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The 3 papers in this report cover different aspects of a longitudinal research program undertaken by the American Council on Education (ACE) to assess the impact of different college environments on student development. ACE plans to create a comprehensive file of data on students and institutions of higher education which will be updated annually. The first paper focuses on variables that will be used to measure institutional environments, and possible approaches to determine how these variables affect student performance. The second paper deals with relevant criteria for assessing student development, and describes student input data already collected from freshmen for subsequent evaluation of grade point averages in major fields of study, overall college achievement, and performances on achievement tests. The hope is to evaluate changes in student values, attitudes, personality, educational aspirations, and vocational choice, and to relate these to college experience and to student behavior in society at large after graduation. The third paper discusses how results of research on data collected on students and their institutions may contribute to the matching of college-bound students and colleges. It also considers how to present data on a multiplicity of input, outcome, and environmental variables so that they may be of maximum utility in decision-making by students, counselors, and admission officers. (WM)

(16)

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IMPLICATIONS OF A PROGRAM OF RESEARCH ON STUDENT DEVELOPMENT IN HIGHER EDUCATION.

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ON EDUCATION

Implications of a Program of Research on Student Development in Higher Education

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Earlier versions of these papers were originally presented at the Dallas American Personnel and Guidance Association meetings, March 21, 1967 as a symposium sponsored by Commission IX of ACPA. These papers will appear in a forthcoming edition of Journal of College Student Personnel.

A Program of Research on Student Development in Higher Education[1]

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American Council on Education

The American Council on Education has recently undertaken a large-scale program of longitudinal research on student development in higher education. The major objectives of this program are to assess the impact that different college environments have on the student's development and to provide a source of current, readily available descriptive information about the population of college students. It is our hope that the results of this research will have both theoretical and practical implications for college admissions, guidance, and educational administration.

The past few years have seen a significant increase in the number of large-scale studies in higher education, primarily because quantities of data can now be collected and summarized easily and because institutions and students have usually been extremely cooperative. Most of these studies, however, have used biased or accidental samples of students and institutions. Many have been no more than adjuncts to ongoing operational programs. In both cases, these projects have tended to focus on narrow and specialized concerns, and thus have failed to view the student as part of a large, diverse, and complex higher educational system. Most studies of student dropouts, to cite just one example, have concentrated solely on the effects of personal variables, without attempting to assess the impact of the college environment.

In addition, many of these project-oriented research studies are very costly, in that their data files are of limited usefulness in further research. Because of differences in measurement instruments, sampling techniques, and methods of subject identification, the data from different investigations are seldom interchangeable, and the researcher initiating a new project typically starts his data collection from scratch. Not only do such practices result in duplicative costs and make excessive demands on students' time, but they also mean that each new longitudinal study takes an unnecessarily long time to complete.

The initial goal of the American Council on Education's research program is to create and maintain a comprehensive file of longitudinal student data from a representative sample of colleges and universities. In addition to student data, the files will contain comprehensive data concerning college environments, staff, and administrative policies. This file will be used in the Council's continuing program of longitudinal research, and, moreover, may help other research organizations and individual investigators to coordinate their activities.

The general design of the research program is shown schematically in Figure 1. Each box in this figure represents one of the necessary

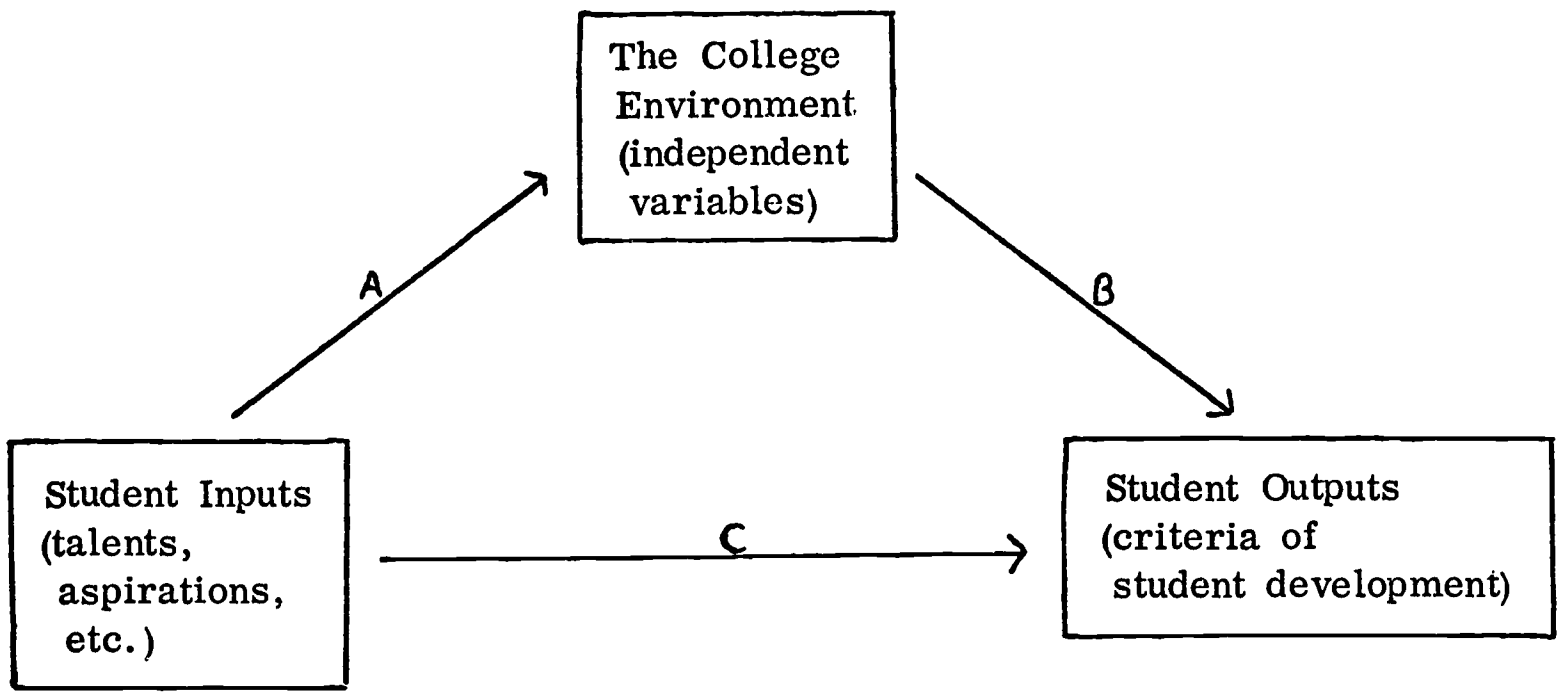

Figure 1. Schematic Diagram of Studies of College Effects.

categories of information about higher educational institutions: inputs, outputs, and environments. Outputs are the operational manifestations of educational objectives. More specifically, they are those skills, attitudes, and behaviors of students that the higher educational institution either does influence or attempts to influence. Adequate measures of relevant educational outputs are, clearly, the sine qua non of meaningful educational research (Panos, 1967).

Inputs are the talents, skills, aspirations, and other potentials for growth and learning that the student brings with him to the higher educational institution. These inputs are, in a sense, the raw materials which the institution has to work with. In collecting input information, the investigator must take care to measure all variables that are likely to affect the student's subsequent performance on the various outputs under study.

The college "environment" includes those aspects of the higher educational institution that are capable of affecting the development of the student. These include administrative policies and practices, curriculum, physical plant and facilities, teaching practices, peer associations, and other characteristics of the college environment. Although some progress has been made in recent years, the measurement of the college environment is still in a relatively primitive state both conceptually and methodologically. Thus, one of the major goals of this research program is to improve techniques for measuring differences in college environments.

Table 1 shows some of the measures of environmental characteristics that will be utilized in the research program. The first set of characteristics (listed under roman numeral I) corresponds to the standard administrative typologies used to classify institutions. Although these characteristics may be convenient to use for ordinary administrative

Table 1

Environmental Variables for the ACE Program of Longitudinal Research

I. Administrative Characteristics

- A. Sex (men's, women's, or coed)
- B. Type (university, liberal arts college, teachers college, or technical institution)
- C. Control (private, private-nonsectarian, Protestant or Catholic)
- D. Geographic region
- E. Size
- F. Affluence or wealth
- G. Selectivity

II. Environmental Stimulus Factors*

A. The Peer Environment

1. Competitiveness versus cooperativeness
2. Arranged dating
3. Independence
4. Cohesiveness
5. Informal dating
6. Drinking versus religiousness
7. Musical-artistic activities
8. Femininity
9. Leisure time
10. Student employment
11. Career indecision
12. Use of automobiles
13. Regularity of sleeping habits
14. Use of the library
15. Conflict with regulations

B. The Classroom Environment

16. Involvement in the class
17. Verbal aggression in class
18. Extraversion of the instructor
19. Severity of grading
20. Familiarity with instructor
21. Formality of the class

C. The Geographic Environment and Living Quarters

22. Bigness
23. Friendliness of the housemother

D. The Administrative Environment

24. Severity of administrative policy against drinking
25. Severity of administrative policy against sex
26. Severity of administrative policy against aggression
27. Severity of administrative policy against cheating

III. The College Image*

1. Academic competitiveness
2. Concern for the individual student
3. School spirit
4. Permissiveness
5. Snobbishness
6. Emphasis on athletics
7. Flexibility of the curriculum
8. Emphasis on social activities

* From the Inventory of College Activities

purposes, they probably have little bearing on student development, since recent research shows that the environments of institutions of even one given type, e.g., men's colleges, differ markedly from one another (Astin, 1967).

The environmental variables listed under II were derived from a recent large-scale study of college environments (Astin, 1967). In this study, the college environment was viewed simply as a set of potential "stimuli." The term stimuli refers here to those events or observable characteristics of the college that are capable of changing the sensory input to the student attending the college. The environmental measures are thus based on the frequency of occurrence of these stimuli on the campus. We believe that this approach to measuring college environments has considerable promise, and future research will be devoted to expanding and refining the list of variables shown in the table.

The third category comprises eight environmental measures (shown under III) relating to the college "image." These measures are based on items similar to those used in the CCI and CUES, although the scales were derived from factor analyses of item intercorrelations rather than from a priori scales. We have reason to believe that scales constructed in this manner yield a maximum amount of information from a minimum number of items. These college image factors seem to have only a moderate degree of overlap with the environmental stimulus factors; apparently, the student's perception of his environment is influenced by factors other than the environmental stimuli which confront him.

The principal objective in our research program is to determine how these environmental variables affect the performance of the student, a relationship indicated by arrow B in Figure 1. From a methodological point of view, however, a thorough knowledge of relationships A and C is

required before we can adequately interpret relationship B. It is easy to see, for example, that the student's output performance is determined, in part, by his input characteristics. To put it more simply: the student's talents and aspirations when he enters college play a major role in determining what he is able to learn and the kind of person he eventually becomes. But the presence of relationship A complicates the design. It is now well known that certain characteristics of the college environment are closely related to student input characteristics. Therefore, since the student input is likely to affect both the output and the college environment, it is possible for a significant relationship B to be mediated simply by differential student input to the various environments. In short, any obtained relationship B between educational practice and student output is necessarily ambiguous so long as no control is exercised over differential student input.

So far in our research program, we have already started to collect data, and we have made plans about further data collection and studies for the next several years. Our initial sampling unit was the institution. In order to select a sample, all "eligible" institutions listed by the U. S. Office of Education in its Education Directory were sorted into 29 cells on the basis of known institutional characteristics that previous research had shown to be related to student input characteristics (Astin, Panos, and Creager, 1966). An institution was considered eligible if it was currently functioning and if it had a freshman class, or its equivalent, of at least 30 students. Under these conditions, the eligible population consisted of 1,968 junior colleges, colleges, and universities. Institutions were selected randomly within each of the 29 stratification cells and invited to participate in the study.

A pilot study was conducted in the fall of 1965, when a prelimin-

ary version of a questionnaire for collecting student input information[2] was administered to each of 42,061 entering freshmen in 61 institutions. The full-scale study involving slightly more than a quarter of a million students entering a sample of 307 institutions was begun in fall, 1966.[3]

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SUMMARY OF DATA ON ENTERING FRESHMEN
(FALL 1966)

(Name of Institution)

ITEM DESCRIPTION	NUMBER OF RESPONDENTS	(Name of Institution) MALE	(Name of Institution) FEMALE	(Name of Institution) TOTAL	UNIVERSITIES NATL NORMS MALE	UNIVERSITIES NATL NORMS FEMALE	UNIVERSITIES NATL NORMS TOTAL
REGION OF HOME STATE (4)	438						
MIDDLE STATES		74.4	0.0	74.4	20.2	14.3	17.8
NEW ENGLAND		5.0	0.0	5.0	10.6	9.1	10.0
NORTH CENTRAL		10.5	0.0	10.5	34.4	40.5	37.0
NORTHWEST		0.7	0.0	0.7	7.2	8.2	7.6
SOUTHERN		6.8	0.0	6.8	22.8	22.5	22.6
WESTERN		1.1	0.0	1.1	4.2	5.0	4.5
FOREIGN		1.4	0.0	1.4	0.7	0.4	0.6
FATHERS EDUCATION	442						
GRAMMAR SCHOOL OR LESS		2.3	0.0	2.3	8.0	6.1	7.2
SOME HIGH SCHOOL		9.0	0.0	9.0	14.3	11.1	12.9
HIGH SCHOOL GRADUATE		16.1	0.0	16.1	28.5	25.9	27.4
SOME COLLEGE		16.7	0.0	16.7	18.8	21.6	20.0
COLLEGE DEGREE		27.4	0.0	27.4	19.0	22.0	20.3
POSTGRADUATE DEGREE		28.5	0.0	28.5	11.4	13.2	12.2
MOTHERS EDUCATION	438						
GRAMMAR SCHOOL OR LESS		3.0	0.0	3.0	5.0	3.8	4.5
SOME HIGH SCHOOL		5.9	0.0	5.9	11.9	9.6	11.0
HIGH SCHOOL GRADUATE		31.5	0.0	31.5	43.7	39.4	41.9
SOME COLLEGE		22.6	0.0	22.6	20.0	24.9	22.1
COLLEGE DEGREE		32.0	0.0	32.0	16.3	18.9	17.4
POSTGRADUATE DEGREE		5.0	0.0	5.0	3.0	3.5	3.2
RACIAL BACKGROUND	439						
CAUCASIAN		94.5	0.0	94.5	95.0	95.0	95.0
NEGRO		3.0	0.0	3.0	1.4	2.0	1.6
AMERICAN INDIAN		0.2	0.0	0.2	0.4	0.6	0.5
ORIENTAL		1.8	0.0	1.8	0.8	0.6	0.7
OTHER		0.5	0.0	0.5	2.4	1.9	2.2
RELIGIOUS BACKGROUND	439						
PROTESTANT		48.5	0.0	48.5	55.6	61.4	58.0
ROMAN CATHOLIC		24.1	0.0	24.1	29.0	24.0	27.1
JEWISH		20.5	0.0	20.5	8.4	8.6	8.5
OTHER		3.0	0.0	3.0	4.9	3.5	4.3
NONE		3.9	0.0	3.9	2.1	1.9	2.0
PRESENT RELIGIOUS PREFERENCE	434						
PROTESTANT		35.9	0.0	35.9	49.9	56.9	52.8
ROMAN CATHOLIC		19.6	0.0	19.6	27.5	24.6	26.3
JEWISH		17.7	0.0	17.7	7.4	7.9	7.6
OTHER		6.0	0.0	6.0	5.7	4.3	5.1
NONE		20.7	0.0	20.7	9.6	6.4	8.2

(4)
STATES HAVE BEEN GROUPED ACCORDING TO THE AREAS DEFINED BY THE SIX REGIONAL ACCREDITING ASSOCIATIONS.

Figure 2. Sample page from an actual report sent to one of the participating institutions.

Before the end of 1966, each participating institution received a complete tabulation of all data on its entering freshmen. A sample page from an actual institutional report is reproduced in Figure 2. The first three columns of data are based on the information provided by the entering students at this particular institution. The last three columns are the national norms for comparable types of institutions. These normative data have been differentially weighted so as to approximate the population parameters (Astin, Panos and Creager, 1967a). As the report shows, this college happens to be a men's institution (note the column of zeros under "female") which enrolls students who come primarily from the middle states. Compared to the national university norms for male students, the educational level of the parents of these students is very high, although their racial backgrounds are similar to the national norms. One of the largest differences between this institution and the national norms is indicated in the last line of data: more than twice as many students at this institution choose "none" as their current religious preference.

Although these reports are prepared primarily as an incentive to the institution to participate in the study, the national norms based on these data have generated considerable interest among persons concerned with higher education. For this reason, we prepared tables of national norms based on 13 different sub-categories of institutions. A sample page from these national norms, showing data for male students, is presented in Figure 3.

In addition to input data, the research design of the program requires follow-up criterion data and data on college environments. Figure 4 depicts our plans for collecting data for each entering class in the research program. The horizontal line running across the middle of the figure represents a time dimension beginning on the left with matriculation

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OFFICE OF RESEARCH FALL 1966

WEIGHTED NATIONAL NORMS FOR ALL FRESHMEN

	All Institutions	All 2-Year Colls.	All 4-Yr. Colls.	All Universities	2-Yr. Colleges		Technical Insts.	4-Year Colleges				Universities	
					Public	Priv.		Public	Private Nonsect.	Prot.	Cath.	Public	Private
REGION OF HOME STATE (2)													
MIDDLE STATES	20.0	8.1	28.0	17.8	2.6	29.6	44.5	26.5	38.9	18.1	32.6	13.5	32.4
NEW ENGLAND	6.5	5.1	5.0	10.0	0.2	24.4	3.5	2.8	14.5	2.4	4.4	7.8	17.7
NORTH CENTRAL	37.2	33.9	39.1	37.0	40.8	6.9	14.2	45.0	20.5	56.8	20.7	40.2	25.7
NORTHWEST	5.0	3.0	4.3	7.6	0.5	12.8	1.4	3.2	2.6	1.5	16.7	9.4	1.3
SOUTHERN	19.3	19.0	17.3	22.6	17.5	24.6	32.5	15.7	19.6	16.9	14.0	24.3	17.0
WESTERN	11.4	30.4	5.5	4.5	37.9	0.6	2.3	6.7	2.4	3.6	10.2	4.5	4.5
FOREIGN	0.7	0.7	0.8	0.6	0.6	1.1	1.7	0.2	1.5	0.7	1.5	0.3	1.4
FATHERS EDUCATION													
GRAMMAR SCHOOL OR LESS	9.4	12.2	9.2	7.2	12.7	10.1	6.8	12.1	6.7	8.4	6.5	8.0	4.6
SOME HIGH SCHOOL	15.7	21.0	14.6	12.9	21.3	20.1	14.4	19.4	10.5	11.6	11.3	13.9	9.6
HIGH SCHOOL GRADUATE	29.1	31.6	28.9	27.4	31.7	31.2	27.4	34.7	20.3	26.2	28.1	29.0	21.9
SOME COLLEGE	19.1	18.7	18.9	20.0	19.1	17.1	20.8	17.9	17.6	19.2	21.8	20.3	18.9
COLLEGE DEGREE	16.9	12.4	17.3	20.3	11.5	15.9	21.2	11.1	23.6	20.5	19.7	19.0	24.4
POSTGRADUATE DEGREE	9.7	4.2	11.2	12.2	3.8	5.6	9.3	4.8	21.3	14.1	12.7	9.8	20.5
MOTHERS EDUCATION													
GRAMMAR SCHOOL OR LESS	5.9	8.1	5.7	4.5	8.5	6.4	5.1	7.4	3.9	4.8	4.6	4.9	3.2
SOME HIGH SCHOOL	13.5	18.5	12.4	11.0	19.1	16.2	11.8	16.8	9.1	9.3	9.5	11.9	7.6
HIGH SCHOOL GRADUATE	42.2	43.4	41.8	41.9	43.2	44.3	45.7	46.7	32.8	38.9	42.4	43.3	37.1
SOME COLLEGE	20.4	18.6	20.2	22.1	18.7	18.4	20.3	17.2	21.1	22.9	22.8	21.8	23.2
COLLEGE DEGREE	15.3	10.0	16.9	17.3	9.2	13.4	14.7	10.3	25.8	21.1	18.2	15.6	23.3
POSTGRADUATE DEGREE	2.7	1.3	3.1	3.2	1.3	1.3	2.4	1.6	7.3	3.1	2.5	2.5	5.6
RACIAL BACKGROUND													
CAUCASIAN	90.7	89.1	88.8	95.0	88.0	93.2	96.3	85.5	84.7	91.9	94.2	95.1	94.7
NEGRO	5.0	4.1	7.7	1.6	5.0	0.5	0.6	10.1	12.9	6.0	1.1	1.5	2.1
AMERICAN INDIAN	0.6	1.0	0.4	0.5	1.0	0.7	0.1	0.7	0.2	0.1	0.3	0.6	0.3
ORIENTAL	0.7	0.9	0.6	0.7	1.0	0.5	1.1	0.6	0.6	0.5	0.9	0.6	1.0
OTHER	3.0	5.0	2.5	2.2	4.9	5.1	1.8	3.1	1.6	1.5	3.6	2.3	1.9
RELIGIOUS BACKGROUND													
PROTESTANT	58.6	56.5	60.0	58.0	58.4	49.0	53.3	60.4	62.5	87.8	5.5	61.8	45.2
ROMAN CATHOLIC	28.7	28.4	29.9	27.1	28.0	30.2	31.2	28.0	19.4	6.7	92.9	25.8	31.6
JEWISH	4.5	1.5	3.5	8.5	0.9	3.8	10.7	2.4	10.0	1.1	0.1	5.8	17.7
OTHER	6.3	11.0	5.1	4.3	9.7	16.2	3.0	7.7	5.5	3.5	0.8	4.6	3.1
NONE	1.9	2.6	1.4	2.0	3.1	0.8	1.8	1.5	2.5	0.9	0.6	2.0	2.4
PRESENT RELIGIOUS PREFERENCE													
PROTESTANT	53.9	51.3	56.1	52.8	52.7	45.9	48.8	57.2	54.5	84.5	4.1	56.8	38.9
ROMAN CATHOLIC	28.2	27.8	29.6	26.3	27.4	29.3	29.3	28.0	19.0	6.7	91.7	25.2	29.9
JEWISH	4.0	1.3	3.1	7.6	0.8	3.2	9.1	2.3	8.8	1.0	0.2	5.3	15.5
OTHER	7.0	11.8	5.5	5.1	10.3	17.5	3.8	7.9	6.6	3.9	1.2	5.3	4.5
NONE	6.9	7.8	5.6	8.2	8.8	4.0	9.0	4.7	11.2	4.0	2.7	7.4	11.2

(2)
STATES HAVE BEEN GROUPED ACCORDING TO THE AREAS DEFINED BY THE SIX REGIONAL ACCREDITING ASSOCIATIONS.

Figure 3. Sample page from "National Norms for Entering College Freshmen, Fall 1966" (ACE Research Reports, Vol. 2, No. 1).

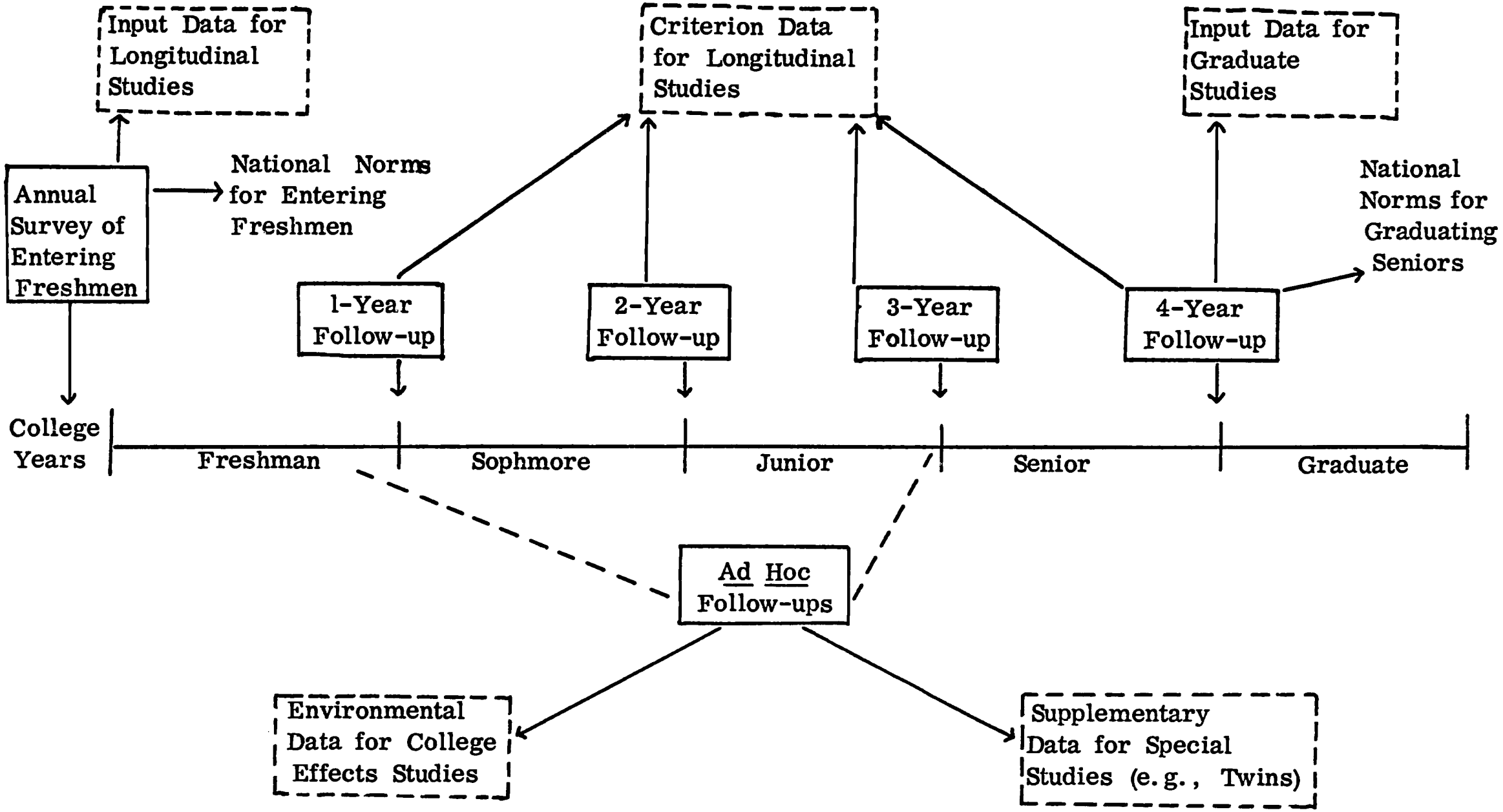

Figure 4. Schedule of Data Collection for the ACE Program of Longitudinal Research.

and ending at some indefinite time in the future after graduation. The boxes formed by solid lines represent different stages in the data collection process. The large box on the left, for example, shows the annual survey of entering freshmen which produces the data shown in the two previous figures. Although the primary purpose of this survey is to collect input data for the longitudinal studies, it also produces a kind of informational "fall-out" in the form of national norms which will be published each fall. After a succession of such surveys, it will be possible to plot trends in the characteristics of students entering different kinds of institutions.

The three smaller boxes to the right of the annual survey of entering freshmen represent follow-ups that will be performed by the participating institutions. Each fall the institution will receive a list of its students who would normally be expected to return for another year. Students who did return will be checked off, and the list returned to the Council. These annual follow-ups will yield basic data for studies on dropouts. The more detailed criterion data on the students' development will be collected at the time of the four-year graduation follow-up. In addition, this follow-up will make available data to compute national norms for graduating seniors; it can also be used as input data for longitudinal studies of the impact of graduate and professional education. For two-year institutions, the two-year follow-up at the end of the sophomore year will serve the same function as the four-year graduation follow-up for students entering four-year institutions.

The purpose of the ad hoc follow-ups (shown below the line) will be to collect information on the college environment and also on special subsamples of students that have been singled out for detailed study. One such study in progress involves all of the twins in the 1966 survey of

entering freshmen. The number and extent of these special follow-ups will, of course, depend upon financial resources and staff interests.

One of the objectives of the research program is to make the data files available to other researchers who wish to perform analyses that differ from those performed or planned by the ACE staff. If outside users are to have ready access to the data files, however, we must prepare a library of flexible programs to perform many of the standard types of data manipulations that are likely to be requested. This "software package" will include routines for computing summary statistics, cross-tabulations, multivariate analyses, and so forth. It is our intention to automate outside requests for special analyses by developing a file system and a software package that is thoroughly documented for use by others. Although such a system means that special requests must be formulated so as to fit the available file and program library, it has the advantage of permitting easy and rapid access to the files and of requiring the user to define his needs in very explicit terms. It it our hope that such an accessing system will be available within the next year.

The file has many other potential uses which are currently being explored. It may be possible, for instance, to link up the ACE data with data collected by other organizations involved in large-scale studies of students--national testing organizations, perhaps, whose data on high school students might, in combination with our data on entering freshmen, throw light on the process of college choice. The contribution that such a data file--and the studies growing out of it--could make to higher education are impressive. It is to be hoped that the design of our research program and the studies performed or planned so far constitute a firm forward step in realizing these possibilities.

Footnotes

[1] The first of three papers presented as a symposium at the 1967 meetings of the American Personnel and Guidance Association.

[2] We are indebted to the Executive Committee of the American Association of Collegiate Registrars and Admissions Officers for their assistance in developing this questionnaire.

[3] The 1967 survey includes approximately 300,000 students at 365 institutions, including 97% of the institutions that participated in the 1966 survey.

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Criteria of Student Development

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Any research program which involves the outcomes of higher education must assess student behaviors that are relevant to the goals of the educational enterprise and relate these behaviors to the dynamic influences that characterize the college environment. Because of the extensive (and expensive) longitudinal research required in such an undertaking, few studies of a comprehensive and representative nature have been carried out. Moreover, a number of difficult problems in the general area remain largely unsolved. These larger problems can be subsumed under three broad--but clearly not independent--categories. First, there is the problem of definition: What are the relevant criteria of student development? Second, there is the question of measurement: What observations of student behavior, in what social context, best elicit the relevant data? Third, there is the problem of research design: What methodology of inferential procedures will organize and display the interrelations among the original observations in the most intellectually satisfying and objectively convincing manner?

The more difficult problems of measurement and research design--at least as they bear on the Council's research program--have been discussed elsewhere (Astin, Panos, and Creager, 1966). The problem of definition is somewhat less difficult because, being primarily analytical, it is more speculative than empirical. For this reason, my major focus will be correspondingly hypothetical.

Asking which criteria are relevant in assessing student development is equivalent to asking what the objectives of higher education are.

More specifically we may ask: What particular student behaviors are the various educational interventions intended to bring about? However, equating "relevant criteria" with "objectives of higher education" by no means simplifies the matter. There are at least two approaches one can utilize in attempting to come to grips with this definitional problem. One way is to specify, on the basis of the statement of an educational objective, the operational (that is, the behavioral) manifestations of the outcome under consideration and the social context in which that behavior is supposed to occur. The verbal specification of the objective is the <u>conceptual criterion</u> (Astin, 1964). A <u>criterion performance</u>, then, can be conceived as any transactional event between an individual and his environment that is judged to be relevant to the conceptual criterion. Observations of the criterion performance, of themselves or after statistical manipulation, become <u>criterion measures</u>. This approach, of course, is the traditional process used in evaluation.

Educational objectives, however, because they are proposed by diverse groups--for example, administrators, teachers, students, and subject-matter specialists--and because they develop gradually, are initially poorly defined and sometimes even contradictory. Unfortunately, they usually remain so. The ideal method for ascertaining the relevant criteria of an educational intervention would be to deduce them from statements of educational objectives. But, unfortunately these statements--as they are usually articulated at the level of higher education--are too global and too abstract to function as a source of viable conceptual criteria.

The fact is that educational goals, as stated in college catalogs for example, consist largely of superficial and essentially nonfunctional utterances about educating students to value the "intellectual" life, and

the like. Although most persons would certainly agree that such goals are relevant and desirable, it is obvious that the terms in such statements mean different things to different people. The task of translating such nonfunctional conceptual criteria into specifiable operations is very nearly impossible. Effort in this area is better devoted to obtaining a clear picture of what actually happens to the students. Perhaps, after we have been able to discover and adequately document what the outcomes of college are, we can think about whether we like them or not and what we can or cannot do about them.

This brings us to a second approach to specifying the outcomes of higher education. In this approach, the global content of abstract statements about educational goals are arrayed under similarly global and abstract labels into areas of research interest. By utilizing such a clas-

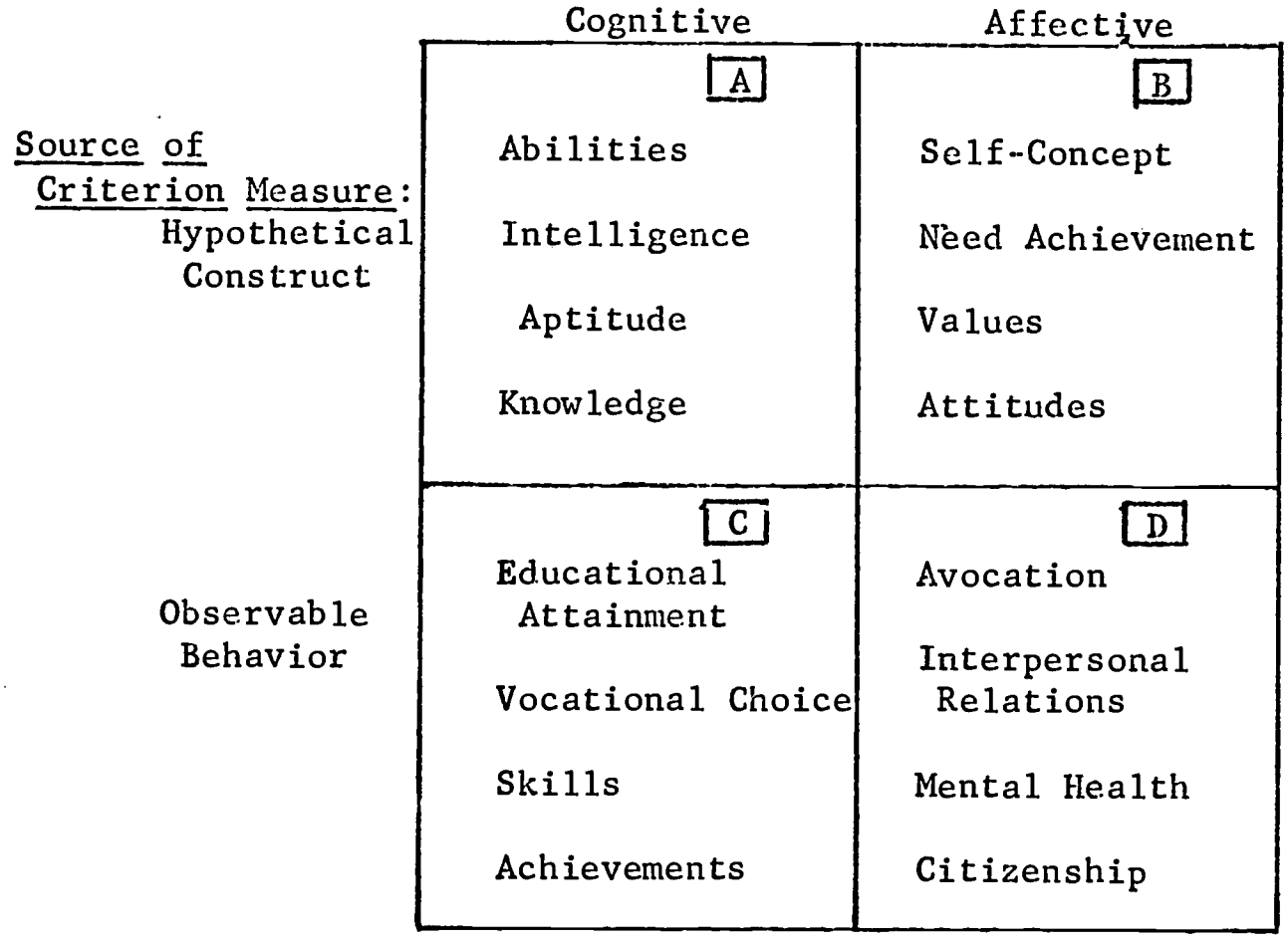

Figure 1. Scheme for classifying types of criteria of student development.

sification scheme, we can then specify criterion performances within the context of a particular study or research program. Figure 1 represents the results of one such attempt to sort our relevant criteria of student development into a simple 2 x 2 classification.

In Figure 1, the so-called behavioral domain has been divided into the traditional categories of intellective, or cognitive, outcomes and nonintellective, or affective, outcomes. The cognitive domain includes such outcomes as the student's knowledge, abilities, and intelligence, while the affective domain includes his motivation, values and attitudes.

Criterion measures can be divided into two groups: those observations which, in themselves, take the form of measures; and those observations that imply a measure of some hypothetical latent (psychological) construct. Measures of the first kind include such empirically verifiable or observable outcomes as whether or not the student obtained a terminal degree and at what level, his extracurricular achievements and awards, and some aspects of his overt behavior toward his fellow man. With the second kind of measure, the outcome can only be inferred, not directly observed, and a person's position on a hypothetical latent continuum can only be estimated. Measures of the second kind include such personality "traits" as intelligence, values, and attitudes. The crucial distinction operating in this classification is between directly observable events and outcomes which are not completely revealed by any set of observable indicators.

Although this second approach apparently ignores important potential interactions--for example, between the cognitive and affective domains, or between a person's aptitude, values, and interpersonal relations and his actual achievements--the classification is intended not as a representation of reality, but rather as a heuristic tool. Its function is to force us to acknowledge explicitly those criteria that we have in-

cluded in our research design and--perhaps more importantly--to recognize potentially relevant behavioral outcomes that have been excluded by the design, or that at least have not been explicitly dealt with in a particular study or research program.

It is essential to note that regardless of their source, conceptual criteria (educational objectives) are not subject to empirical verification or tests. They are rational statements of desired behavioral or social outcomes. In short, they represent normative assuptions about the nature of man, the nature of knowledge, and the nature of reality. Thus, educational criteria can be accepted or rejected only on rational grounds. Similarly, the relevance or irrelevance of the designated criterion performance is a matter of judgment; that is, relevance is not empirically testable.

The point, of course, is that the consumer or potential user of the findings of any research that has implications for educational practice has a special responsibility not only to scrutinize the research design and methodology that produced the findings, but also to determine the relevance of the educational outcome, as defined in the research, to his immediate concerns. In other words, the criterion definition should make sense with regard both to the problem being investigated and to the possible applications of the findings.

Because of the time needed to conduct most educational research, it is important that research projects be designed to incorporate those educational objectives that are relevant to the ongoing educational process and that the research program be sufficiently flexible so that educational outcomes not considered in the original design can be included at subsequent stages. For these reasons, all persons interested in the study of higher education should communicate and collaborate with one

another; this is crucial during the early planning stages, and clearly necessary throughout the conduct of the research.

Obviously, the problems of which student outcomes are relevant to the goals of higher education and of how they can best be evaluated are far from being solved. And just as obviously, general and abstract discussions (such as this one) will not solve them. It might be useful, however, to indicate briefly the types of items that we at the American Council on Education have included in our freshmen input surveys. These items are designed to provide a frame of reference within which the subsequent behavior of the student can be related.

We have collected student input data (see box A of Figure 1) relevant to assessing such outcomes as over-all college grade point average, grade point average in major field of study, and subsequent performances on achievement tests like the area tests of the Graduate Record Examination. Although the prediction of these kinds of intellective outcomes has a history of more than fifty years of research, our success at studying this matter remains at a level far below that which is theoretically attainable (Bloom and Peters, 1961).

In addition, we hope to evaluate changes in the areas of student values, attitudes, personality, and educational aspirations (see box B). Input information concerning the student's self-concept was collected by means of a trait self-rating technique, and information concerning his value-orientation was obtained from a rating scale of life goals. These instruments include items that can be conceptually referred to both interpersonal and noninterpersonal behaviors. By repeating these items in follow-up studies, we will be able to evaluate how the student changes over time and to relate these observations to the college experience. In the area of attitudes, the freshman survey contains input items that will

permit us to study how the college environment shapes the student's perception of and attitude toward his college.

We also hope to shed some light on the process of vocational choice (see box C). For example, Astin (1965)--basing his hypothesis on a theory of selective environmental reinforcement--has suggested that the student's development during college may be largely determined by the types of peer relationships available to him on the campus. Thus, the student's career choice tends to shift in the direction of the dominant or modal choice of his fellow students. We also hope to evaluate such outcomes as relatively high-level extracurricular achievements (for example, awards in the arts and sciences), level of final degree attained, and the personal and environmental factors associated with persistence in college.

Box D presents the most difficult problem because it is here that outcomes of a lasting nature--relatively permanent changes in the student's behavior vis-à-vis society at large--are arrayed. These types of outcomes are usually not manifest in the student's behavior until well after he has left college. In the freshman survey, we have included a large assortment of input items that will permit a controlled evaluation of what may be called day-to-day interpersonal and noninterpersonal behaviors. Although some of these items--for instance, those relating to gambling, drinking beer, participating in organized demonstrations, smoking cigarettes, or, for that matter, praying--may not represent kinds of behavior that a college curriculum explicitly attempts to influence, they are, nevertheless, possible outcomes of the college experience. In short, in all of our studies, we should not forget that educational interventions have a variety of consequences, and that unplanned-for outcomes--including these "side effects"--are necessarily part of the educational experience.

In our research, we begin with the assumption that there is no

one method for effecting change in student behavior. We are primarily concerned with examining how changes in student behavior come about. Thus, our focus is on the process of the student's development and on the identification and isolation of critical variables. We believe that extensive longitudinal research of a comprehensive nature is necessary in order to make finer distinctions among students and their college experiences--distinctions which should be of use to institutions, guidance personnel, and instructors in mapping out a strategy of learning for their particular students. In short, we believe that a thorough knowledge of the student, his environment for learning, and his development during the college years will help us to discover which educational objectives--implicit or explicit--are actually being achieved. Only then can we go on to decide whether these are the objectives that should be pursued and, if not, what can or cannot be done about it.

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Use of Research Results in Matching Students and Colleges

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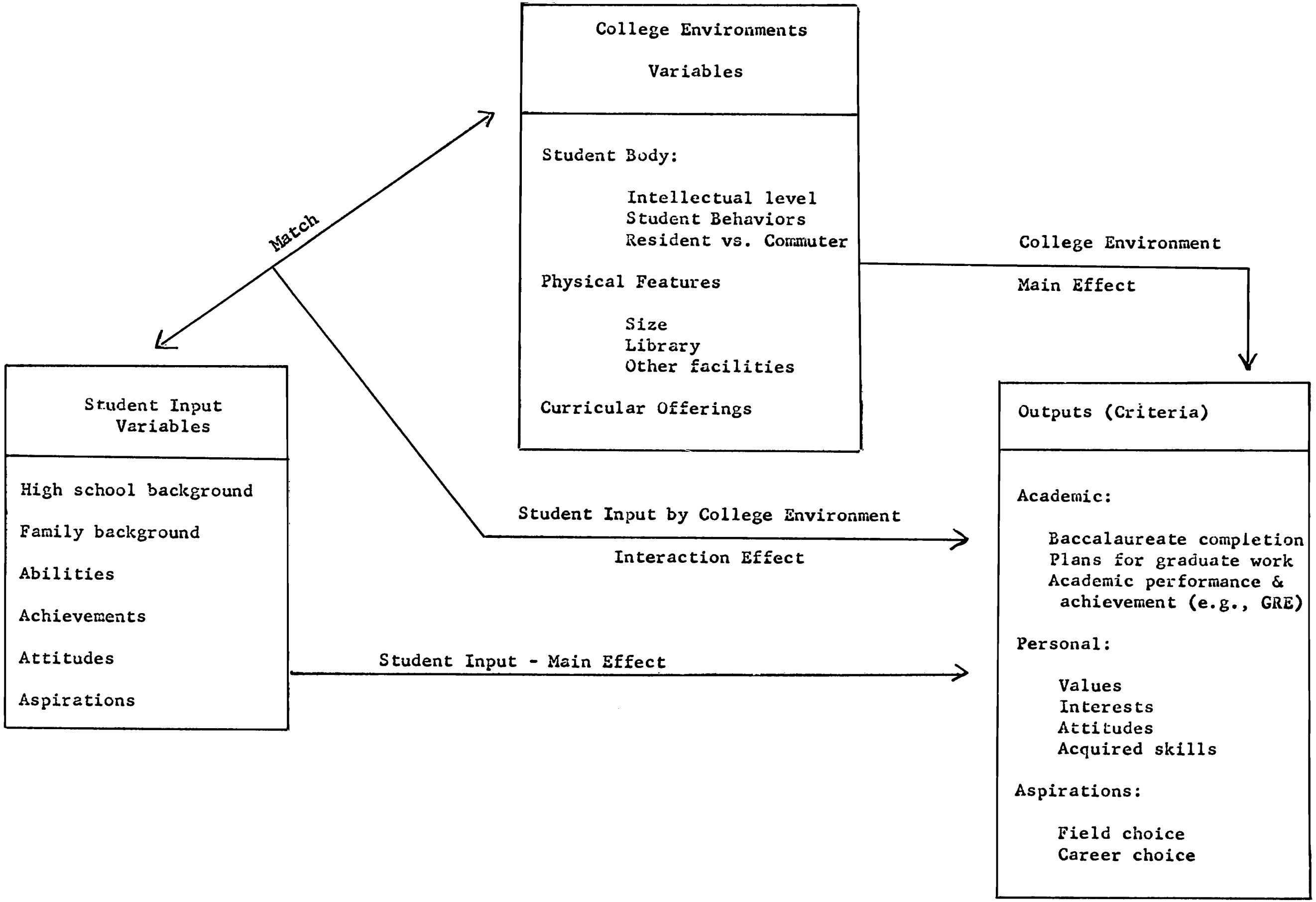
The American Council on Education's program of longitudinal research on the higher educational system provides special opportunities for studying the characteristics of students and of the institutions they attend. These opportunities are based upon the wide range of data obtained from a nationwide representative sample (Astin, Panos, Creager, 1966; 1967). The amount of such data provides the further opportunity to study interactions between the students and their college environments. One goal of these studies is to provide objective, factual information that will be relevant and helpful in solving the problem of matching the college-bound student with an institution of higher education. This paper is concerned with how such information can best be evaluated, summarized, and presented so that students, counselors, and admissions officers can make rational use of research results.

Let us assume that the principal objective of matching students with colleges is to maximize output criteria or educational objectives such as persistence in college, motivation for graduate study, realistic career choice, high academic performance, mental health, knowledge and acquired skills, and certain values and interests. Figure 1 shows that such outputs are a function of three possible factors: the main effect of student input, the main effect of college environment, and the interaction effects from a particular match between student and institution.



Elaboration of ACE Longitudinal Research Design
Figure 1

Suppose we have as an input variable some measure of the student's ability and past achievement, e.g., his College Entrance Examination Board scores. Suppose we also have a measure of a particular college's academic level, e.g., the average ability of the students attending that institution. We wish to estimate the probability that a student with a certain set of C.E.E.B. scores who attends an institution with a certain academic level will complete his baccalaureate degree. By noting what happens to many students attending many different institutions, we can calculate a weighted sum of the freshman ability score and of the academic level of the institution that will maximize prediction of graduation. Such a prediction is represented by the simple model of main effects shown in equation 1:

	Baccalaureate Completion		Ability		Intellectualism
(1)	Y_I	=	W_1X_{SI}	+	W_2X_{CE}
	(Predicted Outcome)		(Student Input Main Effect)		(College Environment Main Effect)

The first term takes into account one of the main effects: that the brighter the student, the more likely he is to graduate. Students in institutions of higher academic level may or may not be more likely to graduate; in either case, this main effect of the college is taken into account by the second term of the equation. Of course, the brighter students are more likely to attend institutions of a higher academic level. This fact, which is reflected in the correlation between the two predictors, is taken into account when the weights are computed for the prediction equation.

Beyond this, however, there are additional effects which we have not yet considered. For example, the effect of an interaction between

the student and his college environment must be considered in the context of prediction. We are concerned with the effects of particular matches between the student and his environment. To return to our example, a bright student matched with an institution of high academic level may find this environment highly stimulating. He also contributes to the environment for other students attending that institution. Conversely, a dull student may find such an institution discouraging, or a bright student may become disgusted if he attends an institution that fails to provide an intellectually stimulating environment. The weights in the first prediction equation may not be the same for these different student-college matches. Conceivably, and for each outcome, we could arrive at different prediction equations for every possible combination of predictors, but this degree of precision would probably be impractical. Fortunately, the problem can be handled by introducing one more term into our prediction equation for these matches, as shown in equation 2. This term is the product of the two scores and will receive its appropriate weight in maximizing the prediction of the outcome, completing the baccalaureate degree:

	Baccalaureate Completion		Ability		Intellectualism		
(2)	Y_{II}	=	W_3X_{SI}	+	W_4X_{CE}	+	$W_5X_{SI}X_{CE}$
	(Predicted Outcome)		(Student Input Main Effect)		(College Environment Main Effect)		(Interaction between Student Input and College Environment)

The American Council on Education's research program is concerned not only with developing equations that maximize prediction of practical outcomes, but also with fostering a better understanding of the higher education system. One way to do this is to compare the efficiency of the

difference predictions that result from alternately including and excluding various terms of the prediction equation (Bottenberg and Ward, 1963). Suppose we found that omitting the interaction term leads to little or no loss of prediction. We could then conclude that the various kinds of interactions mentioned earlier are not relevant to predicting this particular outcome, in which case we could return to the simpler equation #1 for prediction. Suppose, however, omission of the interaction term did make a substantial difference. Not only would we want to keep the term in the prediction, but also we would then be interested in what different types of matches make the difference. This question could be investigated either by sorting the data into the different interaction types or by generating and investigating a more elaborate prediction equation involving the interaction between levels of each types of predictor.

We have been dealing with one characteristic of the student (his college entrance composite), one institutional characteristic (the average academic ability of the student body), and one outcome (baccalaureate completion). Neither the student nor the guidance counselor nor the admissions officer should be so naive as to suppose that these three variables are sufficient to make a final decision about what college the student should attend. The student has many characteristics; he has patterns of abilities, interests, aspirations, and financial resources which are very similar to those of many other students. The institution has many characteristics that may affect student development; it is one of several institutions with a similar pattern of student input characteristics, administrative policies, and physical and academic facilities. The multiplicity of characteristics to be taken into account implies the need for prediction equations of a more complex nature, such as equation 3.

$$(3)\quad Y = \underbrace{(W_1X_1 + W_2Y_2 + W_3X_3 +\ldots)}_{\substack{\text{ability} \\ \text{achievement} \\ \text{aspiration} \\ \text{Student Input Profile}}} + \underbrace{(W_aX_a + W_bX_b + W_cX_c +\ldots)}_{\substack{\text{intellectualism} \\ \text{size} \\ \text{policy} \\ \text{College Environment Profile}}}$$

$$+ \underbrace{(W_{1a}X_1X_a}_{\substack{\text{Student ability by intellectualism of student body}}} + \underbrace{W_{1b}X_1X_b}_{\substack{\text{Student ability by size of college}}} + \ldots + \underbrace{W_{2b}X_2X_b)}_{\substack{\text{Student high school achievement by size of college}}}$$

The many different possible outcomes should be considered differently, according to the needs of the user; e.g., the student aspiring to a career that does not require graduate education will not need to give as much weight to prediction of that criterion as will the student who wants to go into scientific research or certain other professional careers. How, then, are we to select, digest, and present the vast information involving so many input, environmental, and outcome variables? Some of the ACE research studies are aimed to meet this need. By studying the redundancy of information, we can reduce the number of variables to those which make independent contributions to the prediction of relevant outcomes. We can ascertain which student environment interactions are important in prediction and which are not. We can determine which profiles or combinations of student and institutional characteristics yield the same prediction and can therefore be treated the same way in making personnel decisions.

To demonstrate how such information might be presented in a maximally useful way, let me relate a dream. As with most dreams, there is no way to be sure that the contents will come true in the form they were

dreamt. Unlike most dreams, which are alleged to represent riotous symbolism from unconscious processes, this one has both coherence and practical possibilities.

In the dream a few years of carefully done and well-supported research produced a document about the size of the Chicago telephone directory. This directory is divided into two sections. The first, or main, section is designed to be used by the high school guidance counselor during his discussions with a student. The second section, the "yellow pages," are designed to be used by the college admissions officer. At the very back are comprehensive indexes to student and college environment profiles. Let us look first at the main section which contains a page, or a group of pages, giving information on each type of student. In the first scene of the dream, the counselor is interviewing a student concerning whom he has obtained information from school records, test scores, and prior interviews.

A typical page of the main section of the directory is shown schematically in Figure 2 for a white male Protestant with college board scores of 600. The student being interviewed has aspirations to become a medical doctor, but he is not sure whether he has the financial resources and the persistence to fulfill his aspirations.
He realizes he should consider being a medical technician. Even if he were sure he could complete graduate study, he is still not certain that he wants to go into clinical practice: perhaps he should become a research biologist. Such possible outcomes are listed on the left, designating rows of the table. During the session, the counselor and the student discuss a number of institutions, all of which are geographically and financially feasible for this student, but which differ from one another in the environments they provide and in the outcome probabilities

Subsection for Student Profile No. 117

Student Characteristics:

White Protestant Male
College Board Scores - 600

Output Criteria	College Environment Profile Number					Student Profile Main Effect
	01	02 . . .	.05. . . .	23 . .	.37. .	
Educational Aspirations						
Baccalaureate Completion	.	.	.4	.6	.7	.5
Entry into Graduate School	.	.	.3	.3	.2	.2
Doctorate Attainment	.	.	.2	.2	.1	.1
Career Choices						
Physician	.	.	.1	.2	.1	.1
Biologist	.	.	.2	.2	.1	.2
Medical Technician	.	.	.1	.1	.1	.1
Engineer	.	.	.1	.2	.3	.2
Artist	.	.	.3	0	.3	.2
Lawyer	.	.	.2	.1	.1	.2
Other	.	.	.	.	.	.

Schematic Example of a Page from Main Section

Figure 2

that they imply for a student with this set of characterisitcs. These institutions may be looked up in the index to determine their environmental profiles. For example, college A may be a large public university with liberal administrative policies, broad curricular offerings, and a student body which has a high intellectual level, but is given to consider-

able Joe-College carousing. The index says this profile is number 5, so we look in column 5 to find what outcome is predicted if this student were to to to college A. College B may be a small, Protestant, liberal arts college with some scientific curricula, severe administrative policies against drinking, a student body of moderately high intellectual level, and an unusually excellent and well-used library. The college environmental profile index says this is profile number 37, so we look in column 37 for the output information that would be predicted if the student were to go to this college.

One might wonder why this table does not have a column for every college or a row for every student. The obvious reason is that the directory would become too big. Thus, one phase of our research involves a taxonomy of colleges in terms of their environmental characteristics, and a taxonomy of students in terms of their personal characteristics. But there is another and more important practical reason for this classification. Because they are uncertain that their applications will be accepted by a particular college, many students hedge their bets and submit multiple applications. By knowing which other colleges have similar profiles and, hence, a similar set of predicted outcomes, some rationality may be introduced into this shotgun approach. Such information can be combined with other considerations, e.g., financial and geographical, in deciding to which colleges to apply.

Going down the columns 5 and 37 for the profiles of colleges A and B, we find that the probability that this kind of student will complete a baccalaureate degree is .4 at college A and .7 at college B. However, the counselor does not tell the student that college B, or any of the colleges having profile 37, is necessarily "better" than college A, or any of the colleges in profile 5. He notes that graduates of college A

are more likely to enter graduate study (.3 versus .2), and that a greater proportion of students like him at college A still want to be physicians upon graduation. If the student were absolutely sure that he was bound for medical school, and if the choice were really his, college A would seem to be the better bet, provided he were willing to work hard.

But remember that this student's career goals are not absolutely crystallized and that he recognizes that the need for some flexibility in his planning. He may want to look at the rows for other career choices such as research biologist and medical technician. The counselor might then tell the student, "college A is probably better for one of your goals and college B for another. Have you considered college C (profile number 23)? Although it is not quite as appropriate for any one of your goals, it does offer favorable chances on several." In other words, the directory would not make final, automated personnel decisions, nor should it. What it does provide is objective information in readily available form to aid the counselor in his discussions with the student.

How does such a table relate to the prediction equations involving main effects and interactions? The right hand side of the table shows the outcomes predicted from the student input main effect regardless of what college this student attends. For a given outcome, however, the values in the rows will vary considerably wherever the main effects of the college environment or the effects of the student-by-college interactions add to the predictability of the outcome. This is more likely to occur with students and institutions having jagged profiles, emphasizing special characteristics of either. One further point needs to be made about the values tabulated. Where the outcomes are categorical, the tabled values are predicted probabilities of membership in a category, as we have been

assuming. If the outcome is a continuous variable, such as scores on the Graduate Record Examination, the tabled values may either by predicted scores on the outcome variable, or probabilities that the student's score will be above a certain level.

Now let us move on to the next scene in the dream. An admissions officer at a private sectarian college has more applicants than dormitory space. In its educational objectives, this institution is less concerned with turning out students who will go on to graduate school than it is with developing certain religious and moral values in its students. Moreover, because of its faculty and physical facilities, it is better equipped to educate some career groups than others. At any rate, the admissions officer is forced to be selective. What does he do? He "lets the Yellow Pages do the walking."

Figure 3 shows the schematic layout for a typical yellow page of the directory. Since each page in this section refers to a different environmental profile, the admissions officer chooses the page that bests describes his own institution. Each column now represents some outcome that this institution might consider representative of its educational capabilities and goals. The admissions officer goes down these columns to find predicted outcomes in favorable ranges; he then looks over to the left hand column in order to find out which student profiles to prefer. Having read the profile numbers, he can, if he wishes, refer to the student profile index and there obtain a description of the typical student who has such a profile.

Like the guidance counselor, the admissions officer must guard against blindly using any single index to make a final personnel decision. The directory information is partial input to be weighed into whatever selection process he is using. Excessive concern about achieving one admissions goal may be inconsistent with achieving another goal, perhaps

Subsection for College Environment Profile No. 23

College Environment Characteristics: 4 year private, Protestant
College with Intellectualism 520.....

Student Profile Number	Output Criteria									
	Educational Aspirations			Career Choices						
	Baccalaureate Completion	Entry into Grad. School	Ph.D. Attainm't	Physician	Biologist	Med. Tech.	Engineer	Artist	Lawyer	Other
001										
.										
002										
.										
.										
.										
.										
117	.6	.3	.2	.2	.2	.1	.2	0	.1	.....
.										
.										
200										
.										
.										
College Environment Main Effect	.7	.3	.2	.2	.1	.2	.2	.1	.1	

Schematic Example of a Page from the "Yellow Pages"

Figure 3

equally important. He would thus be well advised to look at more than one outcome column of the yellow page applicable to his institution.

This kind of table relates to the prediction equations involving main effects and interactions in much the same way as do the tables in the main section. There is one difference. Here, a row at the very bottom of the table presents predicted outcomes on the various criteria for this type of institution, no matter what student input profile is considered. This row shows the outcomes predicted only from the main effect of that particular college environment profile. For a given outcome, values in the columns will vary considerably where the student profile main effects and the effects of student-by-college interactions add to the predicability of that outcome.

Such a directory has considerable potential for dealing with still other kinds of problems. For example, suppose the student has already decided on an institution (the father is an illustrious alumnus and junior is going to alma mater no matter what), and the counseling interview is focused on choice of major field or later career. In this situation, either section of the directory can be consulted to ascertain those field and career choices that seem most promising, given this combination of student and college profile.

In another example an admissions officer may have a fixed pool of candidates for admission: the range of student profiles is limited, perhaps, by certian geographic and economic factors, or by current admissions policy. Perhaps members of the administration and faculty are giving serious thought to the capabilities and educational goals of the institution. Should a certain department be added or expanded? Should certain changes be made to bring administrative policy more in line with the types of students who normally enter this institution? If certain

changes are made, which goals will be more nearly reached and which less so? Directory information would provide objective information relevant to such decisions.

The guidance counselor working with undergraduates would also find such a directory useful, for example, in assisting students who are contemplating transfer to another institution. The directory would also help him in counseling students considering possible changes either in major field or in choice of career, in which case the predicted implications of the various changes would be relevant.

On awakening from such a dream, one may have doubts as to whether he would like to see the dream become a reality. It remains to consider some of these doubts.

The tabled values in the directory do not represent a fixed set of expected outcomes given a certain match between student and college; rather, they are only estimates of such outcomes. Less than perfect estimates may result from unreliable measurement of student characteristics, of college characteristics, or of outcomes. Imperfect estimates may also result from failure to exhaust the relevant student input and college charactersitics and their possible interactions. Should we not have some indication of how good the estimates are so that we can take this into account in making personnel decisions? Yes: the size of the multiple correlation (or its square, the coefficient of determination) is obtained during the research operations that produce each predicted outcome. This statistic could be shown parenthetically after each estimated outcome, or otherwise tabulated in some prominent place. Reports of the supporting research should also document such information about the trustworthiness of the results.

Would counselors and admissions officers misuse or ignore such a

directory? Potential users, being human, will differ in their insight into the scope and limitations of the directory. But then, one can misuse the telephone directory, or ignore it, obtaining information from other sources, and then proceed to misdial. In a free society, one is free to err. One is also free to learn with experience and to correct mistakes - surely more rational alternatives than disregarding information or burning directories. Counselors and admissions officers are professional people and can reasonably be expected to welcome a professional tool and to use it insightfully.

Will extensive use of the directory, over time, result in more homogeneous college environments with more homogeneous student bodies and more homogeneous pools of alumni? Rigid and uniform nationwide use of the directory to the exclusion of all other factors would indeed carry such a risk. More flexible and rational use of the directory, as well as differential degree of use by counselors and admissions officers in various places seems a more realistic expectation. Counter-measures, both rational and otherwise, may be expected to arise, if indeed such greater homogeneity is encountered and judged to be operationally undesirable.

Characteristics of students and colleges change over time. Won't the directory become obsolete? Yes, it must be updated. This necessity implies continued research to establish information about normative trends and to monitor the regression equations for prediction of outcomes.

Will the directory take all of the relevant outcomes into consideration? No, of course not. In principle, any extensive demand for the prediction of some outcome can be met, provided that the outcome is sufficeintly well defined so that its occurrence or nonoccurrence can be determined, and that it is predictable from student and college

characteristics. The outcome does not have to be a favorable one, or even one that is intended by either students or by educators. It does have to be operationally manifest in some sense, although not necessarily "measurable." It cannot be some vague, global verbalism.

Doesn't the directory make invidious comparisons among institutions? Part of the utility of the directory is that it permits us to compare institutions with respect to different outcomes, separately for different types of students who attend them. In what sense is such comparison invidious? Comparison of institutions is inherent in any problem of college choice. Why not base such comparisons on objective information rather than on hearsay or folklore? If it has been shown that a certain institution usually fails to produce a certain desired outcome on a certain type of student, how is this invidious? If the institution does not claim to provide that particular service, it cannot be faulted; if it does make such a claim, it is guilty of public irresponsibility and can correct the matter either by relinquishing the false claim or by making the necessary institutional changes to validate the claim.

For some groups of institutions, certain student types and certain outcomes may be irrelevant. An example would be the choice of nursing as a career by students in a men's college. Even though an occasional graduate may in fact choose to be a male nurse, a properly designed directory would not present probability estimates for such an unlikely combination of student, college, and outcome types.

Whether such a dream content becomes manifest as a part of higher education in the convenient form described here, such obviously useful information needs to be disseminated in some well-organized and easily usable fashion. To provide this information, we must have a sound base of longitudinal research in higher education like that being conducted

by the American Council on Education. The results of such a program can be used to aid decision making by counselors, students, admission officers, and other concerned with the general problem of matching students and colleges.

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