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This study reports the results of the cluster analysis and a study of the instruments used in the Comparative Guidance Placement Program as they function in each of 20 curricular group clusters. The battery of tests and questionnaires were administered to approximately 6,000 students enrolled in more than 50 different programs within 23 vocational-technical schools in Georgia. Normative data were obtained on approximately 2,004 students which constituted a sufficient size to permit analysis in terms of the validity of the battery against grade point average. The curricular cluster groups were selected on the basis of number of students, that is, groups with a minimum of 50 students. The overall correlation across all 20 curricular groups for the 44 predictors was .457, while the corresponding correlation for the five best predictors was .411. Examination of the data indicates that differential prediction is possible when using the comparative guidance and placement battery. (CH)

RESEARCH REPORT

for

GEORGIA VOCATIONAL-TECHNICAL SCHOOLS

Prepared by

Educational Testing Service
Princeton, New Jersey

INTRODUCTION

In September 1967, the 23 vocational-technical schools in Georgia administered the first experimental battery of the Comparative Guidance and Placement Program* as part of a project sponsored jointly by Educational Testing Service and the College Entrance Examination Board.

Approximately 6,000 students took the battery of tests and questionnaires; they entered more than 50 different programs of study. Normative data were produced and made available to the office of Dr. Gene Bottoms, Director of Leadership Services of the Division of Vocational Education, State Department of Education, and to the participating schools.

Subsequently, in the spring and summer of 1968, criterion data were collected for students completing the first academic term.* When these data were combined with the test data, there were 20 curricular groups, with a total of 2,004 students, of sufficient size to permit analysis in terms of the validity of the battery against grade-point average. This report contains the results of the cluster analysis and a study of the instruments in the operational CGP battery as they function in each of the clusters.

*The battery of the Comparative Guidance and Placement Program (CGP) and a description of the criteria are given in the Progress Report, Comparative Guidance and Placement Program, An Experimental Program for Junior Colleges, September 1968.

INSERT

Research Report

Georgia Vocational-Technical Schools

The test variables used in Analyses discussed on pages 1-12 are as follows:

1. CII-Biology
2. CII-English
3. CII-Fine Arts
4. CII-Mathematics
5. CII-Social Studies
6. CII-Secretarial
7. CII-Physical Sciences
8. CII-Foreign Languages
9. CII-Music
10. CII-Engineering Technology
11. CII-Home Economics
12. CII-Business
13. Reading
14. Vocabulary
15. Sentences
16. Spelling
17. Mathematics
18. Choosing A Path
19. Intersections
20. Tool Knowledge
21. Mechanical Movements
22. Letters
23. Symbols
24. Memory for Design
25. Identifying Var. I
26. Identifying Var. II
27. Identifying Var. III
28. Health Interest
29. Public Service + Education Interest
30. Hidden Figures-Section I
31. Hidden Figures-Section II
32. Work Preference I (People)
33. Work Preference II (Data)
34. Work Preference III (Things)
35. Year 2000
36. Letter Groups-Section I
37. Letter Groups-Section II
38. General Information I (Technology)
39. General Information II (Health)
40. General Information III (Business + Commerce)
41. General Information IV (Public + Social Service)
42. Estimation Questionnaire
43. BIB-Vocational Motivation
44. BIB-Academic Motivation

A description of the tests and test variables is given in the Progress Report, Comparative Guidance and Placement Program, An Experimental Program for Junior Colleges September 1968. This publication may be obtained without charge by writing to the College Entrance Examination Board, Box 592, Princeton, New Jersey 08540.

CLUSTER ANALYSES FOR GEORGIA VOCATIONAL-TECHNICAL SCHOOLS

Twenty curriculums were selected for the central prediction cluster analysis. The curriculums were selected on the basis of number of students, i.e., groups with at least a minimum of 50 students. These 20 curriculums and their respective N's are listed below in Table 1. Also included in Table 1 are the validities using all 44 CGP predictor variables, and the validities using the five best CGP predictor variables as determined by a backward test selection procedure. The backward test selection procedure means simply that at each stage in which a variable was dropped, the variable dropped had the smallest normed (sum of the squared regression weights equals 1) standardized regression weight. After deleting a variable, the regression weights and curricular GPA transformation coefficients are re-estimated for the remaining variables. This will be clarified shortly.

Table 1

Validities for the 20 Curriculums Derived From the Central Prediction Model

Curriculum			Curriculum Validities	
Code	Name	N	44 Variables	Five best Variables
01	Accounting	187	.521	.483
02	Air Cond. & Refrigeration	127	.456	.403
04	Auto Mechanics	109	.284	.200
05	Business-General (Clerk)	109	.596	.478
07	Communication (Radio & TV)	75	.362	.255
08	Cosmetology	86	.387	.451
09	Drafting	77	.327	.273
12	Electrical Technology	57	.460	.515
15	Machine Shop	119	.399	.350
17	Mechanical Technology	85	.187	.050
19	Nursing (Practical)	116	.314	.390
21	Secretarial	210	.567	.575
27	Data Processing Technology	98	.604	.469
28	Electronics Technology	111	.362	.351
31	Aviation Mechanics	66	.540	.498
35	Diesel Mechanics	52	.131	.155
40	Drafting Design Technology	96	.468	.380
46	Welding	53	.194	.214
50	Medical Office Assistant	65	.717	.616
52	Business Data Processing	106	.462	.240

The overall correlation across all 20 curricular groups for the 44 predictors was .457, while the corresponding correlation for the five best predictors was .411. The five best predictors accounted for 78 percent

of the criterion variance predicted by using all 44 predictors. This is a relatively small loss in predictive efficiency when one considers that information from 39 predictor variables was discarded. The five best predictors and their corresponding normed standardized regression weights for the 20 curriculums were Sentences (.611), Mathematics (.477), Letter Groups II (.403), General Information-Health (.380), and Comparative Interest Index-English (.304). The central prediction model assumes that one set of regression weights will adequately fit the data for all curriculums when additive and multiplicative constants are simultaneously determined for each curriculum that adjust the grade-point average within each curriculum so that grade points across curriculums are put on the same measurement scale. In other words, instead of having a separate regression equation for each of the 20 curriculums, we have assumed after adjusting the GPA within each curriculum for differences across curriculums in difficulty and range of GPA that one central set of regression weights will yield an adequate fit for all of the curricular groups. This simplifies prediction tremendously if the assumptions are fulfilled because the same set of regression weights can then be used for all curriculums. In the present case, cursory examination of Table 1 suggests that the single set of regression weights fits some curriculums extremely well (e.g., Medical Office Assistant ($r = .717$)) and others not so well (e.g., Diesel Mechanics ($r = .131$)). Consequently, the data analysis suggests that one set of regression weights, even with GPA adjustments, does not fit the data for all curriculums adequately. However, the single set of regression weights does fit the five business curriculums well so that these five can constitute one cluster. A cluster is defined as a group of curriculums whose adjusted GPAs within each separate curriculum can be adequately predicted with a single set of regression weights. It is this logic that has been used throughout the study to isolate clusters.

CLUSTER I

An examination of the empirical distribution of curricular validities as well as logical considerations suggested that five business-related curriculums formed a cluster (curriculums 01, 05, 21, 50, and 52). These five business curriculums were analyzed together using the central prediction model in order to determine if one set of regression weights would adequately fit this hypothesized business cluster. The validities for the five curriculums, considering all 44 predictors and the five best predictors, are listed below in Table 2.

Table 2

Cluster I

Validities for the Business Cluster Derived from the Central Prediction Model

Curriculum			GPA adjustment constants for 5 var. analysis		Curriculum Validities	
Code	Name	N	Multiplicative a_i	Additive b_i	44 var.	5 var.
01	Accounting	187	.062	-.066	.568	.468
05	Business-General (Clerk)	109	.066	-.289	.627	.483
21	Secretarial	210	.075	-.689	.568	.551
50	Medical Office Assistant	65	.089	-.897	.678	.650
52	Business Data Processing	106	.088	-1.609	.558	.468
	Average Validity				.588	.517

A cursory examination of Table 2 indicates that for 44 predictors and for five predictors a good fit for all five curriculums can be obtained using a single set of regression weights. For practical purposes, the five-variable equation relative to the 44-variable equation does extremely well considering that the information from 39 predictors is discarded. These five business curriculums can be considered as constituting a cluster since the same set of regression weights gives an adequate fit for each curriculum. The five best predictors and their associated normed standardized regression weights are as follows: Reading (.646), Memory for Design (.431), Vocabulary (.417), Academic Motivation (.343), and General Information - Business (.325).

The additive and multiplicative constants for transforming or scaling the GPA distribution within each curriculum are also given in Table 2. The transformed or adjusted GPA distribution within each curriculum is a function of the appropriate adjustment constants.

CLUSTER II

The remaining 15 curriculums were then analyzed using the central prediction model. This analysis suggested that six technical curriculums might be analyzed together using the central prediction model. The validities for the six curriculums are listed below in Table 3.

Table 3

Cluster II

Validities for the Technical Cluster 1 Derived from the Central Prediction Model

Curriculum			GPA adjustment constants for 5 var. analysis		Curriculum Validities	
Code	Name	N	Multiplicative a_i	Additive b_i	44 var.	5 var.
02	Air Cond. & Refrigeration	127	.073	-.446	.578	.477
12	Electrical Technology	57	.098	-1.850	.604	.484
15	Machine Shop	119	.060	.281	.434	.398
27	Data Proc. Technology	98	.085	-1.233	.656	.473
31	Aviation Mechanics	66	.048	.557	.523	.445
40	Drafting Design Technology	96	.063	-.085	.571	.418
Average Validity					.561	.448

The five best variables accounted for 63 percent of the criterion variance that could be predicted by all 44 variables. There is some loss of information when 39 variables are deleted from the analysis. However, practical considerations could not allow many more than five variables to be used in a prediction equation and the five best variables still yield a reasonable fit for all six curriculums. Both the 44-variable analysis and the five-variable analysis support the hypothesis of these six curriculums defining a cluster.

The five best variables and their respective regression weights were Sentences (.540), Letter Groups II (.529), CII Math (.432), Vocational Motivation (.391), and Tool Knowledge (.298). Deleting Tool Knowledge from the regression equation decreases the curriculum validities only slightly. Machine Shop and Drafting Design Technology might be considered as marginal members of this technical cluster.

CLUSTER III

There remained nine curriculums that had not been assigned to a cluster. A central prediction analysis was repeated for these nine curriculums. The analysis suggested that Auto Mechanics, Communications, Drafting and Electronics Technology constituted a cluster. The central regression weights also yielded a marginal fit for the nursing group but it seemed illogical to include it in this cluster. The results of the analysis for these four curriculums are presented below in Table 4.

Table 4

Cluster III

Validities for Technical Cluster 2 Derived from the Central Prediction Model

Curriculum			GPA adjustment constants for 5 var. analysis		Curriculum Validities	
Code	Name	N	Multiplicative a_i	Additive b_i	44 var.	5 var.
04	Auto Mechanics	109	.029	2.149	.460	.218
07	Communications	75	.077	1.299	.656	.458
09	Drafting	77	.088	.775	.501	.507
28	Electronics Technology	111	.062	1.319	.452	.398
Average Validity					.511	.396

The five best predictors accounted for 64 percent of the criterion variance accounted for by all 44 predictors. Although there is loss of information when 39 predictor variables are dropped, it is not large relative to the number of predictors that were dropped. It is interesting to note that most of the loss in overall predictability was due to a large decrease in the validity for Auto Mechanics. This suggests that Auto Mechanics might be excluded from this cluster because in practical situations where only a few predictors are used, the validity for this group would be too low. However, in terms of all the variables Auto Mechanics does fit into this cluster. Auto Mechanics seems to require a different level and pattern of abilities.

The five best predictors and their respective regression coefficients are Math (.633), Year 2000 (.497), Symbols (-.442), Work Pref III - Things (-.373), and Public Service and Education Interest (.134). Using only Math, Year 2000, and Symbols does just about as well as using five predictors. The overall validity is still .379 and would be higher if Auto Mechanics was dropped from the cluster.

CLUSTER IV

The five remaining curriculums were subjected to a central prediction analysis. The magnitude and range of the curricular validities as well as the changing pattern of curricular validities as variables were dropped, suggesting that the five curriculums did not form a cluster. Logical considerations led to a separate analysis for Mechanical Technology, Diesel Mechanics, and Welding. The two remaining curriculums, Nursing and Cosmetology, were each analyzed separately using a conventional single group Multiple Regression model.

The results of the three-curriculum analysis are presented below in Table 5.

Table 5

Cluster IV

Validities for Technical Cluster 3 Derived from the Central Prediction Model

Curriculum			GPA adjustment constants for 5 var. analysis		Curriculum Validities	
Code	Name	N	Multiplicative a_i	Additive b_i	44 var.	5 var.
17	Mechanical Technology	85	.118	2.205	.807	.537
35	Diesel Mechanics	52	.074	2.229	.194	.405
46	Welding	53	-.020	2.971	-.460	-.114
Average Validity					.600	.421

The distributions of both the 44 predictor validities and the five predictor validities indicate that Welding does not belong in this cluster. In fact, the central regression weights that seem to fit the Mechanical Technology and Diesel Mechanics curriculums yield a negligible validity for Welding when only five predictors are considered. Notice also how the magnitude and pattern of the validities changed after the 39 predictors were dropped. The same regression weights for 44 variables which yielded positive validities for Mechanical Technology and Diesel Mechanics yielded a substantial negative validity for Welding. In view of this, Welding will be excluded from this cluster and entered in a separate analysis. The five best predictors were CII-Business Interest (.638), CII-English Interest (-.446), Memory for Design (.379), CII-Social Science Interest (-.370), and Identifying Variation I (-.336). This is the only cluster in which interest measures played a crucial role in prediction of GPA. The important contributors in the first three cluster analyses were for the most part various ability measures.

CLUSTER V

The results of the Nursing curriculum analysis are summarized below in Table 6.

Table 6

Cluster V - Nursing

Curriculum			Curriculum Validity	
Code	Name	N	44 Variables	5 Variables
19	Nursing	116	.777	.580

Dropping from 44 predictors down to five predictors decreased the amount of predictable variance by 45 percent. The reason for this is that for a single curriculum a single set of regression weights gives a better fit than a single set of regression weights would for two or more curriculums. Consequently, when variables are dropped that contribute to a good fit, there is a greater loss of information. But even five predictors yield adequate validity. The five predictors and their respective regression weights were General Information - Business (.558), General Information - Public and Social Service (-.533), Symbols (.456), Vocabulary (.353), and CII Math Interest (.268). These predictors seem somewhat strange for predicting nursing GPA, but throughout the sequence of cluster analyses, the nursing curriculum was a marginal member of the technical clusters. Note that there are no constants for adjusting GPA since there are no other curriculums in the analysis for which comparisons among GPA distributions can be made.

CLUSTER VI

A summary of the analysis of the last cluster, Cluster VI, which comprises the single curriculum Cosmetology, is given below in Table 7.

Table 7

Cluster VI - Cosmetology

Curriculum			Curriculum Validity	
Code	Name	N	44 variables	5 variables
08	Cosmetology	86	.729	.538

The five best predictors accounted for 55 percent of the GPA variance that was predictable from all 44 predictor variables. However, the use of a large number of variables is impractical and, furthermore, estimating the regression coefficients for a large number of variables for a small number of students results in regression coefficients that represent peculiarities of the small sample and are consequently not good indicators of the relationship in a generalized population from which the sample is drawn. For example, if the regression weights derived for all 44 variables were applied to the appropriate scores for another sample of cosmetologists at a Georgia vocational-occupational college, then the validity generated for this new sample might be as low or even lower than the validity generated in the new sample by the regression weights for the best five predictors.

The Cosmetology analysis was a simple multiple regression analysis since only one curriculum was involved. The five predictors and their respective regression weights were Identifying Variations I (.517), Letter Groups II (.514), Sentences (.483), Letter Groups I (-.344), and Memory for Design (-.342). The predictors of GPA within Cosmetology seems to be best predicted by perceptual and memory type tests. The apparent contradiction between the weights for Letter Groups I and II (i.e., one being positive, the other negative) is explained by the fact that they are substantially correlated and one compensates for the invalid variance of the other.

When interpreting all of the previous analyses it is important to point out that GPA was based upon one term only and thus not as reliable as an overall one- or two-year GPA. Consequently, it is more difficult to predict something that is measured unreliably. The validities would be higher if a more reliable criterion were available. Also it must be remembered that the error of measurement inherent in the predictor scores decreases the validity. In general, the validities were adequate considering these factors as well as the fact that high school achievement was not used in the analysis.

The series of central prediction analyses led to four clusters (1 business and 3 technical) and two individual curriculums (Nursing and Cosmetology). Except for a few curriculums across the four main clusters, five predictors seem to be adequate in each case for generalized prediction within a cluster. Furthermore, the set of five predictors for each of the four main clusters seems to vary significantly. This should be helpful in differential prediction in that a particular student's predicted GPA should vary considerably across the four main clusters since different variables and associated regression weights are used in each cluster. For example, Reading, Memory, and Vocabulary were the most important predictors for Cluster II - Technical. Math, Year 2000, and Symbols were most important for Cluster III - Technical and GPA in Cluster IV - Technical was best predicted by CII Business and CII English and Memory. GPA in Cluster V - Nursing was best predicted by general information type tests, and GPA in Cluster VI - Cosmetology was best predicted by memory and perceptual type tests.

REFINING THE CLUSTERS

Cluster I, involving the five business curriculums was homogeneous in that one set of central regression weights yielded respectable validities within each of the curriculums.

An attempt was made to clean up Cluster II (make it more homogeneous) so that better prediction within the cluster might be obtained. It seemed reasonable to eliminate Machine Shop and Drafting Design Technology from Cluster II and reestimate the optimal regression weights, adjustment constants, and curriculum validities. The results of the analysis are summarized in Table 8.

Table 8

Cluster II (Revised)

Validities for the Technical Cluster 1 as Revised

Curriculum			GPA adjustment constants for 5 var. analysis		Curriculum Validities	
Code	Name	N	Multiplicative ai	Additive bi	44 var.	5 var.
02	Air Cond. & Refrig.	127	---	---	.609	.457
			.056	1.061		
12	Electrical Technology	57	.062	.525	.600	.446
			.070	.275		
27	Data Proc. Technology	98	.035	1.694	.672	.588
31	Aviation Mechanics	66	---	---	.593	.436
	Average Validity				.623	.492

The five best variables and their respective regression weights were CII-Math (.625), Sentences (.460), General Information II-Health (.389), Letters (.354), and CII-English (-.346).

As in the original Cluster II, Sentences and CII-Math were important predictors. The reclustering was not as beneficial as was hypothesized. In fact, three of the curricular validities decreased slightly, while the validity for Data Processing Technology increased significantly.

The validity for Auto Mechanics in Cluster III was only .218. Consequently, Cluster III was redefined by dropping the Auto Mechanics curriculum and the analysis was rerun. The results of the analysis for Cluster III (refined) are shown in Table 9.

Table 9

Cluster III (Revised)

Validities for the Technical Cluster 2 as Revised

Curriculum			GPA adjustment constants for 5 var. analysis		Curriculum Validities	
Code	Name	N	Multiplicative ai	Additive bi	44 var.	5 var.
07	Communication	75	.075	1.359	.645	.461
09	Drafting	77	.087	.844	.547	.514
28	Electronics Technology	111	.059	1.385	.496	.393
	Average Validity				.557	.451

As expected, the validities of the three curriculums in the refined cluster were higher than the three respective curriculums in the original cluster. The five best predictors for the refined Cluster III were identical with those for original Cluster III. Furthermore, magnitude and ranking of the regression weights were almost identical in both cases.

Welding was dropped from Cluster IV and the analysis was rerun on the remaining two curriculums. The analysis for Cluster IV (refined), which comprised Mechanical Technology and Diesel Mechanics, resulted in a validity of .534 for Mechanical Technology and a validity of .402 for Diesel Mechanics using the five best predictors. These two validities were almost identical to the original Cluster IV validities. Moreover, the five best variables were identical in both cases. The magnitude and ranking of the regression weights were also highly similar.

The four curriculums that were dropped in the process of redefining Clusters II, III, and IV were run together in a single central regression analysis in the hope that they would cluster together. This analysis is described in Table 10.

Table 10

Cluster VII - Revised Technical Cluster

Validities for the Technical Cluster 4 Derived from the Central Prediction Model

Curriculum			GPA adjustment constants for 5 var. analysis		Curriculum Validities	
Code	Name	N	Multiplicative a_i	Additive b_i	44 var.	5 var.
04	Auto Mechanics	109	.058	.634	.345	.332
15	Machine Shop	119	.081	.139	.580	.449
40	Drafting Design Tech.	96	.105	-.872	.618	.444
46	Welding	53	.043	1.584	.300	.320
Average Validity					.501	.400

The five best variables accounted for 62 percent of the GPA variance predicted using all 44 variables. The Auto Mechanics and Welding curricular validities were on the low side but were a considerable improvement over what they were when included in their respective previous clusters. It could be argued that these four curriculums define a relatively loose cluster. The five best predictors had almost equal regression weights and made good sense from a rational viewpoint. The five variables and their associated regression weights were the Year 2000 (.483), BIB-Vocational Motivation (.473), Letter Groups II (.438), Memory for Design (.429), and Tool Knowledge (.408). Notice that there are no "traditional" verbal or quantitative abilities represented among these five predictors as one finds in predicting higher level curriculums such as Cluster I - Business.

CROSS-VALIDATION

Only four of the 20 curriculums had an adequate number of students for cross-validation. The four curriculums were Auto Mechanics (04), Business-General (clerk) (05), Secretarial (21), and Electronics Technology (28). There were 108, 108, 203, and 117 students available, respectively.

The cross-validity coefficient for Auto Mechanics, using the regression weights from the five best variables derived from Cluster III, was .321. This can be compared to the original validity of .332.

The five best regression weights from Cluster I yielded a cross-validity coefficient of .522 for the Business-General curriculum. The original validity was .483. The same five weights yielded a cross-validity coefficient of .423 for the Secretarial curriculums. The original validity was .551.

A cross-validity coefficient of .336 was obtained for Electronics Technology using the best four predictors from Cluster III (revised). The original validity for the four best predictors was .399. The fifth best predictor contributed very little and was consequently not considered.

The results of these four cross-validation analyses were very encouraging. Except for the drop in validity for the Secretarial curriculum, the cross-validities were of virtually the same magnitude as the original validities. The small shrinkage in validity upon cross-validation would be extremely unlikely if unique multiple regression weights were used instead of central regression weights. In most instances, there is considerable shrinkage when conventional multiple regression is used. This is because the multiple regression weights are a function of the unique peculiarities of a particular sample. Consequently, when these weights are applied to a cross-validation sample that has unique peculiarities of its own, the cross-validation validity could drop considerably. However, central regression weights are not so much a function of a particular curriculum's peculiarities; they are partially a function of the characteristics of the other curricular samples in the central regression analysis. Therefore, the central regression weights which are a function of the peculiarities of a number of samples would be expected to yield good validities on a cross-validation sample.

CENTRAL REGRESSION ANALYSES OF OPERATIONAL PREDICTORS

Research involving a sample of 35 junior colleges resulted in 18 of the 44 predictors being retained for use in the first operational year of the CGP program. The logic involving the retention of only 18 predictors out of the original 44 is described in great detail in a CGP Progress Report. In general, backward test selections on the basis of the central prediction model played a substantial role in these decisions.

The 18 Operational I predictors are as follows:

1. CII-Biology
2. CII-Fine Arts
3. CII-Mathematics
4. CII-Social Studies
5. CII-Secretarial
6. CII-Physical Sciences
7. CII-Music
8. CII-Engineering Technology
9. CII-Home Economics
10. CII-Business
11. Reading
12. Sentences
13. Verbal (Reading + Vocab.)
14. Mathematics
15. Health Interest
16. Year 2000
17. Letter Groups (I + II)
18. Academic Motivation

The reason for performing a sequence of central regression analyses for the 18 operational predictors was to determine if the validities for the respective curriculums based upon subsets of predictors from the 18 Operational I predictors were comparable to the respective validities derived from the 44 predictor analyses. In other words, are the 18 operational predictors selected on the basis of school analyses outside of the Georgia system valid for the Georgia schools?

All of the central regression analyses in this section are based upon the Final Clusters, Cluster I, Cluster II (revised), Cluster III (revised), Cluster IV (revised), Cluster V, Cluster VI, and Cluster VII and the 18 Operational I predictors.

The analysis for Cluster I is summarized in Table 11:

Table 11

Operational Predictor Analysis for Cluster I

Curriculum			GPA adjustment constants for 5 var. analysis		Curriculum Validities	
Code	Name	N	Multiplicative ai	Additive bi	18 var.	5 var.
01	Accounting	187	.042	-.203	.550	.516
05	Business General (Clerk)	109	.045	-.433	.561	.501
21	Secretarial	210	.048	-.696	.565	.552
50	Medical Office Asst.	65	.048	-.328	.611	.592
52	Business Data Proc.	106	.033	-.012	.330	.316
	Average Validity				.535	.508

A comparison of the five predictor curricular validities in Table 11 with those in Table 2 indicated that with the exception of Business Data Processing, the operational composite validities were of the same magnitude as the research battery composite validities. The validity for Business Data Processing dropped from .468 to .316. The central weights do not yield a good fit for this curriculum and caution should be used when applying these weights. It might eventually be worthwhile to compute a separate conventional regression analysis for this curriculum or determine if it fits into one of the other clusters. The five best operational predictors and their respective regression weights were Sentences (.658), Letter Groups (.429), Academic Motivation (.402), Verbal (.367), Mathematics (.294).

The operational predictor analysis for Cluster II (revised) is summarized in Table 12:

Table 12

Operational Predictor Analysis for Cluster II (Revised)

Curriculum			GPA adjustment constants for 5 var. analysis		Curriculum Validities	
Code	Name	N	Multiplicative ai	Additive bi	18 var.	5 var.
02	Air Cond. & Refrig.	127	.047	.923	.441	.407
12	Electrical Technology	57	.067	-.316	.558	.529
27	Data Proc. Technology	98	.061	-.032	.574	.550
31	Aviation Mechanics	66	.028	1.634	.395	.420
	Average Validity				.494	.474

A comparison of Table 12 with Table 8 indicates that the five-predictor operational composite on the average slightly underperforms the five-predictor research composite. All of the validities are adequate. The five best predictors and their regression weights are CII-Mathematics (.622), Letter Groups (.520), Sentences (.457), Academic Motivation (.265), CII-Fine Arts (-.252).

Table 13 describes the Cluster III (revised) operational analysis:

Table 13

Operational Predictor Analysis for Cluster III (Revised)

Curriculum			GPA adjustment constants for 5 var. analysis		Curriculum Validities	
Code	Name	N	Multiplicative ai	Additive bi	18 var.	5 var.
07	Communications	75	.062	1.350	.451	.423
09	Drafting	77	.062	1.027	.453	.401
28	Electronics Technology	111	.057	1.238	.385	.408
	Average Validity				.425	.410

The validities on the average for the five-predictor operational composites were somewhat lower than the research composites. The operational composite can be substituted for the research composite without a large decrement in validity. The predictors and their weights were Mathematics (.668), CII-Home Economics (.418), Health Interest (-.364), Year 2000 (.351), and CII-Engineering-Technology (-.351).

Table 14 summarizes the Cluster IV (revised) operational battery analysis:

Table 14

Operational Predictor Analysis for Cluster IV (Revised)

Curriculum			GP A adjustment constants for 5 var. analysis		Curriculum Validities	
			Multi- plicative	Addi- tive	18	5
Code	Name	N	ai	bi	var.	var.
17	Mechanical Technology	85	.074	2.519	.520	.401
35	Diesel Mechanics	52	.066	2.395	.219	.384
	Average Validity				.431	.395

The Diesel Mechanic validity for the operational composite was about equivalent to the research composite validity. However, the Mechanical Technology validity decreased from .539 to .401. It is interesting to note that all of the predictors for the operational composite are CII measures. The CII scales and their respective weights were CII-Business (.693), CII-Social Studies (-.600), CII-Secretarial (-.280), CII-Biology (.240), and CII-Physical Sciences (-.156).

The operational battery five-predictor composite for Cluster V (Nursing) yielded a validity of .539 compared to a research predictor composite of .580. The five best operational variables and their weights were Verbal (.66), Year 2000 (.417), CII-Social Studies (-.373), CII-Mathematics (.360), and Reading (-.344). Reading has a negative regression weight. However, it can be dropped from the composite and the composite validity would only decrease .01. The Cluster V analysis is summarized in Table 15:

Table 15

Operational Predictor Analysis for Cluster V (Nursing)

Curriculum			GPA adjustment constants for 5 var. analysis		Curriculum Validities	
			Multi- plicative	Addi- tive	18	5
Code	Name	N	ai	bi	var.	var.
19	Nursing	116			.611	.539

The Cluster VI (Cosmetology) analysis revealed a drop in validity from .538 to .470 when substituting an operational composite for a research

composite. The five best operational predictors and their weights were Sentences (.758), Year 2000 (.397), CII-Music (.310), CII-Social Studies (-.307), and Health Interest (.280). Table 16 describes the operational battery analysis for Cluster VI:

Table 16

Operational Predictor Analysis for Cluster VI (Cosmetology)

Curriculum			GPA adjustment constants for 5 var. analysis		Curriculum Validities	
Code	Name	N	Multiplicative ai	Additive bi	18 var.	5 var.
08	Cosmetology	86			.516	.470

The final operational battery analysis involved Cluster VII and is summarized in Table 17. The curriculum validities for the operational composite were somewhat lower than for the research composite. The operational composite is an adequate substitute for the research composite. In both analyses, the validities are somewhat lower than desired. However, it should be remembered that this cluster is composed of the four curriculums that did not seem to fit in the other clusters. It also seems that they themselves do not form a good cluster.

Table 17

Operational Predictor Analysis for Cluster VII (Technical 4)

Curriculum			GPA adjustment constants for 5 var. analysis		Curriculum Validities	
Code	Name	N	Multiplicative	Additive	18 var.	5 var.
04	Auto Mechanics	109	.035	1.969	.218	.286
15	Machine Shop	119	.053	1.881	.480	.407
40	Drafting Design Tech.	96	.054	1.485	.476	.356
46	Welding	53	.028	2.495	.203	.298
	Average Validity				.387	.348

SUMMARY AND CONCLUSIONS

In general, the substitution of operational battery composites for the research battery composites closely approximated the validity level of the research battery composite. Although these operational battery composites

themselves were not cross-validated, the cross-validation of similar composites derived from the research battery indicated that the central regression weights are pretty well stable.

The operational predictor battery analyses can best be summarized by one last table, Table 18, where a set of recommended operational composites and associated regression weights and validity are summarized for each of the seven clusters. In many cases, only four predictors are recommended, since the additional predictor accounts for little additional criterion variance.

Table 18

Recommended Operational Predictor Composites

(Table Entries are Normed Standardized Regression Weights)

Predictor	Cluster I	II-R	III-R	IV-R	V	VI	VII
1. CII-Biology				.166			
2. CII-Fine Arts							
3. CII-Mathematics		.621			.484		
4. CII-Social Studies				-.655	-.485		
5. CII-Secretarial				-.277			
6. CII-Physical Sciences							
7. CII-Music						.349	
8. CII-Engineering Technology			-.351				-.337
9. CII-Home Economics			.418				
10. CII-Business				.683			
11. Reading							.546
12. Sentences	.664	.457				.811	
13. Verbal (Reading + Vocab)	.438				.489		
14. Mathematics			.668				
15. Health Interest			-.364				
16. Year 2000			.351		.540	.470	.551
17. Letter Groups (I + II)	.461	.574					.533
18. Academic Motivation	.393	.276					
Average Validity *	.501	.465	.410	.393	.529	.448	.340

* Correlation Coefficient

In some cases the average validity is relatively low because one low validity curriculum within a particular cluster could bring down the average validity for that cluster. Obviously, the central weights work better (i.e., more valid) for some curriculums within a cluster than others and this fact should be taken into consideration when applying these weights.

Cursory examination of Table 18 indicates that different predictors and/or regression weights are associated with different clusters; consequently, the composites should not be highly correlated, indicating that differential prediction is possible.