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This study was to identify variables potentially useful in predicting a larger proportion of variance in community college study fields than accounted for by the current Washington Pre-College (WPC) battery. Selected tests from the Comparative Guidance and Placement (CGP) Core and Research Batteries, and the Tool and Form Matching subtests from the General Aptitude Test Battery (GATB) were administered to high school seniors or to freshmen entering three Washington State community colleges. The subjects' scores on these tests, along with their WPC scores, constituted the input data for two correlation matrices. One correlation matrix, based on the high school subjects, consisted of WPC variables, the two GATB subtests, and the CGP Research Battery. The second matrix was based on the community college subjects and consisted of WPC variables and the CGP Core Battery variables. The two matrices were subjected to three separate sequential predictor selection analyses: (1) the prediction of each CGP Research Battery and GATB subtest from WPC variables; (2) the prediction of each CGP Core Battery test from WPC variables; and (3) the prediction of each WPC variable from CGP Core Battery subtests. From the results of the predictor selection analyses, ten CGP variables and the two GATB subtests appeared to warrant further investigation as potentially useful predictors. All of the WPC tests except Reading Speed showed relatively high predictability from the CGP Core Battery. (Author/HH)

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**An Investigation of Test Variables Potentially Useful to
the Washington Pre-College Testing Program for
Community College Subject Fields¹**

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During fall 1967 all high school seniors in the state and new enrollees at three community colleges who were completing the Washington Pre-College (WPC) Test Battery also were administered tests from the Comparative Guidance and Placement (CGP) Battery and from the General Aptitude Test Battery (GATB). A series of predictor selection analyses based on these test performances identified ten CGP and two GATB subtests as unique relative to the established WPC battery. Only one WPC measure, Reading Speed, was not predictable from the CGP Core Battery. Implications of these findings for the search for new variables potentially predictive of community college performance are discussed.

In recent years the enormous growth in enrollment of community colleges has drawn attention to the need for new testing instruments for students entering these colleges. College testing programs which wish to provide useful test batteries for community colleges face a difficult task since it appears that new tests must be developed in addition to the traditional tests used successfully for students entering four-year colleges.

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Evidence that new predictors could be found for community college vocational-technical areas was suggested by Lunneborg and Lunneborg (1967a). They found that the Mechanical Reasoning subtest of the Washington Pre-College (WPC) Test Battery, which had previously been of only marginal utility in predicting success in four year institutions, contributed extensively in the prediction of several community college vocational-technical areas. In a later study (Lunneborg and Lunneborg, 1967b) two subtests (Tool Matching and Form Matching) from the General Aptitude Test Battery (GATB) were found to be highly unique from the WPC battery and to merit further investigation as predictors of community college success.

The College Entrance Examination Board (CEEB) recently developed the Comparative Guidance and Placement (CGP) Battery specifically for community college students. To discover new predictor variables to enhance prediction in community college areas, the WPC Program entered a cooperative research study with the CEEB to administer selected subtests of the CGP battery to Washington State high school seniors and first year community college students.

Method

Subjects. Two separate groups of subjects were used to obtain data for this study. These were: (1) high school seniors participating in the fall 1967 WPC Program and (2) freshmen entering Centralia, Clark, and Lower Columbia Community Colleges.

High schools were classified according to size of graduating class and proportion of seniors going to college to produce six groups matched according to these two classifications. The experimental tests were similarly divided into six sets such that each experimental set could be administered

in approximately thirty minutes. Each experimental test set was then randomly assigned to one of the six high school groups. The total group of subjects consisted of 20,395 seniors who completed the regular WPC battery and one of the experimental test sets in a single testing day (6 hours). The sample contained 48 percent females and had a mean age of seventeen.

The initial community college sample consisted of 842 students who were administered the CGP Core battery shortly after enrolling in college. In this group it was possible to locate 687 students who had also completed the WPC battery. The mean age of this final sample was eighteen and contained 44 percent females.

WPC Test Battery. The WPC Test Battery consisted of twelve measures: Vocabulary, English Usage, Spelling, Reading Speed, Reading Comprehension, Quantitative Skills (three subtests, Data Sufficiency, Quantitative Judgment and Functional Relationships), Applied Mathematics, Mathematics Achievement, Spatial Ability, and Mechanical Reasoning. Administration of the total test requires $5\frac{1}{2}$ hours.

CGP Core Battery. The CGP Core Battery used with the community college sample consisted of tests in Reading, Vocabulary, Sentences, Spelling, Mathematics, Spatial Reasoning, Mechanical Ability and Perceptual Efficiency. Also in the core battery were twelve interest indices--Biology, English, Fine Arts, Mathematics, Social Science, Secretarial, Physical Science, Foreign Language, Music, Engineering Technology, Home Economics and Business. A series of biographical items in the core battery was not included in this study. Two additional scores were derived from subtests in the core battery. A total Verbal score was obtained by combining the CGP Reading and Vocabulary scores, and a total English score by combining Sentences, Spelling, and Vocabulary scores.

High School Experimental Test Sets. A total of nine different experimental tests were distributed within the six experimental test sets. These were two subtests from the GATB, four General Information tests from the CGP Research Battery, the Induction test from the CGP Research Battery, the Integration test also from the CGP Research Battery, and the 1967-68 Survey of Educational Plans after High School. Results from the Survey of Educational Plans have not been included in this report. A description of the composition of the six experimental test sets follows:

Experimental Test Set I. GATB Form Matching (6 min.), CGP Induction - Parts 1 and 2 (14 min.), and CGP General Information--Technical (10 min.).

Experimental Test Set II. GATB Tool Matching (5 min.), CGP Integration (10 min.), and CGP General Information--Social (10 min.).

Experimental Test Set III. GATB Form Matching (6 min.), CGP General Information--Business (10 min.), and CGP General Information--Social (10 min.).

Experimental Test Set IV. GATB Tool Matching (5 min.), CGP General Information--Technical (10 min.) and CGP General Information--Health (10 min.).

Experimental Test Set V. Survey of Educational Plans (20 min.) and CGP Induction--Parts 1 and 2 (14 min.).

Experimental Test Set VI. Survey of Educational Plans (20 min.) and CGP Integration (10 min.).

Procedure. Intercorrelations among the variables were computed separately for the high school sample and the community college sample. These correlations provided the input for a series of sequential predictor selections (Horst and Smith, 1950). For the high school sample the WPC tests were used as predictors and each of the eight experimental tests in turn as a criterion. For the community college students who had completed both the

CGP Core and WPC batteries, two series of sequential prediction selections were computed. In one series the WPC tests were used as predictors with each CGP test as a criterion. In the second series the CGP Core battery tests were used as predictors with each WPC test as a criterion. In all three series predictors were selected until the shrunken multiple correlation between the predictors and the criterion dropped. In predicting WPC test scores from the CGP Core Battery, the total Verbal and English scores were deleted as predictors since they combined scores from other tests.

Results

Table 1 presents the correlations of the WPC variables with the CGP and GATB tests. Table 2 presents the results of predictor selections in which the WPC variables were used to predict each of the CGP Core and Research Battery tests and the two GATB subtests, and Table 3 presents the prediction of each of the WPC variables from CGP Core Battery variables. The square of the multiple correlation coefficient (R^2) indicates the proportion of variance accounted for in predicting each of the test scores. One difficulty in using R^2 to estimate test uniqueness is that R^2 tends to overestimate uniqueness by ignoring test unreliability (Horst, 1966, p. 330). Once reliability data for the CGP tests are available the correlational information reported here may be used to obtain better uniqueness estimates. In searching for new predictors for use in community colleges, the primary emphasis should always be on measuring something unique relative to established predictor variables.

In general, the two GATB subtests, CGP Perceptual Efficiency, CGP Mechanical Ability, and all of the CGP interest tests except Mathematics Interest appear to be promising, new predictor variables. Less than twenty percent of the variance on each of these tests was predictable from the WPC

Table 1

Correlations of WPC Subtests with Selected CGP and GATB Subtests
(Decimal points omitted)

	EU	SP	RC	MR	SA	AM	RS	VO	QSA	QSB	QSC	MA	N	Mean	SD
CGP Reading	51	30	51	21	29	34	08	58	35	-11	27	36	687	52.68	11.63
CGP Vocabulary	50	38	56	13	19	29	22	69	27	36	23	31	687	52.70	12.13
CGP Verbal	55	38	58	19	27	35	16	69	34	27	28	37	687	53.24	12.04
CGP Sentences	63	44	42	04	24	31	11	52	27	35	21	30	687	53.54	11.56
CGP Spelling	49	56	36	-03	15	29	16	44	19	31	19	22	687	51.06	11.87
CGP English	66	56	53	06	24	35	19	65	30	20	25	33	687	53.34	11.98
CGP Math	35	21	33	29	39	51	13	33	39	32	39	59	687	50.38	15.40
CGP Spe. Reas.	12	-04	17	46	39	28	08	20	30	54	23	37	687	51.88	14.52
CGP Mech. Ability	-01	-10	04	37	18	11	04	08	11	33	11	21	687	48.75	15.94
CGP Mech. Efficiency	27	25	14	01	20	21	08	20	14	18	18	21	687	48.72	16.45
CGP Percep. Interest	08	03	-05	11	04	05	06	07	02	09	07	12	687	16.53	8.35
CGP Biology Interest	24	15	25	-08	03	04	09	33	04	02	03	01	687	15.41	8.01
CGP English Interest	15	10	06	-09	11	-05	00	13	-07	-07	-02	-04	687	16.20	8.45
CGP Fine Arts Interest	07	-02	07	32	31	43	03	03	30	41	34	54	687	14.97	9.85
CGP Math Interest	09	06	19	-06	-06	04	09	22	00	04	04	05	687	18.36	8.77
CGP Soc. Sci. Interest	00	11	-14	-30	-10	-08	-06	-20	-13	-16	-02	-16	687	17.09	8.42
CGP Secretarial Interest	06	-05	16	37	19	25	08	17	22	30	18	35	687	16.86	9.37
CGP Physical Sci. Interest	31	27	23	-15	04	05	05	28	03	05	06	07	687	18.04	9.84
CGP For. Lang. Interest	19	10	15	-04	09	-01	03	19	-04	-01	-01	00	687	15.46	8.94
CGP Music Interest	-11	-17	00	41	24	14	04	-04	12	20	10	22	687	17.22	9.39
CGP Engin. Tech. Interest	14	17	00	-37	-07	-13	-03	-02	-18	-18	-04	-19	687	18.08	9.03
CGP Home Ec. Interest	-09	22	-09	-09	-04	05	-03	-15	-04	-01	05	00	687	18.31	7.55
CGP Business Interest	63	45	55	26	44	58	22	56	54	54	43	53	3370	13.01	3.29
CGP Induction 1	40	29	30	17	37	41	09	29	35	38	33	39	8185	9.70	2.80
CGP Induction 2	44	33	33	15	36	45	10	34	39	41	36	41	8116	9.18	2.63
CGP General Information 1	27	13	41	63	36	49	20	43	42	53	36	54	6416	10.69	4.27
CGP General Information 2	52	45	49	11	19	31	15	61	29	32	23	32	2204	10.87	3.57
CGP General Information 3	38	25	50	31	23	42	24	51	37	41	32	43	3536	8.53	3.70
CGP General Information 4	45	35	52	23	23	41	27	58	36	39	32	40	7912	9.08	3.43
GATB - Part 5	12	13	12	00	18	12	18	09	07	10	14	12	6757	31.84	5.52
GATB - Part 7	21	15	16	11	29	23	12	14	17	21	20	23	8535	28.53	6.50

Note.--Correlations in the upper section were obtained from community college subjects; correlations in the lower section were obtained from high school seniors.

Table 2

Standard Partial Regression (Beta) Weights for the Prediction of CGP Battery Scores and.
Two GATB Subtests from WFC Scores

(Decimal points omitted)

	EU	SP	RC	MR	SA	AM	RS	VO	QSA	QSB	QSC	MA	R ²
CGP Reading	17	-07	16	00	05	00	-15	38	04	05	00	00	40
CGP Vocabulary	00	00	11	-03	00	00	-04	63	00	00	00	00	49
CGP Verbal	10	00	16	00	05	00	-11	53	00	07	-08	00	51
CGP Sentences	51	00	00	-11	07	00	-05	19	00	-08	00	00	43
CGP Spelling	15	38	00	-06	07	10	00	14	-06	00	00	00	37
CGP English	31	16	00	-07	07	00	00	36	00	-05	00	00	53
CGP Math	00	00	00	00	00	12	00	07	00	15	00	36	38
CGP Spatial Reas.	00	-15	00	28	18	00	05	09	04	00	00	11	28
CGP Mech. Ability	-08	-06	00	32	00	00	05	00	00	00	00	11	15
CGP Percep. Efficiency	14	13	-07	-10	14	00	00	00	00	00	05	07	11
CGP Biology Interest	00	00	00	08	00	00	05	00	-10	00	00	13	03
CGP English Interest	12	-12	00	-14	00	00	00	39	00	00	00	-11	15
CGP Fine Arts Interest	16	00	00	-11	25	-07	00	11	-13	-15	00	00	10
CGP Math Interest	-13	-08	00	05	00	16	00	-15	00	00	11	49	37
CGP Soc. Sci. Interest	00	-12	08	-11	-11	00	00	27	-07	00	00	10	08
CGP Secretarial Interest	19	16	00	-23	05	00	00	-37	00	-11	08	00	18
CGP Physical Sci. Interest	-14	-11	00	23	-07	00	03	15	00	06	00	27	21
CGP For. Lang. Interest	23	00	06	-22	06	-07	-06	18	-06	00	00	00	16
CGP Music Interest	16	00	00	-06	17	-05	00	17	-14	-07	-05	00	09
CGP Engin. Tech. Interest	-20	-05	00	34	10	00	08	-05	00	00	00	12	23
CGP Home Econ. Interest	30	08	00	-32	17	00	00	-13	-14	-09	06	-12	23
CGP Business Interest	-06	00	00	-12	00	14	00	-17	00	00	08	00	05
CGP Integration	30	04	05	-04	15	18	08	06	13	08	04	08	54
CGP Induction 1	21	08	00	-08	21	12	03	-11	05	06	07	00	26
CGP Induction 2	21	09	-03	-11	17	16	02	-05	08	05	09	00	30
CGP General Information 1	-18	-08	04	44	-06	07	09	30	00	12	00	14	54
CGP General Information 2	10	10	05	-04	00	00	-03	45	-04	03	00	02	39
CGP General Information 3	-06	-10	16	10	-08	09	07	35	02	04	03	08	35
CGP General Information 4	-03	-01	09	04	-05	08	10	43	01	04	03	05	38
GATB Part 5	03	08	00	-12	23	00	18	-08	-05	00	06	03	09
GATB Part 7	11	05	-03	-06	27	04	12	-08	-04	00	05	05	12

Note.--Entries in the upper section were obtained from community college subjects; entries in the lower section were obtained from high school seniors.

Table 3

Standard Partial Regression (Beta) Weights for the Prediction of WPC Scores from

CGP Core Battery Test Scores

(Decimal points omitted)

	EU	SP	RC	MR	SA	AM	RS	VO	QSA	QSB	QSC	MA
CGP Reading	09	00	21	12	17	13	-27	13	23	16	14	11
CGP Vocabulary	10	13	40	00	-11	00	33	57	00	-07	00	00
CGP Sentences	45	06	00	00	00	00	00	00	08	19	00	09
CGP Spelling	00	44	00	-10	-05	07	10	03	-07	-13	00	-09
CGP Math	07	00	06	05	20	29	04	00	15	33	23	35
CGP Spatial Reasoning	-11	-18	-08	22	22	00	00	-08	06	00	00	00
CGP Mech. Ability	-20	-22	-16	15	-15	-26	00	-12	-22	-18	-13	-15
CGP Percep. Efficiency	11	16	00	-16	13	16	00	00	10	10	11	11
CGP Biology Interest	00	00	-06	00	00	-08	00	00	-09	-05	00	-05
CGP English Interest	07	00	08	08	07	07	08	15	11	00	00	00
CGP Fine Arts Interest	00	00	-10	-10	05	-09	-07	-06	-09	-09	00	-04
CGP Math Interest	08	06	06	11	16	31	00	04	21	24	26	38
CGP Soc. Sci. Interest	-06	-04	00	-11	-11	-08	00	00	-11	00	00	-05
CGP Secretarial Interest	00	00	-03	-03	00	00	00	-07	00	-07	00	-08
CGP Physical Sci. Interest	07	00	13	08	00	10	07	10	14	08	00	10
CGP For. Lang. Interest	07	07	05	00	00	00	00	05	00	00	00	04
CGP Music Interest	00	00	04	05	00	00	00	00	-05	00	-06	00
CGP Engin. Tech. Interest	00	00	00	22	15	00	00	00	00	07	00	00
CGP Home Econ. Interest	00	00	00	-15	00	-12	00	00	-13	-10	00	-11
CGP Business Interest	-10	-03	-09	-11	-11	00	00	-11	-03	00	00	00

R²

48

41

40

43

28

40

09

56

29

41

22

51

00

test battery. This is encouraging from the standpoint of the great need for new instruments to measure success in community college areas.

The results of the predictor selection when the two GATB subtests were used as criteria are essentially identical to those obtained by Lunneborg and Lunneborg (1967b). Once again, these two subtests achieved a high degree of uniqueness. Since a total of over 13,000 students has completed both the two GATB tests and the WPC battery, it should be possible to locate enough students who have entered community colleges in the state to obtain validity data.

The WPC tests accounted for less than 25 percent of the variance in eleven of the twelve CGP interest tests which, assuming reasonable reliability of the CGP tests, would indicate that they too may be useful additions in community college prediction. Making them even more attractive, these interest tests have low intercorrelations (median $r = .17$). Also, from the standpoint of differential prediction (as opposed to absolute prediction), it will be worthwhile to explore such interest measures, because such nonintellective measures tend to be selected over traditional aptitude and achievement measures within this model (Lunneborg, 1968).

Two of the CGP special abilities tests appeared promising. Both CGP Perceptual Efficiency and Mechanical Ability were essentially independent of the WPC Battery. CGP Mechanical Ability correlated only .37 with WPC Mechanical Reasoning while Perceptual Efficiency had its highest zero-order correlations of .27 and .25 with WPC English Usage and Spelling respectively.

None of the remaining ability tests in the CGP Core Battery or any of the CGP research tests would appear to offer new sources of variance not

already contained in the WPC battery. The CGP Core Battery tests were able to account for relatively large proportions of the variance of all of the WPC test scores except Reading Speed.

Summary

The purpose of this study was to identify variables potentially useful in predicting a larger proportion of variance in community college study fields than accounted for by the current WPC battery. Selected tests from the CGP Core and Research Batteries, and the Tool and Form Matching subtests from the GATB were administered to high school seniors, or freshmen entering three Washington State community colleges. The subjects' scores on these tests along with their WPC scores constituted the input data for two correlation matrices. One correlation matrix, based on the high school subjects, consisted of WPC variables, the two GATB subtests, and the CGP Research Battery. The second matrix was based on the community college subjects and consisted of WPC variables and CGP Core Battery variables. The two matrices were subjected to three separate sequential predictor selection analyses: (1) the prediction of each CGP Research Battery and GATB subtest from WPC variables; (2) the prediction of each CGP Core Battery test from WPC variables; and (3) the prediction of each WPC variable from CGP Core Battery subtests. From the results of the predictor selection analyses ten CGP variables and the two GATB subtests appeared to warrant further investigation as potentially useful predictors. All of the WPC tests except Reading Speed showed relatively high predictability from the CGP Core Battery.

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