Career Plan Changes in Boys During the High School to Post High School Transition

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Last year at APA John Flanagan reported on the great number of career plan changes that took place during and immediately following high school for our national Project TALENT sample. Using 31 career plan categories, he showed, for example, that only 17% of our grade 9 boys had the same career plans following high school as they did at ninth grade. This great instability in plans suggests that plans formed in high school are unrealistic for one reason or another. This is an unfortunate phenomenon insofar as educational decisions made during and immediately following high school are based upon these unrealistic (or at least unstable) plans. Today we shall look at the relationships between career plan changes and the attributes of those boys who made specific types of changes.

There is really no concern if a boy changes his plans from physics to mathematics between grade 9 and grade 12 when there are no necessary differences in the high-school behavior of future physicists and future mathematicians. On the other hand, if a ninth-grade boy planning to go into business later decides at grade 12 to become an engineer, he will be rather set back if he has not taken the necessary mathematics options during high school. It is therefore desirable to see if such changes in plans can be anticipated from data available at ninth grade.

These practical guidance concerns are based on the following rather obvious principles: (1) there is no single high-school curriculum appropriate for all students, (2) the appropriateness of a curriculum depends

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in part upon career plans of the student, (3) different career plans are appropriate for different kinds of students, and (4) the appropriateness of a career plan depends upon the abilities and motives of the student and the projected supply and demand characteristics of the job market.

Turning from practical to theoretical considerations, the study of change in plans becomes even more important. One of the goals of Project TALENT is to better understand the process of career development. A large and important aspect of this career process is the manner in which students "sort themselves" over time. Insofar as this sorting is done rationally, it involves the individual's consideration of his abilities and motives and his perception of the occupational goals he has established for himself. The individual will change his plans and goals when he perceives a discrepancy between what he thinks of himself and what he thinks of his plans and goals. If we can identify those personal characteristics which are related to changes in plans and can actually anticipate such changes, we are then identifying the attributes which may be functionally related to those changes. Student career planning in terms of test data is reasonable only if such data actually allow one to anticipate changes which will take place in plans <u>and</u> if the variables used in predicting those changes can be fitted into a convincing theoretical model of the career choice process.

The success of prediction depends upon: (1) the nature of the predictors, (2) the definition of the criterion to be predicted, and (3) the mathematical-statistical model used in prediction. The predictors available to me were from the Project TALENT battery. The multiple discriminant analysis and probability classification seem to be the most effective method for making predictions to group membership criteria. That leaves only the problem of the criterion to be predicted. That is, how should career plans be classified?

The extent to which plans are considered stable depends in part upon how one classifies plans in the first place. For example, plans will appear to be more stable if broader categories are used. In previous research I used a four-category classification scheme for dealing with career plan changes during and immediately following high school. The four categories were defined in terms of whether or not the student was planning college <u>and</u> whether or not the student was planning a career in the science-technology area.

Applying this four-cell scheme to our Project TALENT eleventh graders, we found plans to be 60 percent stable over a two-year period. Subsequent experience with these four groups has indicated that the two college-bound groups should be split into four, the college-going science-technology group into a physical-mathematical-engineering area and a biological-medical area, and the other college group into business and humanitarian career areas. Table 1 in the handout illustrates this six-group classification scheme. The occupations listed in each cell define the general composition of the six groups. Some noncollege occupations, such as farmer, have not yet been fitted into this scheme so at the moment it is not exhaustive.

The six categories were determined using three major considerations. The first consideration was the empirical similarity of more specific career groups. That is boys planning either physics or chemistry were grouped into physical science because their 1960 TALENT profiles were similar. A second grouping consideration was the types of educational decisions students have to make as they move toward these various careers. There is no point in making finer or earlier distinctions in career planning than are required by the educational system. Finally, the six group scheme was based upon the types of back-and-forth changes which tend to be made in career planning. The classification of a student depends upon his plans with respect to college and with respect to the broad career areas.

Table 2 is the joint frequency distribution of career plans for 5,857 males classified both at grade 9 and one year after high school. For example, of 2,379 grade 9 males planning careers in the physical science area, only 965 of them had these same plans four years later. An additional 342 boys changed to the physical sciences from one of the five other areas (106 from bio-medical, for example) bringing the total to 1,307 boys planning careers in the physical sciences one year out of high school.

The large samples in Project TALENT allow the investigator to examine groups of young men who made specific types of career plan shifts. In Table 2 we see that in this subsample of grade 9 boys alone there were, for example, 121 subjects who shifted from plans for a professional career in the physical science area to plans for a career as a technical worker. This one group of changers alone is larger than samples used in some very prominent studies of career development. Therefore, our large Project TALENT sample provides us with a rather unique opportunity in the study of career plan changes.

The six by six distribution of Table 2 defines 36 groups, the six groups in the underlined diagonal cells had the same general type of plan at grade 9 and at follow up, and the 30 off-diagonal groups made specific types of changes. Membership in these 36 groups served as the criterion for three discriminant analyses, using three sets of TALENT predictor variables, interest, ability, and temperament. The specific predictors used are identified in Table 3. All predictors were grade 9 measures.

The two axes of Figure 1 are two discriminant functions based on the 17 interest scales. These two functions are independent recombinations of the 17 scales which best separated the 36 groups. They define a two-dimensional space in which the means (called centroids here) of the 36 groups on the two functions can be located as a point in that space. Each centroid is labeled using the notation of Table 3. Arrows are used to connect the centroids of the six stable groups (indicated as small circles) with the centroids of the five groups who left that particular group (indicated as solid dots). For example, on the left in Figure 1 is the green physical science group centroid. The upper arrow leading out from that centroid locates the centroid of those 121 boys who switched from physical science to technical worker. Notice that this changing group (PS-TE) lies between the group it has left and the group to which it migrated. Moving around the set of green arrows, we see that this directional trend is true in all cases.

Turning to the centroids of the other five stable groups, we also see that the arrows radiating out from their centroids are properly oriented toward the appropriate group. This means that the grade 9 interest profiles of the changing groups tended to anticipate the type of change which took place.

The horizontal interest discriminant function is primarily the famous Roe (1956) "people or not" orientation, with the people orientation being on the right. Thus humanitarians are furthest to the right and our physical scientist-engineers are furthest to the left. The vertical function loaded nonprofessional careers (P-713 to P-717 in Table 3) positively and professional careers negatively, Biological Science and Medicine (P-702) having the largest negative loading.

This tendency to predict change is even more dramatically indicated in Figure 2, in which the ability information is summarized in the first two discriminant functions. The fact that the arrows are longer here indicates that the ability measures were more highly related to the type of plan change which occurred than were the interest measures. In fact, most of the centroids for the changing groups are closer to the groups they moved into than to the groups they left. This latter trend is also seen in Table 4, which gives the two Mahalanolis D^2 distance measures of the shifting group, one with the group left and the other with the group entered. For example, group 2 consists of boys who changed from physical science plans to medical-biological plans. The fact that D^2 is smaller between group 2 and the medical-biological group (.41) than between group 2 and the physical science group (.62) indicates that the average profile of these particular changers more closely resembled the group which they joined. This was true for 23 of the 30 D^2 comparisons. Incidentally, although the D^2 values were computed in the 19-dimensional ability space, the relative distance were rather close to those indicated in Figure 2. This illustrates the fact that the two-dimensional discriminant space preserved most of the information about group differences found in the 19-dimensional ability test space.

The first discriminant function in the ability space (the horizontal one) was primarily a general scholastic ability dimension, with the most able groups being on the left. Farming information was the only ability variable in the Table 3 list which had a substantial positive loading on that function. The high end of the vertical ability function was primarily determined by positive loadings on spatial, mathematical and mechanical reasoning abilities, with more verbal predictors loading negatively. It is important to remember that this vertical function is uncorrelated with the other general academic ability function. Notice also that the technical workers are as high as the physical scientists on this factor.

Turning to the ten temperament scales from the Student Activities Inventory (SAI), the first two discriminant functions in Figure 3 show a similar, if less dramatic directional tendency. Even here the angle between the change vector and a line between the two relevant stable groups tends to be smaller than the angle between the change vector and lines drawn from the group left to the other four stable group centroids. That is, the change in plans was, in general, directionally consistent with temperament profiles. The horizontal discriminant function had only one positive loading, the impulsiveness scale. Our college bound students appeared more mature and self-confident at grade 9 and are therefore on the left (negative end) of that function. Our second SAI dimension loaded leadership and sociability at the high (positive) end, thus locating the science and technical types at the lower end of that function.

The results summarized in these three figures are truly remarkable testimonies of the predictive validities of the TALENT battery. It is important to remember that considerable changes in group membership will continue to occur over time. We expect that our five-year follow-up data, now being collected, will indicate the further shift of the centroids of changer groups from the centroids of the original plans to the centroids of the new plans. Also, after this additional sorting has taken place, we will probably be able to use narrower career classification categories for more refined predictions. These in turn will eventually contribute to a more useful process of student career planning.

Appendix I

Tables and Figures for Career Plan Changes

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Table 1

Six-Category Classification Scheme

	Science-Technology		Nontechnical	
	(1) Physical	(2) Biological-Medical	(3) Nonbusiness	(4) Business
College	Mathematician Physical scientist Engineer Scientific aide	Biological scientist Nurse Physician Pharmacist Dentist Medical technician	Social scientist Social worker Clergyman Teacher	Accountant Lawyer Businessman Government Salesman
Noncollege	(5) Aviation Engineering aide Medical technician Skilled worker Structural worker		(6) Government Salesman Accountant Service worker Businessman Office worker	

Table 2

Career Group Self-Predictions

(Grade 9 Males)

	Follow-up Plans						
Grade 9 Plans	1	2	3	4	5	6	Grade 9 Totals
1. Physical science	965	291	378	545	121	79	2,379
2. Biological-Medical	106	377	173	213	29	37	935
3. Humanities	49	47	261	120	36	19	532
4. Business (C)	57	50	140	440	24	39	750
5. Technical	94	28	67	97	316	128	730
6. Business (NC)	36	27	72	178	93	125	531
Follow-up totals	1,307	820	1,091	1,593	619	427	5,857

42 per cent hits (underlined cells define "hits")

FIGURE 1
THE 36 CENTROIDS IN THE INTEREST SPACE

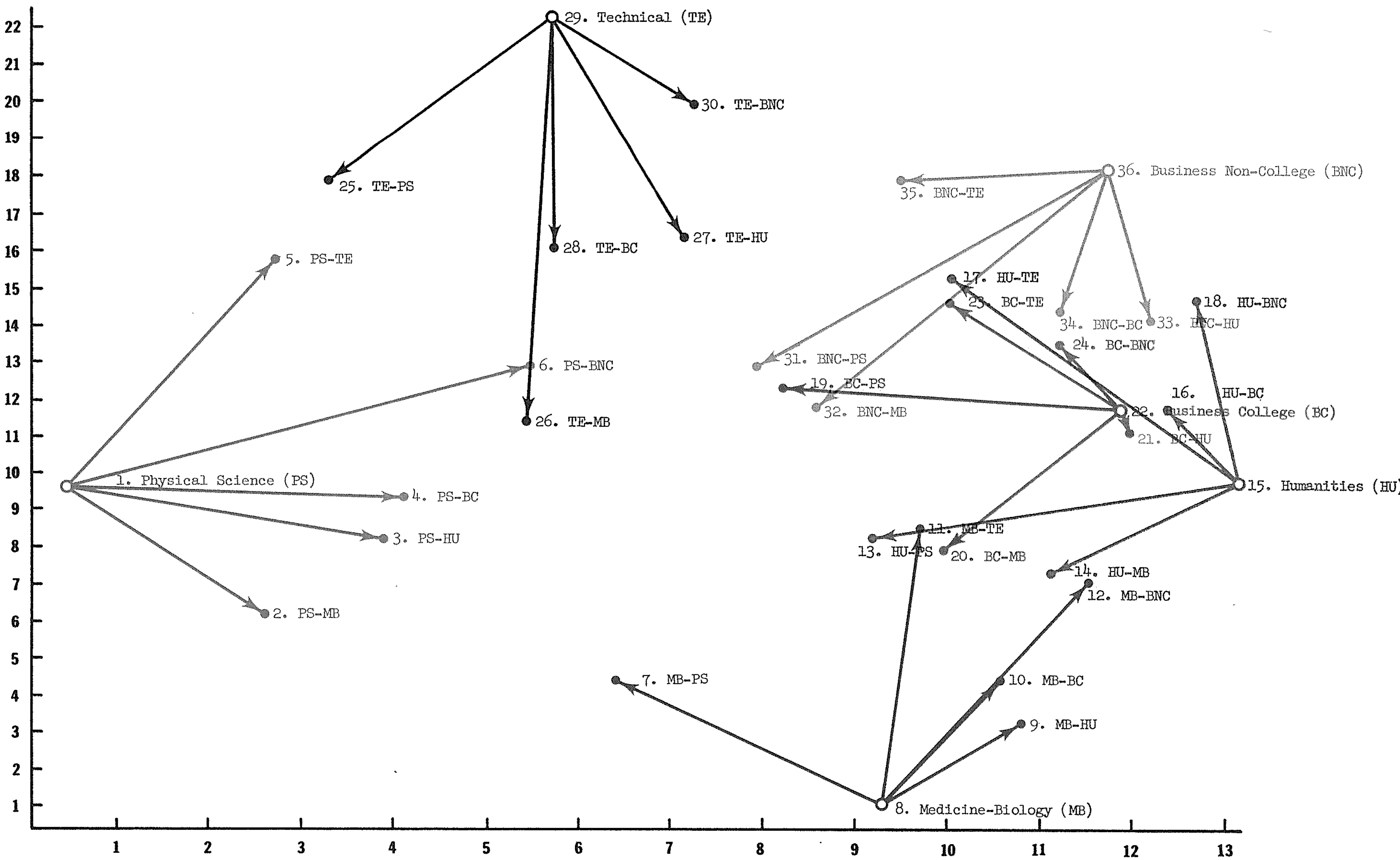

FIGURE 2

THE 36 CENTROIDS IN THE ABILITY SPACE

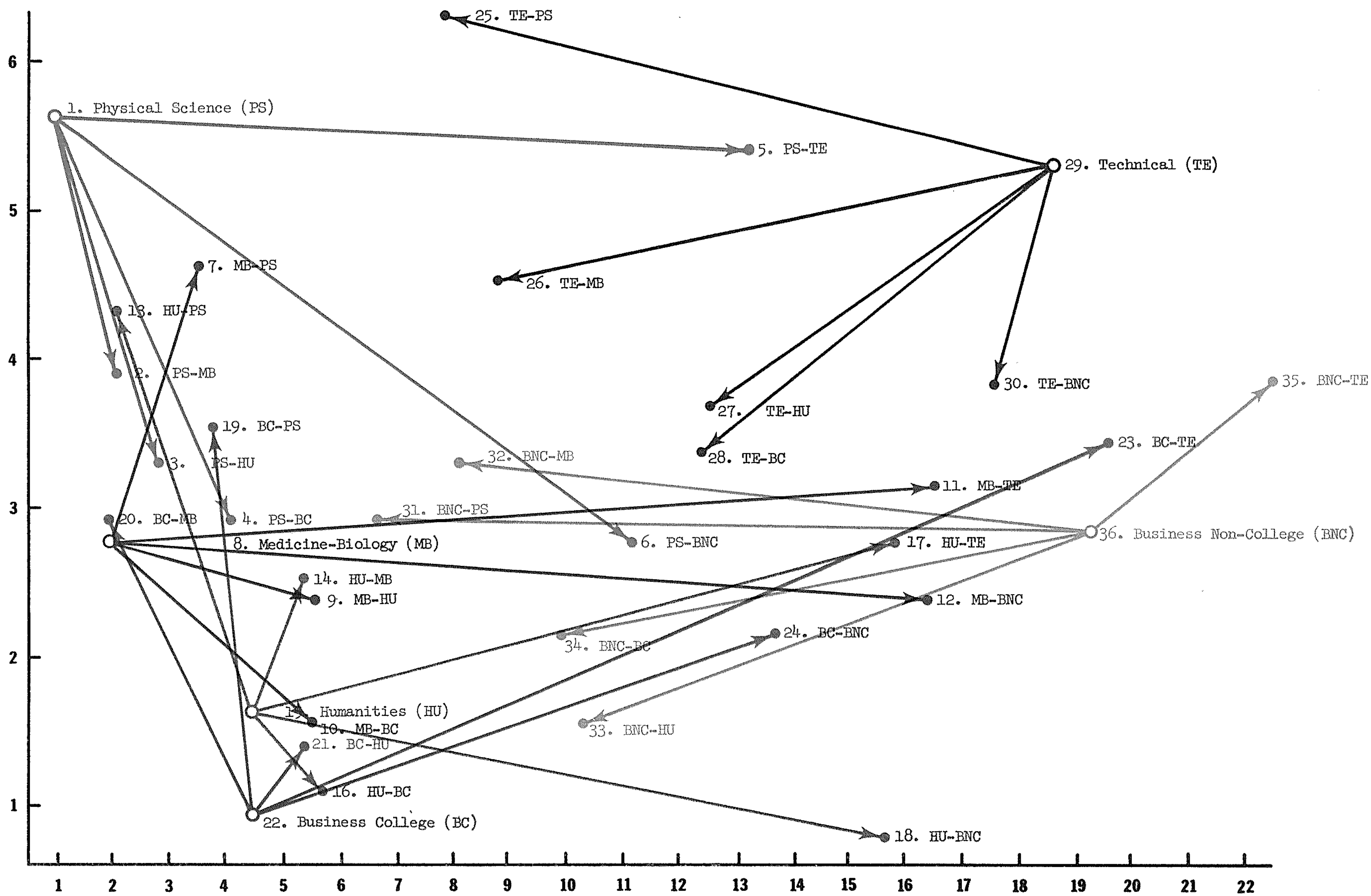

FIGURE 3
THE 36 CENTROIDS IN THE SAI SPACE

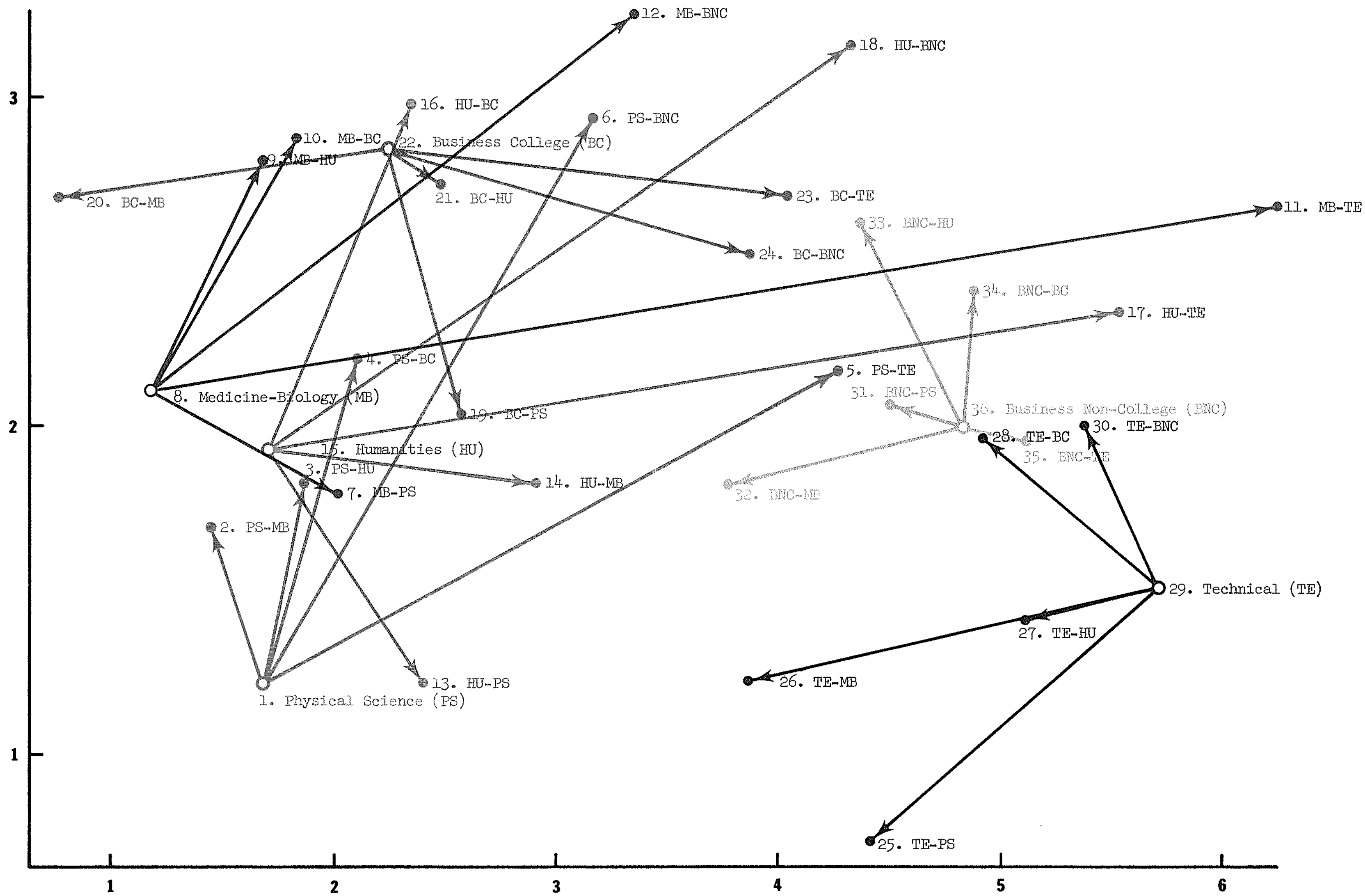

Table 3

Variables for 36-Group Discriminant Analysis

Criterion Groups[a]

1. Physical Science (PS)
2. PS-MB
3. PS-HU
4. PS-BC
5. PS-TE
6. PS-BNC
7. MB-PS
8. Medicine-Biology (MB)
9. MB-HU
10. MB-BC
11. MB-TE
12. MB-BNC
13. HU-PS
14. HU-MB
15. Humanities (HU)
16. HU-BC
17. HU-TE
18. HU-BNC
19. BC-PS
20. BC-MB
21. BC-HU
22. Business-College (BC)
23. BC-TE
24. BC-BNC
25. TE-PS
26. TE-MB
27. TE-HU
28. TE-BC
29. Technical (TE)
30. TE-BNC
31. BNC-PS
32. BNC-MB
33. BNC-HU
34. BNC-BC
35. BNC-TE
36. Business-Noncollege (BNC)

Ability Variables

1. R-102 Vocabulary
2. R-103 Literature
3. R-104 Music
4. R-105 Social Studies
5. R-106 Mathematics
6. R-107 Physical Science
7. R-108 Biological Science
8. R-112 Mechanics
9. R-113 Farming
10. R-115 Sports
11. R-212 Memory for Words
12. R-230 English Total
13. R-250 Reading Comprehension
14. R-260 Creativity
15. R-270 Mechanical Reasoning
16. R-282 Visualization in Three Dimensions
17. R-290 Abstract Reasoning
18. R-340 Mathematics Total (Parts I, II, III)
19. R-410 Arithmetic Computation

Interest Variables

1. P-701 Physical Science, Engineering, Math
2. P-702 Biological Science and Medicine
3. P-703 Public Service
4. P-704 Literary-Linguistic
5. P-705 Social Service
6. P-706 Artistic
7. P-707 Musical
8. P-708 Sports
9. P-709 Hunting and Fishing
10. P-710 Business-Management
11. P-711 Sales
12. P-712 Computation
13. P-713 Office Work
14. P-714 Mechanical-Technical
15. P-715 Skilled Trades
16. P-716 Farming
17. P-717 Labor

SAI Variables

1. R-601 Sociability
2. R-602 Social Sensitivity
3. R-603 Impulsiveness
4. R-604 Vigor
5. R-605 Calmness
6. R-606 Tidiness
7. R-607 Culture
8. R-608 Leadership
9. R-609 Self-Confidence
10. R-610 Mature Personality

[a] For example, PS-MB indicates that group of boys who changed from physical science at grade 9 to medical-biology plans at follow-up. The N for each group is found in the corresponding cell of Table 2.

Table 4

Distances Measures between Changing Career-Plan Groups and Corresponding Stable Groups

Centroid	D^2 with Group Left	D^2 with Group Entered
2. PS(1) to MB(8)	.62	.41
3. PS(1) to HU(15)	.76	.66
4. PS(1) to BC(22)	.87	.61
5. PS(1) to TE(29)	1.73	.97
6. PS(1) to BNC(36)	1.61	1.17
7. MB(8) to PS(1)	.82	.65
9. MB(8) to HU(15)	.62	.64
10. MB(8) to BC(22)	.74	.39
11. MB(8) to TE(29)	2.51	1.48
12. MB(8) to BNC(36)	2.20	.77
13. HU(15) to PS(1)	1.06	.62
14. HU(15) to MB(8)	.71	.81
16. HU(15) to BC(22)	.55	.40
17. HU(15) to TE(29)	1.72	1.39
18. HU(17) to BNC(36)	1.48	1.56
19. BC(22) to PS(1)	.95	.95
20. BC(22) to MB(8)	.75	.59
21. BC(22) to HU(15)	.48	.62
23. BC(22) to TE(29)	2.39	1.43
24. BC(22) to BNC(36)	1.32	1.03
25. TE(29) to PS(1)	1.67	1.08
26. TE(29) to MB(8)	1.81	1.39
27. TE(29) to HU(15)	1.33	1.52
28. TE(29) to BC(22)	1.10	1.23
30. TE(29) to BNC(36)	.71	.65
31. BNC(36) to PS(1)	1.96	1.32
32. BNC(36) to MB(8)	1.79	1.33
33. BNC(36) to MU(15)	1.37	.99
34. BNC(36) to BC(22)	1.33	.81
35. BNC(36) to TE(29)	.80	1.02