SPELLING with School Subjects

Subjects	Schools							
	(a)		(b)		(c)		(d)	
	N	r	N	r	N	r	N	r
English	72	.19	26	.45*	27	.52**	19	-.11
Mathematics	59	.18	26	.49**	27	.20	6	-
Physics	21	.00	26	.91**	27	.19	-	-
Chemistry	21	.56**	26	.35	27	.23	-	-
Biology	-	-	13	-.04	10	-.06	-	-
Drawing	21	.46*	13	-.23	17	.16	-	-
Hindi	51	.29*	-	-	-	-	19	.23
Economics	50	.22	-	-	-	-	13	-.06
Commerce	42	.14	-	-	-	-	-	-
Civics	10	-.54	-	-	-	-	19	.09
History	10	.40	-	-	-	-	19	.00
Aggregate Marks	72	.12	26	.35	27	.15	19	.07

* Significant at 5% level of confidence.

** Significant at 1% level of confidence.

TABLE 37

Schoolwise Correlation Coefficients of Scores in LANGUAGE USAGE-GRAMMAR with School Subjects

Subjects	Schools							
	(a)		(b)		(c)		(d)	
	N	r	N	r	N	r	N	r
English	72	.16	26	.20	27	.14	19	.15
Mathematics	59	-.03	26	.31	27	.23	6	-
Physics	21	.07	26	.21	27	.09	-	-
Chemistry	21	.09	26	.31	27	-.03	-	-
Biology	-	-	13	-.03	10	-.05	-	-
Drawing	21	.38	13	.08	17	.19	-	-
Hindi	51	-.04	-	-	-	-	19	.68**
Economics	50	.07	-	-	-	-	13	.12
Commerce	42	.02	-	-	-	-	-	-
Civics	10	-.40	-	-	-	-	19	.52*
History	10	-.17	-	-	-	-	19	.18
Aggregate Marks	72	.11	26	.24	27	.25	19	.15

* Significant at 5% level of confidence.

** Significant at 1% level of confidence.

The average correlations were also studied. These were probably more indicative of the general relationship between a test and a subject as these were based evidently on a larger number of cases. Such computation also reduced the effect of the individual schools. Table 38, on the next page shows the average coefficients, thus obtained.

TABLE 38

Average Validity Coefficients between various Tests and Marks in School Subjects

Tests		Subjects											
		Eng.	Math.	Phy.	Chem.	Bio.	Dr.	Hindi	Econ.	Comm.	His.	Civ.	Agg.
Verbal Reasoning	N	143	114	72	72	24	47	71	64	43	29	29	144
	r	.25**	.29**	.22	.08	.26	.19	.25*	-.16	-.13	-.15	-.14	.25**
Abstract Reasoning	N	140	108	71	71	20	49	69	64	42	27	27	140
	r	.11	.17	.06	-.06	-.11	.25	.07	.15	.05	-.03	-.14	.17*
Mechanical Reasoning	N	140	108	71	71	20	49	69	64	42	27	27	140
	r	.09	.10	.05	-.08	.04	.33*	.03	-.15	-.02	.10	-.15	.05
Space Relations	N	143	113	69	69	22	46	75	70	48	28	28	143
	r	.05	.10	-.01	-.09	.22	.14	.15	.08	.10	-.13	.23	.03

Table contnd.

Tests		Subjects											
		Eng.	Math.	Phy.	Chem.	Bio.	Dr.	Hindi	Econ.	Comm.[1]	His.	Civ.	Agg.
Clerical Speed and Accuracy[2]	N	77	50	16	16	-	16	61	60	48	14	14	77
	r	.35**	.18	.20	-	-	.15	.42**	.24	.33*	.09	.58*	.30**
Numerical Ability	N	143	113	69	69	22	46	75	70	48	28	28	143
	r	.20*	.34**	.32**	.35**	.29	.25	.21	.15	.10	.16	.19	.33**
Language Usage-Spelling	N	144	122	74	74	23	51	70	63	42	29	29	144
	r	.27**	.25**	.54**	.37**	-.05	.14	.27*	.17	.14	.13	-.13	.16*
Language Usage-Grammar	N	144	122	74	74	23	51	70	63	42	29	29	144
	r	.15	.11	.13	.13	-.05	.25	.22	.08	.02	.07	.28	.16

* Significant at 5% level of confidence. ** Significant at 1% level of confidence.

1. The coefficients are the actual coefficients obtained in school, (a) as this school, of four sampled, consisted of commerce students.

2. The N and r for this test represent the obtained coefficients of school (a) only. School (b) and (c) were not included, as reported earlier, and school (d) where the test was administered had extremely low no. of students. Hence an average of these two schools were not taken.

Tables 39 to 50 on the following pages present the same information (val. coefficients between tests and subjects) in in another useful way. The Tables show the validity coefficients between <u>each</u> subject and the eight tests. The respective N is not entered here again, as it may be be found from the preceeding tables. The letters denoting schools are agin the same as those used in all previous tables. It may be observed that for the CSA test (in all tables) the spaces against school (b) and (c) are left blank, denoting,as explained earlier, that the correlation was not studies for these schools.

TABLE 39

Validity Coefficients between Tests and Examination Marks in English

Schools	VR	AR	MR	SR	CSA	NA	LU-sp	LU-gr
(a)	.34**	.19	.04	-.08	.35**	.22	.19	.16
(b)	.13	.11	-.12	.01	.17	.24	.45*	.20
(c)	.41*	.11	.58**	.23	.52	.38	.52**	.14
(d)	-.19	-.32	-.23	.34	-.14	-.30	-.11	.09
Average	.25**	.09	.11	.05	.31**	.20*	.27**	.15

* Significant at 5% level of confidence.

** Significant at 1% level of confidence.

TABLE 40

Validity Coefficients between Tests and Examination Marks in Mathematics

Schools	VR	AR	MR	SR	CSA	NA	LU-sp	LU-gr
(a)	.25*	.28*	.05	0	.18	.46**	.18	-.03
(b)	.36	-.09	-.33	.06	-	.56**	.49**	.31
(c)	.32	.14	.61**	.33	-	.46**	.20	.23
(d)	-	-	-	-	-	-	-	-
Average	.29**	.17	.10	.10	.22*	.34**	.25**	.11

* Significant at 5% level of confidence.

** Significant at 1% level of confidence.

TABLE 41

Validity Coefficients between Tests and Examination Marks in Physics

Schools	VR	AR	MR	SR	CSA	NA	LU-sp	LU-gr
(a)	.16	.28*	-.30	-.04	.20	-.15	0	.07
(b)	.24	-.02	-.34	-.01	-	.37	.91**	.21
(c)	.24	-.04	.55**	.02	-	.42**	.09	.24
(d)	-	-	-	-	-.14	-		
Average	.22	.06	.05	-.01	-	.32**	.54**	.13

* Significant at 5% level of confidence.

** Significant at 1% level of confidence.

TABLE 42

Valdity Coefficients between Tests and Examination Marks in Chemistry

Schools	VR	AR	MR	SR	CSA	NA	LU-sp	LU-gr
(a)	.22	-.14	-.30	-.19	.04	-.12	.56**	.09
(b)	-.33	-.17	-.37	-.13	-	.40*	.35	.31
(c)	.41*	.12	.39*	-.03	-	.48**	.23	-.03
(d)	-	-	-	-	-	-	-	-
Average	.08	-.06	-.08	-.09	-	.35**	.37**	.13

* Significant at 5% level of confidence.

** Significant at 1% level of confidence.

TABLE 43

Validity Coefficients between Tests and Examination Marks in Biology

Schools	VR	AR	MR	SR	CSA	NA	LU-sp	LU-gr
(a)	-	-	-	-	-	-	-	-
(b)	-.02	.23	-.14	.04	-	.05	-.04	-.03
(c)	.57	.09	.35	.37	-	.57	-.06	-.05
(d)	-	-	-	-	-	-	-	-
Average	.26	-.11	.04	.22	-	.29	-.05	-.05

TABLE 44

Validity Coefficients between Tests and Examination Marks in Drawing

Schools	VR	AR	MR	SR	CSA	NA	LU-sp	LU-gr
(a)	.11	.27	.22	-.01	.15	.23	.46*	.38
(b)	.46	.42	-.05	.38	-	.12	-.23	.08
(c)	-.02	.06	.68**	.07	-	.34	.16	.19
(d)	-	-	-	-	-	-	-	-
Average	.19	.25	.33*	.14	-	.25	.14	.25

* Significant at 5% level of confidence.

** Significant at 1% level of confidence.

TABLE 45

Validity Coefficients between Tests and Examination Marks in Hindi

Schools	VR	AR	MR	SR	CSA	NA	LU-sp	LU-gr
(a)	.40	.12	.07	.06	.42**	.26*	.29*	-.04
(b)	-	-	-	-	-	-	-	-
(c)	-	-	-	-	-	-	-	-
(d)	-.32	-.13	-.10	.47	0	-.02	.23	.68**
Average	.25*	.07	.03	.15	-	.21	.27*	.22

* Significant at 5% level of confidence.

** Significant at 1% level of confidence.

TABLE 46

Validity Coefficients between Tests and Examination Marks in Economics

Schools	VR	AR	MR	SR	CSA	NA	LU-sp	LU-gr
(a)	-.14	.10	-.01	-.06	.24	.21	.22	.07
(b)	-	-	-	-	-	-	-	-
(c)	-	-	-	-	-	-	-	-
(d)	-.1	.50	-.54	.69**	-.02	-.17	-.06	.12
Average	-.15	.15	-.15	.08	-.5	.15	.17	.08

* Significant at 5% level of confidence.

** Significant at 1% level of confidence.

TABLE 47

Validity Coefficients between Tests and Examination Marks in Commerce

Schools	VR	AR	MR	SR	CSA	NA	LU-sp	LU-gr
(a)	-.13	.05	-.02	.10	.33*	.10	.14	.02
(b)	-	-	-	-	-	-	-	-
(c)	-	-	-	-	-	-	-	-
(d)	-	-	-	-	-	-	-	-
Average	(not calculated as there was only one school-school (a).							

* Significant at 5% level of confidence.

TABLE 48

Validity Coefficients between Tests and Examination Marks in History

Schools	VR	AR	MR	SR	CSA	NA	LUsp	Lu-gr
(a)	.24	.10	.58**	-.34	.09	.49	.40	.17
(b)	-	-	-	-	-	-	-	-
(c)	-	-	-	-	-	-	-	-
(d)	-.35	-.13	-.30	-.01	-.09	-.05	0	.18
Average	-.15	-.03	.10	-.13	-	.16	.13	.07

** Significant at 1% level of confidence.

TABLE 49

Validity Coefficients between Tests and Examination Marks in Civics

Schools	VR	AR	MR	SR	CSA	NA	LU-sp	LU-gr
(a)	.34	-.17	-.26	.17	.58*	.74**	-.54	-.40
(b)	-	-	-	-	-	-	-	-
(c)	-	-	-	-	-	-	-	-
(d)	-.39	-.11	-.09	.26	-.34	-.25	0	.52*
Average	-.14	-.14	-.15	.23	-	.19	-.13	.28

* Significant at 5% level of confidence.

** Significant at 1% level of confidence.

TABLE 50

Validity Coefficients between Tests and Aggregate Examination Marks

Schools	VR	AR	MR	SR	CSA	NA	LU-sp	LU-gr
(a)	.23*	.20	0	-.06	.30**	.33**	.12	.11
(b)	.24	.09	-.25	.11	- 8	.39	.35	.24
(c)	.68**	.02	.62**	.06	-	.44*	.15	.25
(d)	-.48	.42	-.26	.31	-11	-.15	.07	.15
Average	.25**	.17*	.05	.03	-	.33**	.16*	.16*

* Significant at 5% level of confidence.

** Significant at 1% level of confidence.

In these tables, the spaces for the average validity coefficients of the CSA have not been entered. For explanation, footnote 2 of the Table 38 may be referred.

Fig. 9 on page 188 page shows the information presented in Tables 30 to 37 graphically.

Fig. 9

Average validity coefficients of Hindi DAT with school subjects

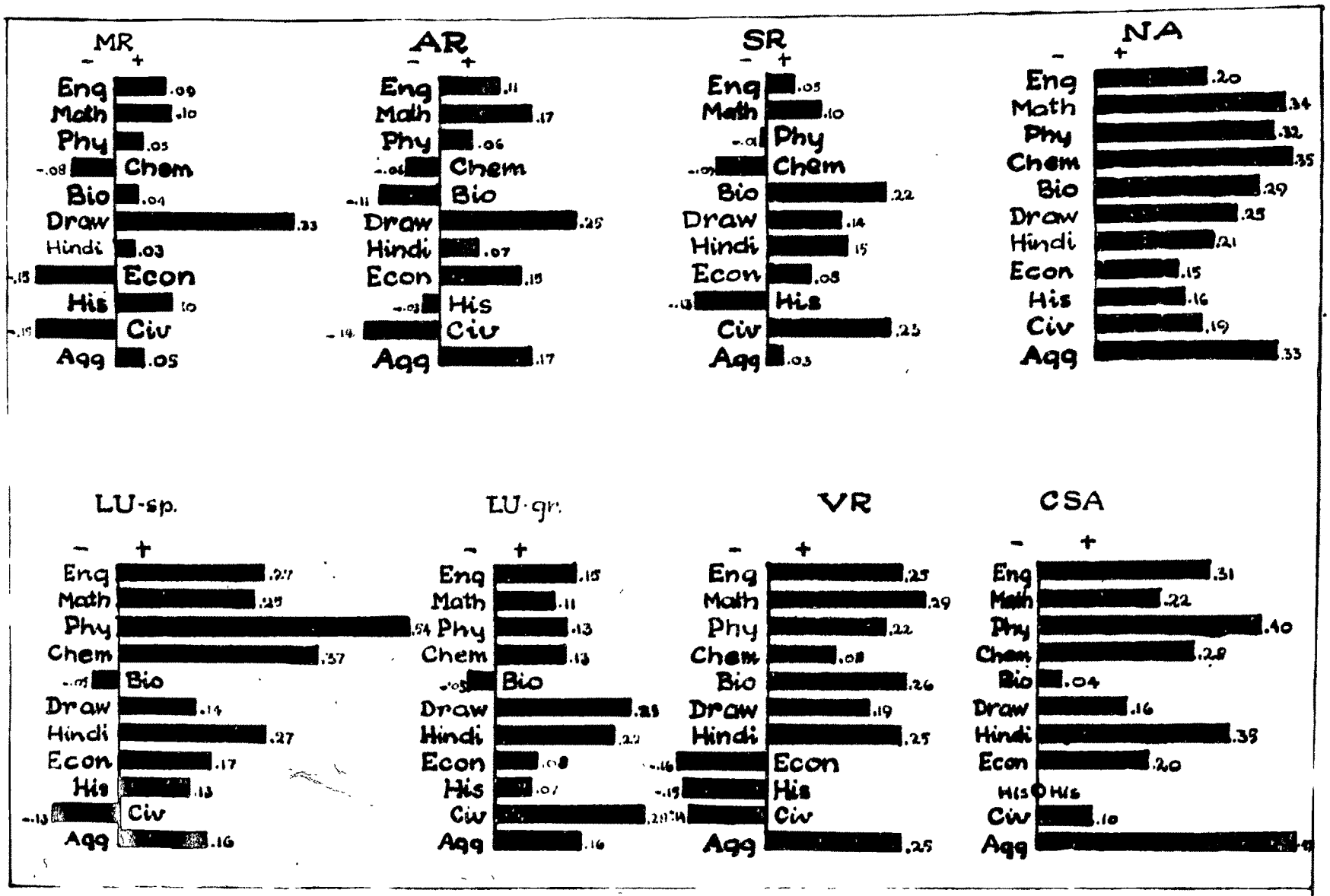
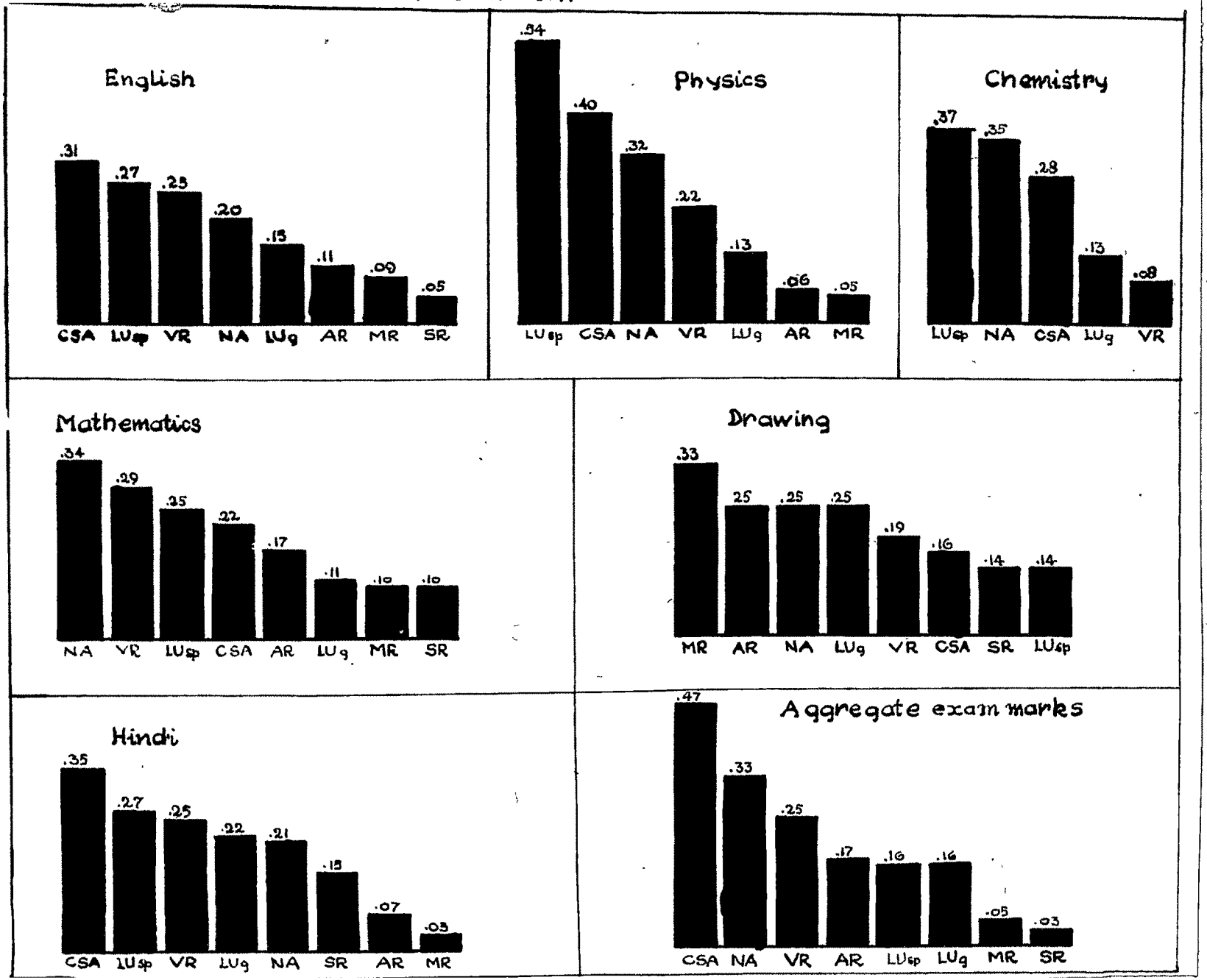


Fig. 10 on page 190 presents the most important informations of tables 39 to 50, in graphical form. The various bar-graphs shows the validity coefficients of some important school subjects with various tests.

With the Hindi DAT



7.4 Discussion

Number of cases.-- As evident from the various tables cited, the total number of students from each school was about 140. The number of students in each subject, however, varied due to their distribution in various subjects. A short description of the curriculum would be helpful to understand this pattern of distribution of students in various subjects.

Most of Higher Secondary schools in Delhi offer two groups - Arts and Science - and few others Commerce. There are several subjects offered for each group, besides English which is compulsory for all and Hindi which is compulsory for all except those who have elected for science group. In this case (of science students), Mathematics is compulsory. Out of remaining subjects offered for the group, three subjects are to be taken. A student of Higher Secondary classes in Delhi is, thus, examined in five subjects. Table 51 shows the most common pattern of subject-allocation.

TABLE 51

Compulsory and Optional Subjects in Delhi Higher Secondary Schools included in the Sample

Group	Compulsory subjects	Optional subjects
1. Arts	1. English 2. Hindi	1. Economics 2. Sanskrit 3. Mathematics 4. History or Civics
2. Science	1. English 2. Mathematics 3. Physics 4. Chemistry	1. Drawing 2. Biology
3. Commerce	1. English 2. Hindi 3. Economics 4. Commerce	1. History 2. Civics

Usually sections in the classes are made up of students taking the same general groups-Arts, science or commerce. Although the compulsory subjects for that group are common to all, there could be a different number of students for each elective subject. This is, especially so in Arts, where the subjects offered as optionals are quite many in number. As a section generally consist of above 40-50 students, it is obvious that except for compulsory subjects, the number of cases would dwindle for elective subjects of the group.

TABLE 52

Number of Students for a School Showing Significant Validity Coefficients[1]

Subjects		VR	CSA	AR	MR	SR	NA			LU-sp	LU-gr
English	N	71	77	-	25	-	-			26	27	-
	r	.34**	.35**	-	.58***	--	-			.45*	.52**	-
Mathematics	N	59	-	-	57	25	-	58	24	31	26	-
	r	.25*	-	-	.28	.61***	-	.46***	.56***	.46**	.49**	-
Physics	N	-	-	-	25	-		31			26	-
	r	-	-	-	.55***	-		.42**			.91***	-
Chemistry	N	26	-	-	25	-		31			21	-
	r	.41*	-	-	.39*	-		.48**			.56**	-

Table 52 concd.

Subjects		VR	CSA	AR	MR	SR	NA	LU-sp[illegible]n	LU-gr
Hindi	N	53	61	-	-	-	58	51	19
	r	.40**	.42**	-	-	-	.26**	.29*	.68***
Commerce	N	-	48	-	-	-	-	-	-
	r	-	.33	-	-	-	-	-	-
Drawing	N	-	-	-	16	-	-	21	-
	r	-	-	-	.68***	-	-	.46*	-
Aggregate	N	71 26	77	-	25	-	71 33	-	-
	r	.23 .68***	.30**	-	.62***	-	.33** .44*	-	-

1. As the significant correlation was usually obtained only in one school, only one coefficient is given. Underlined Ns under any test indicate that there were as many schools (as are the underlined Ns) from where a significant validity coefficients were obtained.

* Significant at 5% level of confidence ** Significant at 1% level of confidence.

*** Highly significant-significant beyond 1% level of confidence.

It is evident from Table 52 that out of 36 significant coefficients most of coefficients are based on numbers larger than 30, in some cases as large as 77. There are only 16 coefficients based on numbers smaller than 30, but not less than 25, except two based on 16 and 19 cases respectively. It may be noted that most of the cases where N <25 are in MR and almost all of significant correlation between therein and in other cases of small N, are highly significant, beyond 1% level of confidence.

The condensed table 52 does not include some significant correlations- which appeared to be superious, such as between a test and Civics or History or Economics.

Low correlations.-- All obtained significant correlations were positive. Significant correlations, mostly, were obtained in one school, while in others, they were, usually, either low or negative. It may be noted, however, that these low or negative correlations are not significant. Moreover, the low or negative correlations were usually obtained where they were based on small number of cases. It has already been explained earlier as to how it occured. The number could not have been increased except by combining them for different schools. This was not appropriate, as the groups were heterogenous in several respects.

Because of the possible effect of the nature of the school on the correlations, the correlations were averaged. Thus, while one one hand the number on which the average correlations

were based, became a larger number, on the other hand this reduced any effect of the school, if there was any. Table 53 compares the correlations obtained first for each school and then by averaging. It is interesting to note that a number of significant correlations, obtained in one school, disappear (or became insignificant) when averaged. It may be presumed, therefore, that the genuine significant correlations between tests and subjects are those which were so found by averaging. This, however, is a problem which may be further investigated.

In some cases, it was just the contrary. For example, CSA was not significantly correlated with Mathematics in any school, but was significantly correlated when averaged. The same happened with the Abstract Reasoning and aggregate marks, and Numerical Ability and English. It would be seen that most of the correlations which were quite significant when calculated for individual schools were also significant when averaged. Out of 36 such correlations, only 12 are such where the significance vanished when averaged.

TABLE 53

Significant Correlations between Tests and Subjects Schoolwise and Averaged*

Tests	Subjects																	
	Eng.		Math.		Phy.		Chem.		Dr.		Hindi		Econ.		Civ.		Agg. Marks	
	S	av.	S	av.	S	av.	S	av.	S	av.	S	av.	S	av.	S	av.	S	av.
VR	x	x	x	x							x	x					x	x
AR			x															x
MR	x		x		x		x		x	x							x	
SR													x					
CSA	x	x		x	x	x	x	x			x	x			x		x	x
NA		x	x	x	x	x	x	x			x				x		x	x
LU-sp	x	x	x	x	x	x	x	x			x	x			x		x	x
LU-gr											x				x			

* As the actual coefficients are referred in other tables, this table shows only (by a cross mark x) whether a significant correlation exists (at 5% or 1% level of confidence). Blank spaces denote insignificant relationships.

S = correlation as obtained from a school.

av. = average correlation

It is, however, the general impression that the Mr and most of the similar Mechanical Aptitude tests would not correlate highly with school subjects. Perhaps, the school subjects are not the proper criteria for the validation of such tests of Mechanical knowledge.[1] The MR is suited for the careers, and a good validity coefficient may be expected with occupational criteria.[2] Ghisselli[3] has reported radical fluctuation in validity coefficient in Test of Mechanical comprehension, where the range is -.30 to +.60; and 14% of the studies reveal correlation below .20.

This leads us to think that we may better ignore the MR test as one which does not show high correlation with course grades. SR is another test which does not show any validity with any of the school subjects in the present investigation. The authors also observed this in their original study.[4] This lack of proper validation of Spatial tests with educational criteria has been a general observation of all workers in this field. Smith[5] has cited a number of relevant evidences in this regard. Though the Spatial tests do not ordinarily show a good correlation with school subjects, their importance in predicting success in technical courses, college mathematics and some branches of science are included by several studies quoted

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1. J.P.Guilford, "The Guilford-Zimmermann Aptitude Survey," in Super, Use of Multi-factor Tests in Guidance,
2. G.K.Bennet et al, Manual, p. 38.
3. quoted in L.J.Cronbach, Essentials of Psychological Testing, p. 118.
4. Bennet et al, loc. cit.
5. J.M.Smith, Spatial Ability.

by him.[1] Ghisselli has summarized published evidences to show that Spatial tests are more valid for predicting vocational rather than educational criteria.[2]

7.5 Conclusion

It may be appropriate to derive some inferences from the validity studies reported so far. The two parts that follow, certain concluding validity inferences based on the observations reported so far in this chapter.

a. Subjects and Tests

English.-- English is not the mother tongue of the students but is an accepted common language. It is also the most demanded foreign language, language of the elite and the lingua franca among the intelligentsia. Though, according to the constitution, English would be replaced by Hindi and other regional languages, its importance and learning is on the increase. There are three important reasons, among many, contributing to its position in India: (1) its importance for the government services (2) its importance as a common medium of conversation and unity, and (3) the social prestige of one who knows it.

Therefore, in the ability to learn and use English well, the ability to learn foreign languages also plays an important part besides the verbal intelligence needed in learning of a

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1. ibid., pp. 27-35.
2. quoted in ibid., p. 151.

common language.

In the present study English learning, as indicated from the annual examination marks, is correlated well with (1) Verbal Reasoning (2) Clerical Speed and Accuracy, (3) Mechanical Reasoning and (4) Language Usage-spelling. Of these 4 tests VR is probably the best indicator of general intelligence. The CSA and LU-spelling also, as would be explained later, are indicators of the general intelligence factor. The fact that the English learning ability was correlated well with MR, however, seems to be spurious, and was perhaps due to the interaction of several factors, such as general intelligence, and chance. That this was probably a spurious relationship, is also seen from the fact that the MR did not correlate with English at all, when the correlations were averaged. It may be interesting to compare with the original studies, where the English was also well correlated with VR, LU-sp, NA and LU-gr.

It may be concluded therefore, that the grade in English could be predicted well by 3 DAT (Hindi) tests: Verbal Resoning, Clerical Speed and Accuracy, and Language Usage-spelling.

Mathematics.-- This is a compulsory subject for students opting for the science group, and an optional for all others. Mathematics comprises of Arithmetic, Algebra, and Geometry.

Our findings show that grades in Mathematics are well correlated with the following in that order:

Numerical Ability
Language Usage-spelling
Abstract Reasoning
Mechanical Reasoning and
Verbal Reasoning

When, however, we study the averaged correlations, we find the following tests:

Numerical Ability
Language Usage-spelling
Clerical Speed and Accuracy and
Verbal Reasoning

It may be inferred that the NA, LU-sp and VR are well correlated with grades in Mathematics vice vers, Mathematics grade can be well predicted by scores in VR, LU-sp and NA.

Comparison.-- In the original study in US, Mathematics grades were well predicted by NA, VR, and LU-spelling and AR. We see that while NA and VR are good predictors of Mathematics grades in both studies, the original study, LU-sp is correlated well. As we will see in the next section, in the present study LU-sp (Hindi) is proved to be more indicative of a general factor, which may be identical to the V:ed factor of Vernan.

Likewise the AR which is supposed to be a good measure of Abstract Intelligence, was not significantly correlated with any of the school subjects in our studies. It is seen, however, that the correlation between AR and Mathematics is quite high when the correlations are obtained from the individual schools ~~for a set~~. Even when correlations are averaged, the correlation was only marginally insignificant i.e. significant at 10% level,

It appears, however, that probably with a different sample a better correlation may be observed between the AR scores and grades in Mathematics.

Physics-Chemistry.-- These two subjects have been taken together as they both are compulsory subjects for the students who opt for science group. The compulsory papers for the science group students are English, Mathematics, Physics and Chemistry. The next option is between Drawing or Biology. Any test which may predict the success in Physics, Chemistry as well as Mathematics, may be thought as good indicator for the science courses.

It would be seen that most of the tests, which correlate well with either Physics or Chemistry also correlate well with the other. VR which correlated well with Chemistry, ain a school did not show any significant correlation with this subject when correlations were averaged.

The tests which predict the grades in these two subjects are:

Clerical Speed and Accuracy
Numerical Ability and
Language Usage-spelling

These tests correlated with the success in Physics or Chemistry, even when the average correlations were computed. The MR correlated significantly when considered schoolwise, but was not significantly correlated when averaged, and therefore may be disregarded. The relationship between the MR and the Physics and Chemistry may ~~be~~ not be definitely conclusive on

the basis of the present study.

In the original study, the tests predicting well with the science group were:

Numerical Ability
Language Usage-grammar
Verbal Reasoning
Abstract Reasoning

It is very difficult to make any comparison in this area of science, as the courses taught, as well as the standard and content of teaching are entirely different. Though this fact is more or less true in all cases, it is especially so in science course.

Hindi.-- This subject is compulsory for all, except those who offer science group. Unlike compulsory English, this is the mother tongue of most of the students. The subject correlated significantly with the following tests, when calculated schoolwise:

Verbal Reasoning
Clerical Speed and Accuracy
Numerical Ability
Language Usage-spelling
Language Usage-grammar

But when the average was calculated, some spurious correlations were eliminiated. Ultimately the following tests remained as the significantly correlated valid measures:

Verbal Reasoning
Clerical Speed and Accuracy
Language Usage-spelling

It is interesting to note that English was also correlated

with these tests, besides with the Numerical Ability. This is probably because these tests are usually viewed as the measures of general intelligence. It can be assumed that the most important ability in learning Hindi and English language is the general intelligence. It is possible, when the study is further extended to some other parts of the country where Hindi is a compulsory subject, that some other factors are also noticeable.

As was reported earlier Hindi is not compulsory for the students of science in Delhi schools; as bright students usually elect science a substantial number of students who take Hindi are mediocre.

Commerce.-- In the present sample, there was only one school, where this subject was offered. It was found that out of the eight tests only Clerical Speed and Accuracy is predictive of grades in commerce. This is according to the expectation as the Clerical Speed and Accuracy test consists of matching items. The ability to effectively deal with such tests is an important ability for the work of filing, checking, and other routine office work.[1]

Aggregate Marks.-- We find that as the basis of this study the total grades can be satisfactorily predicted by scores in:

Verbal Reasoning
Clerical Speed and Accuracy
Abstract Reasoning
Numerical Ability and
Language Usage-spelling

1. G.K.Bennett and R.M.Cruickshank, A Summary of Clerical Tests, p. 17.

The above results seemed sufficient to establish the usefulness of the above five tests for predicting the success in later school courses. Out of the remaining three tests, the L. MR and SR, as have been already discussed, have no appropriate relationship with school courses. Their low correlation with school marks, therefore, can be well appreciated. As far as the Language Usage tests are concerned, the spelling test seems to be highly indicative of the general intelligence, rather than the grammar test. This was unlike the American study, when the spelling test indicates only the level of achievement and grammar that of general intelligence. A possible explanation lies in the very nature of the Hindi language and its alphabets which are phonetic in nature. Hindi words are spelt as they are spoken and vice versa. A correct grasp of the spoken language, brings into play some intellectual faculties. It appears therefore, that the writing and recognition of the correct spelling in Hindi is indicative of the general intelligence. As a consequence the emphasis in teaching Hindi language has not been on memorising the word, as in English. This lack of emphasis or memorising the word several times, therefore seems to have created an impression that writing correct spelling in Hindi is never a difficult task. This assumption, however, requires a further probe, in a seperate investigation.

In English, on the other hand, the spelling is chiefly learned from rote, as the same vowel may have different

pronunciations and one can not rely for proper spelling on the correct listening and comprehension. The student who knows some words, must have memorised them several times for writing correct spelling. In that case, therefore, recognition of correct or incorrect spelling is purely a measure of achievement, as is not, or is very slightly, a measure of general intelligence.

b. Tests and Subjects

Verbal Reasoning Test.-- This test of verbal comprehension is an important measure of general intelligence, and is also highly correlated with school marks in English, Hindi, Mathematics and the total marks. In the original study, too, the VR is highly correlated with grades in most of the courses. The reasons, according to the authors are (1) our usual practice of giving marks on the basis of written material, (2) the test's close proximity to verbal comprehension and (3) the fact that this test measures 'Verbal intelligence' which plays an important role in scholastic achievement.[1] The ability measured by this test is similar to the verbal factor of Thurstone.[2]

Clerical Speed and Accuracy Test.-- From the results of the present investigation, this test also appears to have a fair loading of the general factor, inasmuch as this test is correlated with several coursessubjects, including the aggregate

1. Bennett et al, Manual p. 38.
2. i.e. one of the Primary Mental Abilities.

marks. In particular, the CSA is significantly correlated with the following subjects:

English, Mathematics, Physics, Chemistry, Hindi, Commerce and Aggregate marks.

It may be assumed that score in this test predicts the grades in these subjects and indicates the overall standing of the student to some extent.[1] Several factor analytic studies of many clerical tests reveal that the important factors in these tests are (1) perceptual analysis, (2) speed in making simple discrimination and (3) comprehensions of relations, primary verbal.[2] In another study, the important factors were found to be (1) speed and accuracy in carrying out small tasks, (2) speed in simple discriminations, (3) spatial, (4) speed in motor ability and (5) ability to observe and compare.[3]

The authors also report another factor analysis study where the factors found are (1) verbal, (2) numerical, (3) spatial and (4) perceptual factors. It appears, that this test measures important abilities also useful in several other intelligent tests. Because all of these are also the important factors for success in several school courses, the high correlation of the CSA with these subjects is not unexpected. The fact that the CSA is correlated with more subjects in our study,

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1. A.Anastasi, Psychological Testing, p. 396.
2. ibid.,
3. Bennett and Gruickshank, A Summary of Clerical Tests, p. 17.

though not so well in the original Americantstudy, leads us to think that possibly our school courses demand such abilities as perceptual discrimination, comprehensions of relation, speed etc. This fact may be important view of educational planning.

Mechanical Reasoning.--- This test had no significant correlation with any of the school subjects tested except a slightly with drawing. Here the correlation may be due to the overlapping of some common factors. Ofcourse, the correlations were quite high on several subjects, in one school, but that seems to be due to the particular school and not owing to the actual correlation.

In the original study too the MR did not have significant validity with school courses. Appropriate criteria are perhaps shop courses, mechanical jobs etc.

Space Relations.--- Like the MR, this too did not show significant correlation with any subject. In the original study too, the authors mentioned this as another test (other being MR and to some extent CSA) "where adequate criteria are not usually available among the grades."[1] They further state;

> "Tests of this type have a general utility in the prediction of success in engineering and mechanical design. Although advanced mechanical drawing can be expected to require spatial ability, the begining courses usually stress motor skills and the learning of symbols to a considerable extent, obscurring the relationship which exists in later stages when greater demands are made on visualization. That the Space Relations test can be quite

1. Bennett et al, Manual, p. 38.

> valuable in specific instances may be seen in the prediction of plane geometry and in the results from the American Institute of Specialized Watch Repair where the program very closely resembles that for an industrial apprenticeship."[1]

Numerical Ability.-- This test has high validity with Mathematics and most other courses, including the total marks. The original studies also report an identical validity pattern. The test is one of the best measures of general intelligence along with other tests of this type, VR, LU-sp etc., as the "ability in arithmetic is a function of general intelligence."[2]

Abstract Reasoning.-- This is a test of general intelligence and ordinarily should have correlated well with school subjects, as it did in the original study. In the original study the scores on this test, along with the combined scores of VR and NA, "measure functions associated with general intelligence and, it should be added, are most useful as measures of scholastic ability."[3]

In the present study, we see that while the NA and VR are indicative of the general intelligence and are correlated with important subjects, AR is not so well correlated with subjects. With Mathematics, correlation of the AR is significant at 5% level in one school; when correlations were averaged this significance is reduced to a little less than 10% level.

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1. Bennett et al, Manual, p. 38.
2. F.S.Freeman, Theory and Practice of Psychological Testing, p. 508.
3. ibid., p. 419.

This indicates that although relationship may not be strong, it is also not totally absent, probably with some other samples, a better correlation may be expected.

Another important fact which emerged from this study of AR's validity was that even the aggregate marks are not significantly correlated with the scores in AR when computed from seperate schools. The aggregate marks are generally supposed to be indicator of the level of intelligence. This correlation, however, becomes significant when the correlations are averaged, is significant at 5% level. These facts lead the investigator to hope, that the low correlation of AR might be due to some sampling fluctuations.

Language Usage.--- We find a remarkable phenomenon here. The grammar portion was not significantly correlated with most of the subjects except the language viz, Hindi, while the spelling showed significant correlations with most of the important subjects. This was so in both the cases when the correlations were calculated seperately for each school and also when averaged. This was unlike the results in U.S.A. where it is the grammar portion (senctences in Form A) which was highly correlated with most of the subjects while the spelling test was mainly correlated only with the achievement in English language. This was already discussed in the earlier section, but a further investigation may be both interesting and revealing. We may presume that the performance in spelling is

indicative of the level of intelligence and is a factor in prediction of most grades, including the aggregate marks.

7.6 Summary

The main purpose of the present study was to establish predictive validity of the tests with school success. Detailed findings of the validity study have been reported. The sample was the same as used for the study of reliability. The criterionsselected was the examination marks in the annual examination, held 3 months after the DAT battery was administered.

Four schools were selected for this study. Validity coefficients were reported for each school. The average correlations were also computed, to eliminate the school effect. It was found that all tests, except Mechanical Reasoning, and Space Relations had a good predictive validity with school courses. Abstract Reasoning also did not show the expected relationship, but it was probably a chance effect and application on different samples may perhaps show better results. Studies were cited to support the contention of the investigator that Mechanical Reasoning and Space Relations were not adequately correlated with usual school courses.

The tests which showed a high relationship with schools courses were Verbal Reasoning, Language Usage-sp, Language Usage-gr, Numerical Ability and Clerical Speed and Accuracy, which were probably good indicators of general intelligence. Further investigations on similar lines were suggested.