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AUTHOR	Harris, William; And Others
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ABSTRACT

Research was conducted to determine whether statistical sampling techniques' could be applied effectively in followup studies of high school graduates and, if so, what sampling model is most appropriate. Records at four high schools in the Santa Barbara area were examined to develop statistical, demographic profiles of two populations, the 1970 and 1971 graduates. A questionnaire was sent to each graduate. Three weeks later a second questionnaire was sent to non-respondents, and three weeks after that non-respondents were interviewed by telephone. Data from 78% of the 1970 and 82% of the 1971 graduates were thus obtained. Examination of the statistical profiles of respondents revealed the questionnaire data to be representative of the entire population. Differences in response rates and in responses to questionnaire items were analyzed and found to be related to sex, ethnic background, and grade point average. Subsequently, random and stratified-random samples of different sizes were drawn from the respondent pools. Samples of the latter type were stratified on combinations of sex, ethnic background, and GPA. Several behavioral and attitudinal questionnaire items were selected to evaluate the effectiveness of the sampling models. It was found that the stratified-random sample models provided more accurate results than the random sample models. Several criteria for selecting the proper sample size are discussed. (Author/KM)

Project TRACE:

RESEARCH AND EVALUATION OF FOLLOW-UP STUDIES OF HIGH SCHOOL GRADUATES USING SAMPLING TECHNIQUES

William Harris
Charles Abrams
Henry K. Simpson

Prepared for

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Prepared by

Human Factors Research, Incorporated
6780 Cortona Drive
Goleta, California 93017

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ABSTRACT

The main purposes of this investigation were to determine whether statistical sampling techniques could be applied effectively in follow-up studies of high school graduates and, if so, to determine what sampling model is most appropriate for that purpose.

The 1970 and 1971 graduates of four high schools in the Santa Barbara City area served as the populations of interest. The high school record of each graduate was analyzed and the following information was recorded: the graduate's name, sex, address, phone number, parent's name, ethnic background, grade point average, graduating class rank, Lorge-Thorndike Verbal Test score, citizenship grades, years at the school, extracurricular activities, and the types and number of courses of each type he had taken. These data were used to develop statistical, demographic profiles of the two populations.

A questionnaire that had been specifically developed to provide actionable data and that had been pretested to evaluate its comprehensibility and conciseness was sent to each graduate. Three weeks later a second questionnaire was sent to the non-respondents and three weeks after that the non-respondents were interviewed by telephone. Data from 78 percent of the 1970 and 82 percent of the 1971 graduates were thus obtained.

The statistical profiles of the respondents with respect to the previously mentioned variables recorded from their student record cards were very similar to the population profiles so that, in essence, the questionnaire data were representative of the entire population. However, differences in the response rates and in the responses to the questionnaire items were found among the respondents. These differences were analyzed and found to be related to the sex, ethnic background, and grade point average of the respondents.

Subsequently, different size random and stratified-random samples were drawn from the respondent pools of the two populations. The latter type samples were stratified on various combinations of sex, ethnic background, and grade point average. Several behavioral and attitudinal items appearing in the questionnaire were selected to evaluate the effectiveness of the sampling models. When the sample statistics were compared to the population values, it was found that the stratified-random sample models provided more accurate results than the random sample models.

It was concluded that statistical sampling techniques applied to follow-up studies of high school graduates could provide accurate data in a cost-effective manner and it was recommended that samples stratified on sex, ethnic background, grade point average, and high school program be used in such studies in the future, as should the data collection procedures developed in the present investigation. In addition, several criteria for selecting the proper size sample were discussed and recommendations made based upon those criteria.

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PROJECT TRACE:
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INTRODUCTION

There currently exists a need to develop an effective and economic means of obtaining up-to-date evaluative data on recently implemented educational programs in the State of California, particularly at the secondary school level. Perhaps to a greater extent than ever before in our history, significant changes in educational philosophy, in curricula, in communication media, in instructional emphasis, and in policies and practices have been instituted in the schools of our nation. In coming years, social and educational pressures upon the educational system will undoubtedly continue, with the probable result that more changes and innovations will be made. Some of these may possibly result in improved educational programs; others will not.

One method used in the past to obtain evaluative data has been the follow-up of recent graduates. In conducting follow-up studies, it has been common practice to attempt to collect information from the *entire* graduate population rather than from representative *samples* of the population. This is both impractical and unnecessarily expensive.

The major purpose of the present investigation was to determine whether statistical sampling techniques commonly used by survey research organizations could be applied effectively in conducting follow-up studies of high school graduates and, if so, to determine what sampling model is most cost-effective. A secondary purpose was to develop a concise, self-administered questionnaire which could provide *actionable* information from graduates, that is, information which could be put to direct use in the development of effective programs for future students.

The Problem

The use of follow-up studies to evaluate educational programs, however, is not without problems. An issue of fundamental concern is *how often and how long after graduation attempts should be made to obtain the evaluative data.* Is it satisfactory, for example, to contact the graduates only once, perhaps a year after graduation, or should the information be obtained periodically over a period of several years after graduation? The latter approach seems more defensible in that it is unlikely that the full consequences of a particular program would be manifest shortly after graduation and, further, the consequences very likely would change over time. A reasonable approach might be to follow up a graduating class for a period of from, say, four to five years at intervals of perhaps a year between follow-ups. If this approach were used in follow-up studies of four consecutive graduating classes of 600 students each, and if, as has been the custom, an attempt were made to obtain information from the entire population, then in the fourth year a total of 2,400 potential respondents would have to be contacted and their data processed and evaluated. The amount of administrative manpower needed for such a project would be great, as would be the associated costs; generally, they can be expected to be beyond the scope and budget of individual schools and school districts.

Another problem that often arises in follow-up studies stems from the typical response rates. The rates for various follow-up studies have varied from about 45 percent to 97 percent, more often falling at the lower end of this range. Thus, the validity of the conclusions that can be drawn from the obtained data may be suspect. High response rates (90 percent and above) appear to be obtainable only when intensive orientation programs for the students have been previously

carried out. But of greater importance than the absolute response rate is the *representativeness*, by the respondents, of the population. Most often this is a problem when response rates are low and various segments of the population respond disproportionately. For example, if graduates who are scholastically below average or who are members of minority groups do not respond as readily (as is often the case) as other graduates, the resultant data may not accurately reflect the experience and attitudes of the entire graduate population. Though this problem might be partially resolved using statistical weighting techniques, a great deal of the data obtained from those groups of students who are proportionately overrepresented among the respondents are unnecessary for evaluative purposes. Thus, there results a waste of time and money in obtaining, processing, and analyzing all the follow-up information of the overrepresented groups.

Alternative Approaches

Both of these major problems--the required manpower and associated costs of administration, and the difficulty of obtaining representative, valid data--are due for the most part to the attempts made to gather information from the *entire* graduate population. An alternative approach which may alleviate these problems is to apply statistical sampling techniques in follow-up studies. With such an approach there is no need to obtain information from the entire population; rather, data are obtained from a number of carefully selected, representative graduates and inferences are then drawn from their responses and projected to the entire population. Because only a relatively small number of graduates need be contacted, the administrative and cost requirements are reduced and, to the extent that the selected graduates are representative of the population, valid inferences can be made to the entire population and valid conclusions can be reached.

There are various sampling techniques which may be used. Associated with each, however, are advantages and disadvantages. Two of the more promising techniques for use in follow-up studies are (1) the *random sample* technique, and (2) the *stratified-random sample* technique.

The most easily selected sample is the *random sample*. In such a sample, each individual in the population of interest (in this instance, the graduates of a given year) has an equal chance of being selected. While this sampling procedure is relatively inexpensive and easily implemented, it does have some drawbacks. Because the sample is selected randomly, it is difficult to ensure that the diverse segments of the population, e.g., good and poor students, minority and non-minority group members, etc., are proportionately represented. Though this problem can be remedied somewhat by increasing the sample size, thus making it more likely that all segments are represented, that solution also serves to increase the manpower and cost requirements.

A *stratified-random sample* differs from a random sample in that the population is divided into subgroups or strata before the sample is drawn. The subgroups are identified by variables thought to be related to the outcome of the study (e.g., ethnic group or grade point average). After the stratification is accomplished, a random sample is drawn from each stratum. Usually the size of the sample from each stratum is proportional to the size of the subgroup in the population; however, disproportionate samples may be drawn from the strata depending upon the particular aims of the study. The stratified sampling procedure serves to ensure that various segments of the population are properly represented in the sample and thus increases the likelihood that valid inferences may be made to the population.

The main disadvantage of stratification is its associated cost. The population members must be classified according to

the variables of interest and, obviously, the more variables and the more strata used, the more laborious and costly the procedure. Thus, a major consideration in implementing a stratified-random sampling approach is the selection of critical variables and the number of strata to use within each variable.

Another consideration in implementing sampling techniques is the size of the sample to be drawn from the population. The larger the sample, whether random or stratified, the greater the confidence one can have that the conclusions drawn from it can be generalized to the population. However, mere size does not assure representativeness in a sample. The more diverse the population (with respect to some critical variable[s]), the less likely that the results obtained from two or more independently drawn samples would be the same. Thus, the data from a small random or stratified-random sample is likely to be superior to a larger but badly selected sample.

The present investigation was designed to evaluate alternative sampling plans that can be used in conducting follow-up studies of high school graduates. The elements of the study included assessments of the sampling plans, the sample sizes, the information gathering and measurement techniques, the data collection methods, and the cost-effectiveness of the various alternatives for each of the elements.

METHOD

The study was conducted in three major phases and with two populations, the 1970 and 1971 high school graduating classes in the Santa Barbara City area. The participating schools included Santa Barbara High School, San Marcos High School, Dos Pueblos High School, and Carpinteria High School.[1] In the first phase, the high school records of all the graduates were analyzed and a follow-up questionnaire developed. In the second phase, an attempt was made to obtain follow-up data from all the graduates; and in the third phase, various sampling methods were evaluated using the data obtained in Phase 2.

The general procedure was to categorize each of the graduates on certain classification factors and to obtain behavioral and attitudinal data from them through suitably prepared questionnaires. The resulting data were evaluated with respect to the classification factors and statistical descriptions of the populations were formulated. Differences in attitudinal and behavioral data and in response rates, as functions of the classification factors, served as the basis for the selection of stratification variables which were used in samples of various sizes. The samples were evaluated by comparing the sample values with the population values on several of the attitudinal and behavioral questions. The procedures used and the relationships among procedures are shown in Figure 1. They are described in detail in the following sections.

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[1] Another high school, La Cuesta, also participated in the initial two phases of the study. However, owing to the small number of graduates from that school and the fact that La Cuesta is a continuation school rather than a typical high school, the data obtained from its graduates were not used in the third phase of the study.

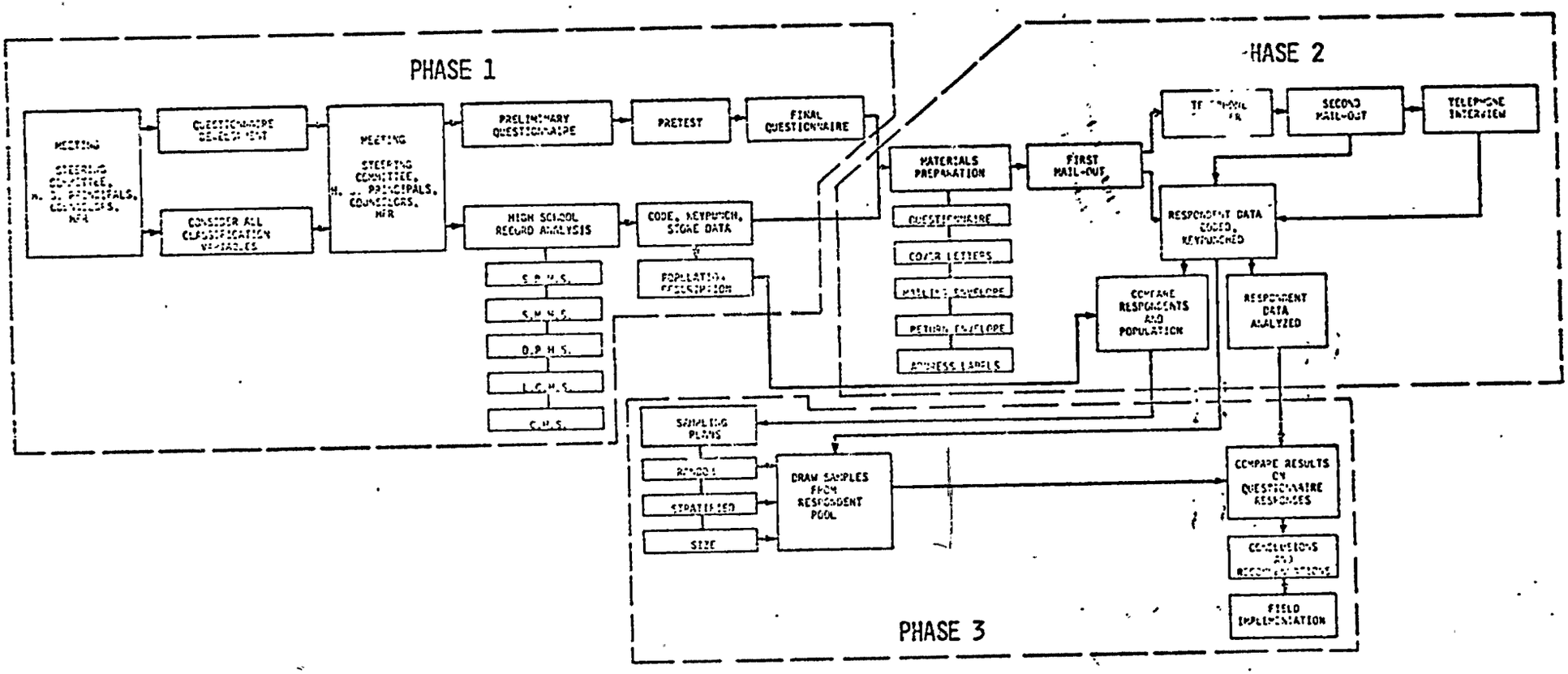


Figure 1. Flow diagram of the procedures.

Procedures

Phase 1 - Informational Requirements, Record Analysis, and Questionnaire Development

In this phase of the study, the objectives were to gain the cooperation and to learn the informational needs of the local high school administrators and counselors, to conduct the record analyses of the graduates, and to develop a questionnaire that would provide actionable data.

Meetings were held with the project steering committee (representatives of the Santa Barbara County Schools) and high school principals, administrators, counselors, and other interested members of the educational community. The initial meetings, some of which were held with individual school personnel and some with all the schools represented jointly, were devoted to descriptions of the project objectives and its potential usefulness to these personnel. Having thus obtained their interest and willingness to participate, it was then determined what sort of information they desired from their graduates and which variables they thought would be pertinent in classifying them into subgroups for stratified sampling.

Lists of potential items for inclusion in the questionnaires were devised, based upon the results of the meeting. These were forwarded to the meeting attendees for study, evaluation, and comment. The attendees were also asked to formulate potential questionnaire items which would be considered and discussed at a subsequent meeting.

At the same time, sample student records were obtained from each of the schools and examined as the classification variables to be used would be determined by the contents of the records. The purpose of this step was not only to determine the record contents but also to assess the commonalities and differences among the record-keeping practices of the

schools. It was found that although much the same information was recorded by each of the schools, the techniques of recording differed significantly. For instance, citizenship grades in some schools were recorded as numeric values, but in others they were coded in letter form. Some schools had photographs of the student attached to the record while other schools did not. And some schools maintained listings of the extracurricular activities the student participated in while others did not have such listings on the record. In addition, the location of specific information on the record varied from school to school. It therefore became necessary to develop different techniques for analyzing the records of the various schools. In some instances it was also necessary to rely on other documents and records, such as yearbooks and registration forms, for various kinds of information.

At the subsequent joint meeting of the steering committee and high school personnel, decisions were reached regarding the items to be included in the questionnaire and the manner in which the student records were to be analyzed.

A preliminary form of the questionnaire was designed and pretested on a group of 1969 graduates from Santa Barbara High School. The participants, 8 males and 5 females, represented several ethnic and socioeconomic groups and varied educational objectives. After each person completed the questionnaire, he was interviewed to determine what difficulties he encountered with either its wording or format. A few items were modified as a result of the comments offered though, in general, the graduates felt that the questionnaire was well-worded and easily understood. A final version of the questionnaire was then designed for field use. It is shown as Figure 2.[2]

[2]Analysis of the responses received from the 1970 graduates suggested that two of the questionnaire items were not easily understood by some members of that class. Therefore, the instructions were altered slightly for field use with the class of 1971. It is the latter version which is shown as Figure 2. The modified instructions were for Items 17 and 23.

PROJECT TRACE QUESTIONNAIRE

If the information on the label at the left is incorrect, please enter the correct information at the right.

NAME _____
last first middle

ADDRESS _____
no. street city

_____ PHONE ( ) -
state zip area code number

Please follow instructions carefully and answer all questions that apply to you.

1. (11) What are you doing at the present time? (Check each item that describes your present activity.)

1- ○ In school, full-time
2- ○ In school, part-time
3- ○ In armed forces
4- ○ Housewife
5- ○ Other (please describe) _____
6- ○ Working, full-time
7- ○ Working, part-time
8- ○ Not working, looking for a job
9- ○ Not working, not looking for a job

Complete the questions in this box if you are attending school FULL-TIME or PART-TIME

2. (12) What type of school are you attending?

1- ○ Four-year college or university
2- ○ Technical school (type) _____
3- ○ Trade school (type) _____
4- ○ Private business school
5- ○ Junior college (also check one below)
(13) 1- ○ Plan transfer to 4-year college
2- ○ Two-year AA program only
3- ○ Certificate program (describe) _____
4- ○ Other (describe) _____
6- ○ Other (describe) _____

3. (14) What is the name of the school? _____

4. (15) What is your major subject? _____ 1- ○ None

5. Compare the average grades you received in high school with the average grades you are receiving in your present school by placing a single mark on each line scale.

High school grades (16): F (1-) D (3-) C (5-) B (7-) A (9-)

Present school grades (17): F (1-) D (3-) C (5-) B (7-) A (9-)

Complete the questions in this box if you are working FULL-TIME or PART-TIME or if you are LOOKING FOR A JOB.

6. (18) Which of the following is your present job situation?

1- ○ Unemployed, but looking for a job
2- ○ In an apprenticeship program
3- ○ Receiving on-the-job training
4- ○ In a job I am fully qualified for

7. How many months of part-time employment have you had since finishing high school? (19, 20) _____ mos.
How many months of full-time employment? (21, 22) _____ mos.
How many months have you worked at your present job? (23, 24) _____ mos.

Figure 2. The questionnaire.

If you are employed, answer the following questions for your present job. If you are unemployed, answer them for your last job.

8. (25) What business or industry are you employed in? _____

9. (26, 27) What is your job title? _____

10. (28) Which single statement best describes your job?

1- ○ In a field for which I received specific high school training
2- ○ In a field related to my high school training
3- ○ In a field unrelated to my high school training

11. Indicate your weekly salary by placing a mark on the line scale.

(29) $0 (1-) — $50 (3-) — $100 (5-) — $150 (7-) — $200 (9-) — $250 or more (X-)

12. Read each statement carefully. Make a check in the circle that best describes your agreement or disagreement with the statement for your present job (or last job, if unemployed).

	STRONGLY DISAGREE 1-	DISAGREE 2-	NOT SURE/ UNDECIDED 3-	AGREE 4-	STRONGLY AGREE 5-	
(30)	○	○	○	○	○	The work is interesting to me.
(31)	○	○	○	○	○	My chances for advancement are good.
(32)	○	○	○	○	○	The pay is good, considering my training and experience.
(33)	○	○	○	○	○	I am satisfied with this job, at this stage in my career.
(34)	○	○	○	○	○	The job is related to my ultimate occupational objective.

Please answer all of the following questions.

13. What is your occupational choice now? _____ (35, 36)

1- ○ Have not made a choice.

14. What was your occupational choice when you were in high school? _____ (37, 38)

1- ○ Had not made a choice.

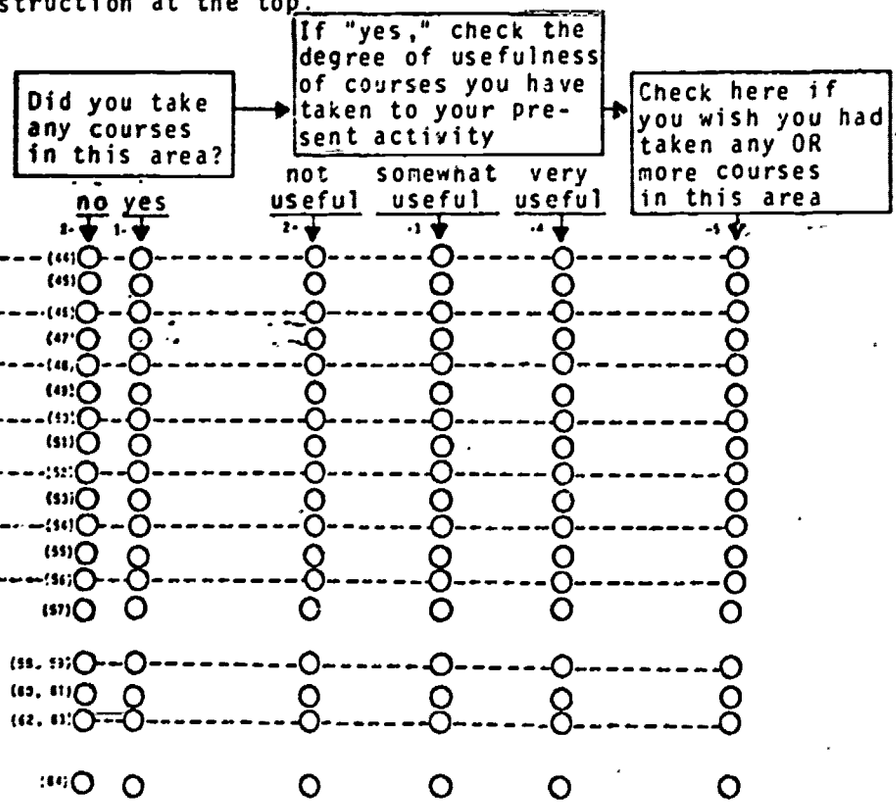
15. (39) What educational program did you take in high school? (Check one.)

1- ○ College preparatory
2- ○ Vocational program (which one?) _____ (40)
3- ○ General program
0- ○ Other (describe) _____

16. (41) What educational program would you take now if you had it to do over again?

1- ○ Same program
2- ○ A different program:
(42)
1- ○ College preparatory
2- ○ Vocational program (which one?) _____ (43)
3- ○ General program
0- ○ Other (describe) _____

17. Read the following list of high school course areas. Then make checks in each column according to the instruction at the top.



18. In your present activity (school, work, home, etc.), which course area, listed in Question 17, is

(65, 66) Most useful _____
(67, 68) Second most useful _____
(69, 70) Third most useful _____

Please write only one course area in each space

19. (71) Are there any specific courses that would be useful to you in your present activity, but were not offered in your high school?

1- ○ Yes (please describe) _____ (72, 73)
2- ○ No

20. (74) If you did not take a Work Experience program, which of the following was your reason?

1- ○ Not interested
2- ○ No program was available
3- ○ No academic credit was offered for work experience
4- ○ I could not get work experience in my area of interest
5- ○ Other (please describe) _____

21. (75) Who helped you most in planning for the future when you were in high school? (Check one.)

1- ○ Parents and relatives
2- ○ On-campus friends
3- ○ Off-campus friends
4- ○ School counselors
5- ○ Teachers
6- ○ Work experience advisor

7- ○ Others (Please describe) _____

22. In your opinion, how much did high school help you gain the following everyday living skills?

	Not Helpful (1)	Somewhat Helpful (2)	Very Helpful (3)	
(29)	O	O	O	Reading for my own instruction and pleasure
(30)	O	O	O	Writing letters, reports, or notes accurately
(31)	O	O	O	Working out numerical problems and managing finances
(32)	O	O	O	Speaking before groups of people
(33)	O	O	O	Preparing for marriage and family life
(34)	O	O	O	Getting and maintaining a job
(35)	O	O	O	Using proper spoken English
(36)	O	O	O	Thinking out problems and issues and forming my own opinions

23. Read the following statements and rank them in the order of their importance to you in making an occupational choice. For example, if you feel to "become well-known" is most important, write a "1" next to that statement. Write a "2" next to the second most important statement, a "3" next to the third most important, and so on, up to 9, until each statement is ranked. (Use each number only once.)

(19) _____ Have a secure job
(20) _____ Become well-known
(21) _____ Have a large income
(22) _____ Be able to pursue my own interests
(23) _____ Have a low-pressure job
(24) _____ Have a job that is respected
(25) _____ Be able to help others
(26) _____ Be able to express myself through my work
(27) _____ Be in charge of people

24. Read each statement carefully and make a check in the circle that best describes your agreement or disagreement with the statement.

	STRONGLY DISAGREE (1)	DISAGREE (2)	NOT SURE/ UNDECIDED (3)	AGREE (4)	STRONGLY AGREE (5)	
(38)	O	O	O	O	O	My counselor gave me good advice in planning my high school program.
(39)	O	O	O	O	O	My counselor gave me good advice in planning my activity after graduation.
(40)	O	O	O	O	O	There was a good deal of useful discussion between students and teachers in my high school.
(41)	O	O	O	O	O	Most of my teachers tried to present information relevant to today's world.
(42)	O	O	O	O	O	Most of my teachers were not prejudiced toward minority group members.
(43)	O	O	O	O	O	Most of my teachers did not show favoritism toward college-bound students.
(44)	O	O	O	O	O	I feel that my high school courses were very useful in helping me meet my career goals.
(45)	O	O	O	O	O	I feel that high school was a pleasant and rewarding experience.
(46)	O	O	O	O	O	A person who works hard can usually get ahead.
(47)	O	O	O	O	O	Succeeding is largely a matter of being in the right place at the right time.
(48)	O	O	O	O	O	People who get ahead usually have connections.
(49)	O	O	O	O	O	This society tends to favor people who have a different outlook on life than I do.
(50)	O	O	O	O	O	I don't think I would be very interested in most of the jobs that I could qualify for.
(51)	O	O	O	O	O	The chances for success are probably better in some foreign countries such as Canada or Australia.

Thank you for completing the questionnaire.

A data sheet was designed for use in the student-record analysis task. The format of the data sheet (Figure 3) was such that it could be used at all of the schools with a minimum of effort and chance for error. With this form, information was obtained about the school the graduate attended, his year of graduation (and whether he graduated mid-year), the graduate's name, student number, sex, address, phone number, parent's name, and ethnic background. The parent's name was recorded to permit the tracing of the student, through the phone directory, in the event he had moved. The ethnic background of the graduate was determined by examining his photograph, his surname, and in some instances by speaking with his counselor. Other information recorded on the data sheet included the graduate's rank in his class, his citizenship grades, his Lorge-Thorndike Test scores, whether he had taken the college entrance examination (CEEB), his overall grade point average, and the number and types of extracurricular activities he participated in. Finally, the analysts recorded the number of semester courses the graduate had taken in a variety of subject areas listed at the bottom of the sheet.

The record-analysts were a group of carefully selected college graduates; most were social science majors who had had experience in data and record analysis of some sort. They were informed about the purpose of the study and were enthusiastic about participating in it. After they had been trained, they performed the analyses at their assigned schools where they quickly established rapport with the counselors and registrars, who in turn provided assistance whenever it was needed.

The information on the completed data sheets was then coded and keypunched onto computer cards. Thus, data on each of the 1970 and 1971 graduates was obtained and readied for computer processing. The data from each graduating class were

PROJECT TRACE RECORD ANALYSIS

[ ] Carpinteria
[ ] Dos Pueblos
[ ] La Cuesta
[ ] Santa Barbara
[ ] San Marcos
(high school)

[ ] 1970
[ ] mid-year
[ ] 1971
(graduation year)

Last First Middle

Number

[ ] Male
[ ] Female (sex)

Number Street

City Zip

Grad. Phone

Parent's Name

[ ] Caucasian
[ ] Spanish Surname
[ ] Black
[ ] Oriental
[ ] Other
[ ] Unknown

____ of ____ (Class Rank)

	1	2
10		
11		
12		

____ 4.0
____ 3.0
____ 2.0
____ 1.0

____ % Verbal
____ % Non-Verbal
(Lorge-Thorndike)

[ ] CEEB (Check if taken)

[ ] 1
[ ] 2
[ ] 3
[ ] 4
(Years at School)

____ (Overall GPA)

[ ] student government
[ ] athletics
[ ] school clubs
[ ] school publications
[ ] pep club
[ ] cheerleader
[ ] others
[ ] no information available

completed by / date

____ Art
____ Business
____ Dance
____ Drafting
____ Drama
____ English
____ Foreign Language
____ Homemaking & Consumer
____ Industrial Arts
____ Math
____ Music
____ Science
____ Social Studies
____ Speech
____ Work Experience
____ Other
____ Other
____ Other

____ Agriculture
____ Construction Trades
____ Data Processing/Computer Programming
____ Distributive Education
____ Electronics
____ Floristry
____ Law Enforcement
____ Motor Vehicle Repairs
____ Other
____ Other
____ Other

____ Nursery School Aide
____ Nurse's Aide
____ Service Station Attendant

Figure 3. Student-record analysis data sheet.

analyzed separately and population profiles were obtained. These profiles described the percentage of graduates in each of the subdivisions of the classification factors derived from the student-record analyses.

Phase 2 - Data Collection

The behavioral and attitudinal data from the two populations, the classes of 1970 and 1971, were collected consecutively. For the 1970 class, data collection began in December, 1971; for the 1971 class, data collection began in April, 1972. The data were collected in this manner so that the techniques used for the 1970 class could be evaluated and, if necessary, modified for the class of 1971. As was mentioned earlier, the questionnaire was modified slightly for field use with the 1971 class. The data collection procedures used for both classes were, however, virtually identical with the exception of some minor details which will be described.

The questionnaires were professionally printed as were mailing and return envelopes. A first-class mailing permit was purchased and printed onto the mailing envelopes; the envelopes also had a printed return address in the upper left corner.* The return envelope was prepared in a business reply format with the same address as above. (For the class of 1971, both the mailing and return envelopes were prepared with conventional postage stamps, though the project address was printed as before on both envelopes. It was felt that this approach would lend a more "personal touch" and perhaps encourage returns.)

A cover letter accompanied the questionnaire. The letter, a sample of which is shown in Figure 4, was typed on the letterhead of each school and signed by the school principal. Copies of the letters were then printed in sufficient quantity for the number of graduates from each school.

*Project TRACE, 6780 Cortona Drive, Goleta, California 93017.

SANTA BARBARA HIGH SCHOOL DISTRICT

SAN MARCOS HIGH SCHOOL

4750 Hollister Avenue — Santa Barbara, California — 93105
(805) 967-4581

Home of the "ROYALS"

GENE G. HARTLEY
PRINCIPAL

Dear Former Student:

Under a special educational project, Project TRACE, a follow-up study of the graduates of 1970 is being conducted. The purpose of this study is to obtain information from former students that can be used to improve high school instructional and guidance programs. Now that you have been out of school for a while, you have probably given some thought to your high school preparation and how it has helped you or could have helped you more. Your opinions are of interest to us. We want to improve the schools. To do this, we need your help.

I have enclosed a questionnaire that deals with your high school and post-high school experiences. It will take you about 15 minutes to complete. I ask that you complete it at your earliest convenience, preferably before January 10, and then return it in the enclosed envelope. Please do not put it off.

Remember, your answers will help us improve the schools for future students, perhaps members of your own family. When we have completed our study, we will send you a letter describing its most important results.

Your replies on the questionnaire will be kept entirely CONFIDENTIAL. We emphasize this because we want you to answer as honestly and completely as possible.

I hope this letter finds you well. Best wishes and good luck to you in your future activities.

Cordially,

Gene G. Hartley

Gene G. Hartley
Principal

Figure 4. Sample cover letter used in first mail-out to the class of 1970.

A pair of address labels was prepared for each graduate. One of the labels was affixed to the mailing envelope; the other, which in addition to the graduate's name and address also had printed on it the graduate's identification number, telephone number, high school identification code number, and his year of graduation, was affixed to the questionnaire. The labels were printed by computer and were based upon the information obtained from the student-record analysis. In addition, a master list of all the graduates, containing all the information appearing on the questionnaire label and also the parent's name, was obtained on a computer print-out. This list was used to maintain a record of the respondents and non-respondents.

Both the questionnaire and the cover letter were pre-folded by the printer for ease in preparing for mailing. The first mail-out to the 1,771 graduates of 1970 took place on 18 December 1971. Two weeks afterward, a professional telephone-interviewing service began calling those graduates who had not yet responded to remind them to return the questionnaire. One week later, a second questionnaire accompanied by a new cover letter (Figure 5) was mailed to the non-respondents. Three weeks after that, the telephone-interviewing service began conducting interviews of the remaining non-respondents. An abbreviated form of the questionnaire (Figure 6) was used by the interviewers. In addition, the interviewers also requested the graduates to complete and return the questionnaire. Another questionnaire was mailed to those graduates who requested them. In the event a graduate was interviewed and also completed a questionnaire, the telephone interview data was discarded.

The same general procedures were used for the 1,941 graduates of 1971. However, one week prior to the first mail-out (which took place on 10 April 1972), postcards (Figure 7) were sent to the graduates informing them of the purpose of

Project TRACE
6780 Cortona Drive
Goleta, California 93017

Dear Former Student:

Several weeks ago we sent you a copy of our high school follow-up questionnaire, with a letter requesting your cooperation in completing and returning the questionnaire to us. You may remember from our letter that the questionnaire is being sent to former students to enable us to obtain information that can be used to improve high school instructional and guidance programs. During the past week you've probably also received a telephone reminder requesting your cooperation.

We have not yet received your completed questionnaire and have enclosed another in case the first was lost or thrown away. The fact that we have telephoned and sent you a second copy of the questionnaire should indicate the importance of your opinions to us. Please take a few minutes of your time to complete and return it now.

We have every intention of using the information obtained from this survey to improve your former high school, perhaps for the benefit of people you know or are related to. Filling out the questionnaire will NOT be a waste of your time. But before we can do anything, we must have your help.

Thank you for your cooperation.

Sincerely,

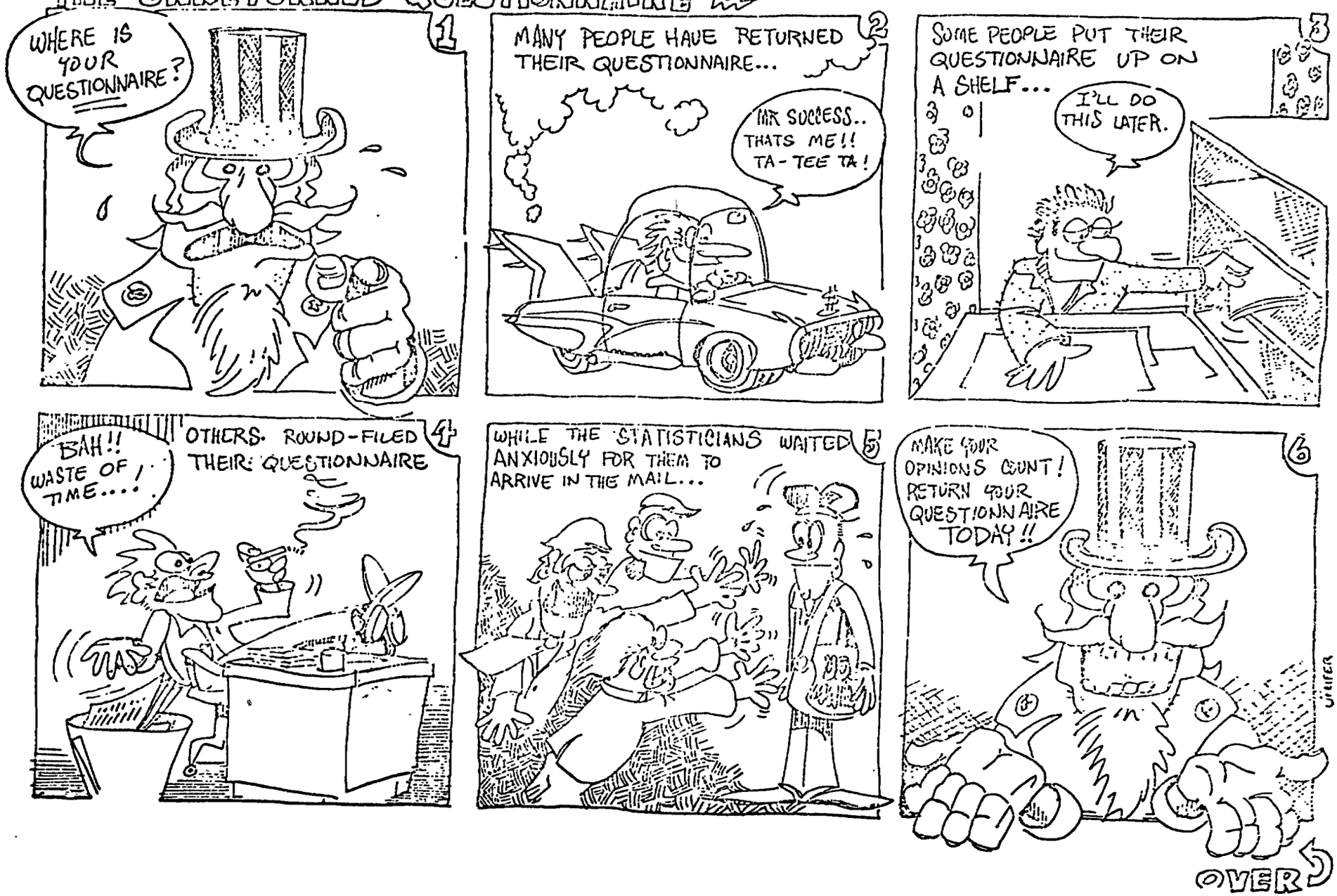
Charles Abrams

Charles Abrams, Ph.D.
Director, Project TRACE

CA/lja

Figure 5. Cover letter used in second mail-out.

THE UNRETURNED QUESTIONNAIRE



PROJECT TRACE TELEPHONE INTERVIEW

Student's Name_____ Interviewer's Initials____
Student's Number_____ Date_____

1. What is the former student doing at the present time? Circle each item that describes his present activity. (Ask italicized major category first; if answer is "yes," then ask sub-category.)

In School	(1) Full-time (2) Part-time	*Working*	(5) Full-time (6) Part-time
In Armed Forces (3)		*Not working*	(7) Looking for a job (8) Not looking for a job
Housewife (4)			
Other (describe) (0)_____			

2. If the former student is attending school full-time or part-time, what type of school is he attending? (Read out all the choices; after respondent indicates type of school, ask the name of the school and write in next to school type.)

(1) Four-year college or university_____
(2) Technical school_____
(3) Trade school_____
(4) Private business college_____
(5) Junior college_____
(0) Other_____

If the student is employed full-time or part-time, ask the following questions. If the student is unemployed, ask the questions in regard to the last job he held. (Write in answers.)

3. What business or industry are you employed in?_____

_____

4. What is your job title?_____

5. Which of the following statements best describes your job? (Read the choices below and circle the answer.)

___In a field for which I received specific high school training.
___In a field related to my high school training.
___In a field unrelated to my high school training.

6. What educational program did you take in high school? (Read the choices and check one.)

(1) College preparatory_____
(2) Vocational program (which one?)_____
(3) General program_____
(0) Other (describe)_____

7. What educational program would you take now if you had it to do over again? (Read choices.)

(1) Same program
(2) Different program (If different, which of the following?)

(1) College Preparatory_____
(2) Vocational program (which one?)_____
(3) General program_____
(0) Other (describe)_____

Thank the respondent for his cooperation and also ask that the questionnaire be completed and returned as soon as possible.

Indicate who respondent was (1) Student (3) Brother or Sister
(2) Parent (4) Other (specify)_____

Figure 6. Telephone interview data sheet.

Project TRACE
6780 CORTONA DRIVE
GOLETA, CALIFORNIA 93017

Dear Former Student:

In a few days you will receive a questionnaire about your high school education and experiences. The questionnaire is being sent out by Project TRACE, a special research project being conducted by the high schools in Santa Barbara and Carpinteria. The purpose of the project is to obtain information from former high school students that can be used to improve their schools. This will give you a chance to voice your opinions about both good and bad aspects of your high school years. The information will of course be kept strictly confidential. We hope that you will participate by completing your questionnaire. If you have any questions about Project TRACE or about the questionnaire, feel free to call Dr. Abrams or Mr. Simpson at (805) 968-1071.

Figure 7. Postcard mailed to the 1971 graduates prior to the first questionnaire.

the project and soliciting their cooperation. At the same time, local radio stations broadcast spot public-service announcements and local newspapers printed articles urging the graduates to cooperate and return the questionnaire.

The data obtained from the questionnaires and telephone interviews were coded, keypunched onto computer cards, and tabulated. The two graduating classes were treated separately. The characteristics of the respondents, in terms of the classification variables previously discussed, were compared with the statistical description of the population developed from the student-record analysis. In addition, the graduates' responses to the questionnaire items were analyzed in relation to several cross-tabulated classification variables.

Phase 3 - Sample Selection and Evaluation

Based upon the return rates and the differences in responses to the questionnaire items, several classification variables were selected for evaluation with stratified sampling models. The sizes of the samples were also varied to assess the effects of that factor upon the results obtained with the various sampling models. Thus, various samples were drawn from the pool of respondents and the quantitative results obtained in response to various questions were compared with the corresponding results for the total population of respondents.

These aspects of the sampling phase of the study--the selected classification variables, the sampling models, and the sample sizes--may be better appreciated when the results of the data collection are described. Therefore, a detailed description of Phase 3 will be deferred until those results are presented in the following section.

RESULTS

In this section, the findings and results obtained in each of the steps of Phase 2 of the study will be described.

The Record Analysis

The main purpose of the student-record analysis was to obtain data on each graduate that might be used effectively to classify him with respect to variables relevant to follow-up studies. These variables were also candidates for selection as stratification variables for use in the development of sampling models. Another purpose was to obtain data which could be used to describe the populations statistically.

Though a host of potential classification variables was examined, three were found which segmented the population with respect to response patterns and return rates. These were Sex, Ethnic Background, and Grade Point Average. Table 1 shows the number and percentage of graduates in the various levels of each of these variables. Of the 1,771 graduates of 1970, for example, 50.7 percent were males and 49.3 percent were females. The great majority of graduates, 83.6 percent, were Caucasian, 11.1 percent were Mexican-Americans, and the remaining small number of graduates were members of other minority groups. With respect to Grade Point Average, 16.2 percent of the graduates had overall averages of less than 2.0 on a 4-point scale; 51.8 percent had averages of between 2.0 to 2.9, and 25.6 percent had averages of 3.0 or greater. For some 6.4 percent of the graduates, no G.P.A. data were available; one of the schools, La Cuesta, does not grade the students. Though the data described above were for the graduating class as a whole, analogous numbers and percentages are presented for the individual schools. Similar data were obtained for other classification variables listed in Table 2 but were not presented since, as will be described later,

TABLE 1

STATISTICAL DESCRIPTIONS OF THE POPULATIONS AND SCHOOLS BY THREE CLASSIFICATION VARIABLES

	High Schools					
	Total	S. B.	S. M.	D. P.	L. C.	Carp.
CLASS OF 1970						
POPULATION SIZE	1771	666	530	384	47	144
SEX (%)						
Male	50.7	47.4	52.5	49.0	74.5	56.3
Female	49.3	52.6	47.5	51.0	25.5	43.8
ETHNIC BACKGROUND (%)						
Caucasian	83.6	75.4	90.0	91.9	83.0	75.7
Spanish Surname	11.1	17.0	5.5	6.3	8.5	18.1
Black	1.9	5.0	-	-	-	-
Oriental	1.3	1.1	1.5	1.6	-	1.4
Other/DK	2.1	1.5	3.0	.2	8.5	4.8
GRADE POINT AVERAGE (%)						
Less than 2.0	16.2	22.1	14.4	9.6	-	18.8
2.0-2.9	51.8	51.5	54.9	52.3	-	57.7
3.0+	25.6	21.5	30.0	33.4	-	16.7
DK/NA	6.4	5.0	.7	4.7	100.0	6.8
CLASS OF 1971						
POPULATION SIZE	1941	714	528	475	53	171
SEX (%)						
Male	50.6	46.2	51.5	53.9	56.6	55.6
Female	49.4	53.8	48.5	46.1	43.4	44.4
ETHNIC BACKGROUND (%)						
Caucasian	80.6	68.8	92.4	89.4	60.5	75.4
Spanisn Surname	12.5	20.0	4.0	6.7	13.2	23.4
Black	1.9	4.3	-	.2	7.5	-
Oriental	.7	1.3	.2	.6	-	-
Other/DK	4.3	5.6	3.4	3.1	18.8	1.2
GRADE POINT AVERAGE (%)						
Less than 2.0	16.5	20.9	14.6	10.5	-	25.8
2.0-2.9	49.8	51.7	51.7	48.8	-	55.0
3.0+	27.9	21.4	33.1	39.2	-	15.7
DK/NA	5.8	6.0	.6	1.5	100.0	3.5

TABLE 2

OTHER CLASSIFICATION VARIABLES

CLASS RANK (PERCENTILE)

CITIZENSHIP

LORGE-THORNDIKE VERBAL TEST SCORE (PERCENTILE)

NO. OF YEARS ATTENDED SCHOOL

NO. OF EXTRACURRICULAR ACTIVITIES

NO. OF SEMESTERS OF:

Art	Speech
Business	Work Experience
Dance	Agriculture
Drafting	Construction Trades
Drama	Computer Methods
Foreign Language	Distributive Education
Homemaking and Consumer Education	Electronics
Industrial Arts	Forestry
Math	Law Enforcement
Music	Motor Vehicle Repairs
Science	Nursery School Aide
Social Studies	Nurse's Aide
	Service Station Attendant

those variables were found to be substantially correlated with certain others and thus did not provide any additional useful basis for stratification.

Data Collection

Several steps were followed to obtain questionnaire responses from the graduates--two mail-outs three weeks apart and finally a telephone interview three weeks after the second mail-out. The 1970 graduates had been out of high school about

18 months before receiving the first questionnaire; the 1971 graduates had been out of high school about 10 months. Neither of the graduating classes had been informed about the follow-up questionnaire or its purposes while they were still in school; therefore, the burden of motivating them to respond fell upon an unexpected written communication. Ideally, of course, a good deal of indoctrination would have taken place while the students were still in school. It has generally been found that prior orientation and discussion regarding follow-up questionnaires are necessary if the study is to be successful. Nonetheless, good response rates were obtained from both classes.

The response rates of the two classes for each of the data collection steps are presented in Table 3. It can be seen that the highest response rates, for both classes, were obtained with the first mail-out, each succeeding step producing fewer returns. A total of 78 percent of the 1970 graduates and 82 percent of the 1971 graduates responded.

TABLE 3

PERCENT RETURNS OBTAINED
WITH EACH DATA COLLECTION PROCEDURE

	RETURNS	
	1970 (N=1,771)	1971 (N=1,941)
First Questionnaire Mail-Out	32%	39%
Second Questionnaire Mail-Out	29%	23%
Telephone Interviews	17%	20%
TOTAL RESPONDING	78%	82%
Undeliverable Questionnaires	9%	5%
Failed to Respond	13%	13%
TOTAL	100%	100%

During the time span between graduation and the first mail-out, some of the graduates had moved and either left no forwarding address or the forwarding order had expired. Questionnaires sent to those graduates were returned by the post office. For the class of 1970, the number of such returned questionnaires was 9 percent of the total mail-out; for the 1971 graduates, the total was 5 percent. Attempts were made to trace these graduates through their classmates, community college registration rosters, and telephone directories, and a small number was successfully located. Questionnaires were eventually returned from various locations in the United States, Europe, Southeast Asia, and the South Pacific.

In general, the percentages of 1970 and 1971 respondents at each level of the classification variables were very close to the population percentages. Table 4 compares the percentages for respondents and the total populations. Of particular interest is the fact that even though the percentages were not identical, the proportional makeups of the respondent pools were very similar to the makeups of the populations and well within sampling error tolerances. This indicates that the respondent pools of 1970 and 1971 were highly representative of their parent populations.

The finding that the percentages of the respondents in the various categories differed from the analogous population percentages is of some consequence in developing sampling models. Three classification variables in particular were noted to be critical in model development--Sex, Ethnic Background, and Grade Point Average. As can be seen in Table 4, though the females made up 49.3 and 49.4 percent of the populations in 1970 and 1971, respectively, they made up 50.5 and 51.1 percent of the respondent pools of 1970 and 1971, respectively. Similarly, the percentage of Caucasians in the respondent pools for both years was slightly *greater* than the

TABLE 4

PERCENT OF GRADUATES IN POPULATIONS AND AMONG RESPONDENTS IN EACH LEVEL OF CLASSIFICATION VARIABLES

	1970		1971	
SEX	POPULATION	RESPONDENTS	POPULATION	RESPONDENTS
Male	50.7	49.5	50.6	48.9
Female	49.3	50.5	49.4	51.1
ETHNIC BACKGROUND				
Caucasian	83.6	85.7	80.6	82.6
Spanish Surname	11.1	9.6	12.5	11.2
Black	1.9	1.5	1.9	1.6
Oriental	1.3	1.4	.7	.8
Other	2.1	1.8	4.3	3.8
GRADE POINT AVERAGE				
Less than 2.0	16.2	13.4	16.5	14.1
2.0-2.9	51.8	52.5	49.8	50.8
3.0+	25.6	29.3	27.9	30.6
DK/NA	6.4	4.8	5.8	4.5
CLASS RANK				
(Upper) 1-20 Percent	20.3	23.5	19.5	21.5
21-40 Percent	18.9	19.8	19.7	21.2
41-60 Percent	19.0	19.7	19.8	19.6
61-80 Percent	18.9	17.9	19.4	18.8
81-100 Percent	17.0	14.8	17.6	15.2
DK/NA	5.9	4.3	4.0	3.7
CITIZENSHIP				
Less than 2.0	1.2	.8	1.0	.6
2.0-2.9	22.9	21.2	20.5	20.2
3.0+	71.4	74.6	74.0	75.8
DK/NA	4.5	3.4	4.5	3.4
LORGE-THORNDIKE VERBAL TEST				
Upper 1-20 Percent	32.0	33.9	29.5	31.3
21-40 Percent	19.5	20.6	17.9	19.5
41-60 Percent	17.6	17.3	17.1	16.8
61-80 Percent	15.2	14.3	14.7	15.3
81-99 Percent	11.4	9.6	10.4	8.9
DK/NA	4.3	4.3	10.4	8.2
YEARS ATTENDED SCHOOL				
1	10.2	7.3	8.9	7.1
2	15.9	15.3	9.9	9.2
3	55.1	57.7	55.6	57.9
4	18.8	19.7	25.6	25.8

TABLE 4
(Continued)

N OF EXTRA-CURRICULAR ACTIVITIES	1970 POPULATION	1970 RESPONDENTS	1971 POPULATION	1971 RESPONDENTS
0	55.8	52.8	66.0	63.8
1	19.3	19.6	15.1	15.8
2	13.1	14.3	9.0	9.3
3	6.9	7.7	5.3	5.8
4	3.5	4.0	2.2	2.5
5	1.1	1.2	1.5	1.8
6	.2	.3	.7	.8
7+	.1	.1	.2	.2
NUMBER OF SEMESTERS OF BUSINESS				
0	33.2	34.2	33.7	33.4
1	14.9	14.9	15.7	15.5
2	22.8	22.8	22.9	23.8
3	8.5	7.9	7.4	7.5
4	7.4	7.0	6.5	6.2
5	3.2	3.2	3.9	3.9
6	4.1	3.9	2.8	2.7
7	1.6	1.5	2.1	2.1
8+	4.3	4.6	5.0	4.9
NUMBER OF SEMESTERS OF DRAFTING				
0	85.9	85.7	82.7	82.7
1	3.0	2.8	3.7	3.3
2	6.4	6.5	7.1	7.5
3	.7	.7	1.5	1.1
4	1.8	1.9	1.5	1.7
5	.3	.4	1.1	1.3
6	1.1	1.3	.7	.7
7	.3	.2	.6	.6
8+	.5	.5	1.1	1.1
NUMBER OF SEMESTERS OF INDUSTRIAL ARTS				
0	71.9	74.2	73.1	73.9
1	4.2	4.2	4.3	4.0
2	10.0	9.9	9.2	9.5
3	3.0	2.5	2.5	2.2
4	4.1	3.6	3.9	3.9
5	1.9	1.4	1.6	1.6
6	1.8	1.6	2.0	1.8
7	.8	.8	.7	.7
8+	2.3	1.8	2.7	2.4

TABLE 4
(Continued)

	1970		1971	
NUMBER OF SEMESTERS OF SCIENCE	POPULATION	RESPONDENTS	POPULATION	RESPONDENTS
0	5.0	4.4	7.4	6.3
1	2.5	2.2	4.9	4.4
2	45.0	44.8	39.5	39.7
3	9.4	9.3	12.9	13.0
4	19.9	19.8	16.8	17.1
5	5.6	6.1	7.2	7.6
6	7.7	8.4	5.5	5.5
7	1.8	1.7	2.3	2.5
8+	3.1	3.3	3.5	3.9
NUMBER OF SEMESTERS OF SOCIAL STUDIES				
0	.9	.8	1.3	.9
1	.2	.1	.4	.1
2	.2	.1	1.1	.9
3	.6	.5	1.0	.6
4	.9	.6	3.3	2.3
5	4.2	3.5	5.5	5.1
6	10.4	9.6	27.2	28.4
7	35.2	34.8	28.2	28.7
8+	47.4	50.0	32.0	33.0
NUMBER OF SEMESTERS OF WORK EXPERIENCE				
0	60.9	60.4	64.4	63.4
1	19.6	19.8	17.4	17.6
2	11.3	11.8	10.9	11.4
3	4.3	4.1	4.0	4.2
4	2.5	2.2	2.6	2.7
5	.8	1.0	.4	.5
6	.3	.4	.1	0.0
7	.2	.2	.1	.1
8+	.1	.1	.1	.1

percentage of Caucasians in the two populations while the Mexican-American and Black ethnic groups were slightly *underrepresented* among the respondents. With respect to Grade Point Average, those graduates who had averages of 3.0 or greater were overrepresented while graduates with averages of less than 2.0 were underrepresented. The graduates with

averages between 2.0 and 2.9 were slightly overrepresented among the respondents.

The differences between the population and respondent percentages are shown in a different manner in Table 5. The percent returns presented in this table are based upon the number of graduates in the populations who actually fell into the various categories. For example, only 76 percent of the 1970 male graduates responded while a total of 80 percent of the 1970 female graduates responded. Eighty percent of the Caucasians in the 1970 class responded but only 68 percent of the Mexican-American graduates responded. The percentage of Black graduates who responded in the 1970 class was even lower--64 percent--but the percentage of Oriental respondents was 83. While 89 percent of the 1970 graduates who had scholastic averages of 3.0 or greater responded, only 65 percent of those with averages of less than 2.0 responded.

For the 1971 graduates, the same general relationships among percentages within a given variable were obtained though the absolute values of the percentages were generally higher.

Examination of the other variables listed in Table 5 reveals discrepant return rates among the several levels of each of them. With respect to Class Rank, for example, it is evident that the response rates decreased virtually linearly as a function of the graduate's scholastic standing. Similarly, response rate can be seen to be positively correlated with Citizenship and also with achievement on the Lorge-Thorndike Verbal Test. Table 5 also reveals that graduates who attended the schools for the full, normal period of time (three or four years) tended to respond more readily than graduates who transferred into the school sometime during their high school educational period. Also, a positive relationship can be seen between response rate and the Number of Extracurricular Activities in which the graduates participated.

TABLE 5

PERCENT RETURNS FROM THE VARIOUS SEGMENTS OF THE POPULATIONS

	PERCENT RETURNS	
	1970	1971
TOTAL	78	82
SEX		
Male	76	79
Female	80	84
ETHNIC BACKGROUND		
Caucasian	80	84
Spanish Surname	68	73
Black	64	69
Oriental	83	92
Other	64	72
GRADE POINT AVERAGE		
Less than 2.0	65	70
2.0-2.9	79	83
3.0+	89	89
CLASS RANK		
(Upper) 1-20 Percent	90	90
21-40 Percent	81	89
41-60 Percent	81	85
61-80 Percent	74	79
81-99 Percent	68	71
CITIZENSHIP		
Less than 2.0	50	56
2.0-2.9	72	80
3.0+	82	84
LORGE-THORNDIKE VERBAL TEST		
(Upper) 1-20 Percent	84	87
21-40 Percent	82	89
41-60 Percent	77	80
61-80 Percent	73	85
81-99 Percent	66	70

TABLE 5
(Continued)

	PERCENT RETURNS	
	1970	1971
YEARS ATTENDED SCHOOL		
1	56	66
2	75	76
3	82	85
4	83	84
NUMBER OF EXTRA-CURRICULAR ACTIVITIES		
0	73	79
1	79	85
2	85	85
3	87	89
4	89	91
5	85	97
6	100	100
7+	100	80

Though all of the variables listed in Table 5 appear to differentiate among the graduates and therefore are candidates for stratification factors in sampling models, it is evident that several of them are highly interrelated. Thus, the use of all of them as stratification factors would be of very limited value in obtaining additional representativeness in any sample of the population and little, if any, gain would be achieved in reducing the error associated with sampling. As can be seen in Table 6, Class Rank, Lorge-Thorndike Verbal Test scores, and Citizenship grades are significantly correlated with Grade Point Average. Because of these correlations, and because Grade Point Average is easily obtained from the student record, there is no need to include the other variables in the sampling model.

TABLE 6

PEARSON PRODUCT-MOMENT COEFFICIENTS OF CORRELATION (r) BETWEEN GRADE POINT AVERAGE AND OTHER VARIABLES FOR 1970 AND 1971 POPULATIONS

	1970	1971
Grade Point Average and Lorge-Thorndike	.60	.54
Grade Point Average and Class Rank	.96	.89
Grade Point Average and Citizenship	.55	.51

Two other variables, years at school and number of extracurricular activities, also appear to differentiate among the graduates. As can be seen in Table 5, differences in return rates existed between those graduates who were enrolled in the schools for normal time periods (3 and 4 years) and those who were enrolled for lesser periods (1 or 2 years). However, inclusion of that variable as a stratification factor would serve to increase the number of strata in the model which, as discussed earlier, is not desirable from a practical and administrative standpoint. Additional examination of that variable is necessary to determine its cogency and usefulness in the sampling model. With respect to the extracurricular activity variable, it was found that pertinent data were difficult to obtain in certain schools and the cost-effectiveness related to the use of this variable suggests that it should not be used as a stratification factor. The issue of cost-effectiveness will be discussed in more detail later in this report.

One potential classification variable, which heretofore has not been discussed, is high school educational program. The three main levels of this variable are College Preparatory, General, and Vocational; these are usually defined in terms of the number and types of courses or course programs in which the

student participated. Earlier, it was stated that as part of the student-record analysis, data were obtained on the number of semester courses taken by students in various subject matter areas. A partial, representative, list of these data and the associated respondent data appear in Table 4. As can be seen, the population and respondent values are virtually identical. No bias is evident among the data to suggest that graduates who had been enrolled in certain educational programs (by virtue of courses taken) responded more readily than graduates enrolled in other programs. It was therefore not necessary to include high school educational program as a stratification variable in *this* study; however, the desirability of doing so in *subsequent* follow-up studies will be discussed in detail in the next section of the report.

In summary, the results obtained indicated that the respondents of the classes of 1970 and 1971 were highly representative of their respective populations. The results also revealed that three particularly cogent variables--Sex, Ethnic Background, and Grade Point Average--were associated with the response rates of the graduates and should therefore be evaluated for use in the sampling models. Though not discussed earlier, these variables were also noted, in some instances, to be related to differences among the kind of responses given by the graduates to items in the questionnaire. This finding further supports the use and evaluation of these variables in the sampling models.

Sampling Procedures

It may be of benefit to the reader if, prior to presenting the results obtained with the various sampling models, the techniques and procedures involved in implementing the models were described briefly. Two classes of samples were evaluated, random and stratified-random.

Although several equally good methods for selecting random samples are available, the method used in the present study was chosen for convenience. The steps were:

1. Determine the sample size desired.

2. Assign a number to each member of the population. If there are, say, 500 members in the population, the assignment would be from 001 to 500.

3. Divide the number of members (500) by the sample size (say, 100). The resulting value, 5 in this case, is the *skip number*.

4. Select a *start number* from a table of random numbers. Because the skip number is 5, the start number would be any number between 1 and 5.

5. Draw the sample. The first member drawn would be the one whose assigned number corresponded to the selected start number. Then, using the skip number as the sampling interval, the other members of the sample are drawn. If, for example, the selected start number was 3, the first member of the sample would be the individual assigned the number 3. Every fifth number from that point on would be drawn; thus, 008 would be drawn, then 013, 018, and so on, until the sample size equaled 100.

In selecting a stratified-random sample, there are a few additional procedures. There are:

1. Select the stratification variables.

2. Partition the population into the appropriate strata. If, for example, the stratification variables selected are Sex and Grade Point Average and the latter variable is subdivided into three levels, each of the population members would be classified in accordance with one of the six possible combinations of these variables. A hypothetical example is shown in Table 7.

TABLE 7

NUMBER AND PROPORTION OF POPULATION MEMBERS IN EACH SEX X GRADE POINT AVERAGE STRATUM (HYPOTHETICAL CASE)

GPA	*SEX* Male	Female	
<2.0	100 (p = .10)	70 (p = .07)	170
2.0-2.9	250 (p = .25)	230 (p = .23)	480
3.0+	150 (p = .15)	200 (p = .20)	350
	500	500	1000 = Total Population

3. Determine the proportion of the population in each stratum using the formula

$$\frac{\text{Number of Members in Stratum}}{\text{Total Number of Population}} = \text{Proportion}$$

In Table 7, the size of the hypothetical population is 1000. The number of Males with G.P.A.'s of less than 2.0 is 100. The proportion is therefore .10; similarly, the proportion of Males with G.P.A.'s of 2.0 to 2.9 is .25, and so forth.

4. Determine total sample size desired. (Considerations relating to sample size are presented later. For this example, assume that a sample size of 200 is desired.)

5. Determine stratum sample sizes using the formula

Total Sample Size x Proportion of Population in Stratum = Stratum Sample Size

Table 8 shows the stratum sizes based upon the proportions obtained in Table 7. The number of Males with G.P.A.'s of 2.0 or less to be included in the total sample is 20 (200 x .10); the number of Males with G.P.A.'s of 2.0 to 2.9 is 50 (200 x .25). The same procedure is used to determine the sample size for each of the other strata.

TABLE 8

INDIVIDUAL SEX X GRADE POINT AVERAGE
STRATUM SAMPLE SIZE AND START AND SKIP NUMBERS
(HYPOTHETICAL CASE)

GPA	*SEX* Male	Female	
<2.0	20 (2, 5)	14 (3, 5)	34
2.0-2.9	50 (1, 5)	46 (4, 5)	96
3.0+	30 (2, 5)	40 (5, 5)	70
	100	100	200 = Total Sample Size

6. Assign a number to each member of each stratum. In Table 7, it was shown that there were 100 Males with G.P.A.'s of less than 2.0. Each is assigned a number from 001 to 100. There were 250 Males with G.P.A.'s of between 2.0 to 2.9. Each is assigned a number from 001 to 250. And so on for each stratum.

7. Determine skip number for each stratum using the formula

$$\frac{\text{Number of Members in Stratum}}{\text{Number in Stratum Sample}} = \text{Skip Number}$$

The values used in this formula are obtained from Tables 7 and 8. There are 100 Males with G.P.A.'s of less than 2.0 (Table 7), of which 20 will be used in the stratified sample (Table 8). The skip number is therefore 5 (100/20). The skip numbers for each stratum are indicated in Table 8. In all cases, the number is 5.

8. Select a start number for each stratum using a table of random numbers.

9. Draw the appropriate sized sample from each stratum using the identified start and skip numbers. The same steps described for drawing a random sample are used.

Another consideration in implementing sampling models is that of the mail-out requirements. Because it is unlikely that every individual member in a sample will respond, it becomes necessary to *over-sample*, i.e., include an additional number of individuals in the sample above that of the desired sample size. There is further discussion of this aspect of sampling in the next section of this report.

Sampling Models

Three classification variables--Sex, Ethnic Background, and Grade Point Average--were found to affect the results obtained with the questionnaire. These variables were therefore evaluated with several sampling models. Examination of the 1970 data indicated that three stratified-random sampling models and a random sampling model should be evaluated. In addition, since size is an important factor in obtaining reliable data from samples, it was decided to evaluate four different sample sizes within each sampling model. Further, it was decided to treat the two populations, the classes of 1970 and 1971, separately and to validate the findings of the sampling models obtained with the 1970 data with the findings obtained with 1971 data using the same models.

Ten items from the questionnaire were selected for sampling model evaluation. They were selected on the basis of differences in responses made to them by the various segments of the population and also on the basis of differences in the absolute percentages associated with the alternative responses. The ten items are shown in Table 9 along with the population percentages associated with each item. The associated percentages can be seen to vary from 5.0 to 50.7 for the 1970 population and from 6.2 to 50.4 for the 1971 population. Also indicated are the base numbers used in computing some of the percentages since some of the items were applicable to only a certain number of graduates, i.e., those who were in school,

TABLE 9

TEN SELECTED QUESTIONNAIRE ITEMS USED IN SAMPLING MODEL EVALUATIONS AND ASSOCIATED POPULATION PERCENTAGES

	Population Percentages 1970	1971
1. In school, full-time	50.4	48.8
2. Working, full-time	24.2	23.6
3. In four-year college[a]	33.8	24.6
4. Receiving on-the-job training[b]	15.5	17.0
5. In field related to high school training[c]	14.0	13.0
6. College preparatory program	49.8	42.7
7. Industrial arts most useful course	5.0	6.2
8. Teachers presented relevant information (agree)	50.7	50.4
9. High school courses useful to career goals (agree)	27.3	24.8
10. Society favors those with different outlook (disagree)	41.9	41.3
	1970	1971
[a]Percentage base = those in school =	781	919
[b]Percentage base = those working =	729	825
[c]Percentage base = those working or looking =	892	1056

those who were working, or those who were working or looking for a job. The items listed reflect both behavioral (items 1-6) and attitudinal (items 7-10) questions posed in the questionnaire.

A total of 1,383 of the 1970 graduates responded in the study and a total of 1,583 of the 1971 graduates responded.

However, data regarding all three variables of interest were available for only 1,304 of the 1970 graduates and 1,474 of the 1971 graduates. The graduates for whom data on all three variables were available were considered as comprising the populations from which samples were drawn. There was no evidence to indicate that a bias existed among those graduates who responded but for whom the classification data were incomplete.

The four sampling models which were evaluated were:

1. Random sample.
2. Stratified-random sample--Sex and Ethnic Background.
3. Stratified-random sample--Sex and Grade Point Average.
4. Stratified-random sample--Sex, Ethnic Background, and Grade Point Average.

Each model was evaluated with four sample sizes:

	Population Percentages	
	1970	1971
1. N = 100	8	7
2. N = 150	12	10
3. N = 200	15	14
4. N = 250	19	17

Thus, a total of 16 samples were drawn from each of the two populations using the procedures described earlier. Each sample was drawn independently; it was therefore possible for any given individual to be a member of several different samples.

For each sample, the percentages associated with each of the 10 items shown in Table 9 were computed. The absolute differences between the population percentages and sample

percentages, for each item, were calculated and a mean error for all 10 items was computed. The results are shown in Table 10.

The mean percent error associated with the random sample of size 100 for the class of 1970 was 2.88 percent. The effect of increasing the sample size upon the error obtained with other randomly drawn samples can be seen by reading down the column headed Random. As is apparent, the amount of error is reduced with each successive increment in sample size. The mean total error obtained with the Random samples (across sizes) was 2.50 percent.

Similarly presented are the mean percent errors associated with each of the other sampling models as a function of sample size. With the exception of two minor reversals (Sex x Ethnic and Sex x G.P.A.; N = 150 in each case), the error is shown to decrease as sample size is increased. This can be clearly seen by examining the MEAN TOTAL ERROR column at the far right of the table.

With respect to the sampling models, it can be seen that there is generally a decrease in error associated with the stratified-random samples as compared to the random samples. However, here again some minor reversals are evident. With a sample size of 150, an insignificant but slightly higher error (1/20 of 1 percent) resulted with the Sex x Ethnic model as compared to the Random model. A slightly higher, but again insignificant, error was obtained with the Sex x Ethnic model as compared to the Random model with an N = 200. The errors associated with the other two stratified-random sampling models were smaller for each N than were the Random model errors. This is clearly seen by comparing the MEAN TOTAL ERROR associated with each model, across the bottom of the 1970 table.

Comparison of the three stratified sampling models indicates that the Sex x G.P.A. and Sex x Ethnic x G.P.A. models

TABLE 10

ERROR OF ESTIMATE ACROSS TEN SELECTED QUESTIONNAIRE ITEMS BY SAMPLING MODEL AND SAMPLE SIZE*

1970 CLASS

Sampling Model

Sample Size	Random	Sex x Ethnic	Sex x GPA	Sex x Ethnic x GPA	MEAN TOTAL ERROR
100	2.88	2.81	2.44	2.61	2.68
150	2.82	2.87	2.50	2.15	2.58
200	2.31	2.50	1.66	2.01	2.12
250	1.97	1.94	1.60	1.66	1.79
MEAN TOTAL ERROR	2.50	2.53	2.05	2.10	

1971 CLASS

Sampling Model

Sample Size	Random	Sex x Ethnic	Sex x GPA	Sex x Ethnic x GPA	MEAN TOTAL ERROR	1970/1971
100	3.93	3.87	3.34	3.60	3.68	3.18
150	4.48	2.18	3.32	2.94	3.32	2.95
200	2.19	3.77	2.02	2.33	2.58	2.35
250	2.75	1.93	2.03	2.37	2.27	2.03
MEAN TOTAL ERROR	3.34	2.93	2.68	2.81		

1970/1971	2.91	2.73	2.36	2.46

*Cell entries are mean differences between sample and population percentages.

resulted in less error than did the Sex x Ethnic model. This was true for each level of sample size. Though it would be expected that a lesser amount of error would be associated with the Sex x Ethnic x G.P.A. model as compared with the Sex x G.P.A. model, such was the case only when N = 150; with the other sample sizes a slightly higher error was obtained with the Sex x Ethnic x G.P.A. model. These reversals from the expected are, however, well within the limits of sampling errors. It should be noted that only one sample of each type was drawn for evaluative purposes. Theoretically, if a large number of samples of each sort were drawn and the distributions of the means of the samples compared, it would be found that the least amount of variability in the sample means (and consequently the least error) would occur with the Sex x Ethnic x G.P.A. model. This is shown in Figure 8 which depicts hypothetical distribution of means from random and stratified-random samples. In each of the four cases, the grand mean (mean of the means) has the same value; however, the distributions of the means around the grand mean differ. Approximately 68 percent of all the means fall between $\pm 1\sigma_{\bar{x}}$ (standard error); the closer $\sigma_{\bar{x}}$ is to the grand mean along the lateral axis, the less the dispersion of the means around the grand mean. Examination of the four cases reveals that the greatest dispersion occurs in Case 1, the random sample means, and the least dispersion occurs in Case 4, the three-variable stratified-random sample means. The dispersion in Cases 2 and 3 are equal since in both cases stratification was on two variables and the assumption was made that the ethnic and grade point average factors were equally cogent.

The results obtained with the same sampling models but using the 1971 data are also shown in Table 10. As with the 1970 data, the mean percent error is shown to decrease as sample size is increased. And, the stratified sampling models resulted in less overall error than did the random models.

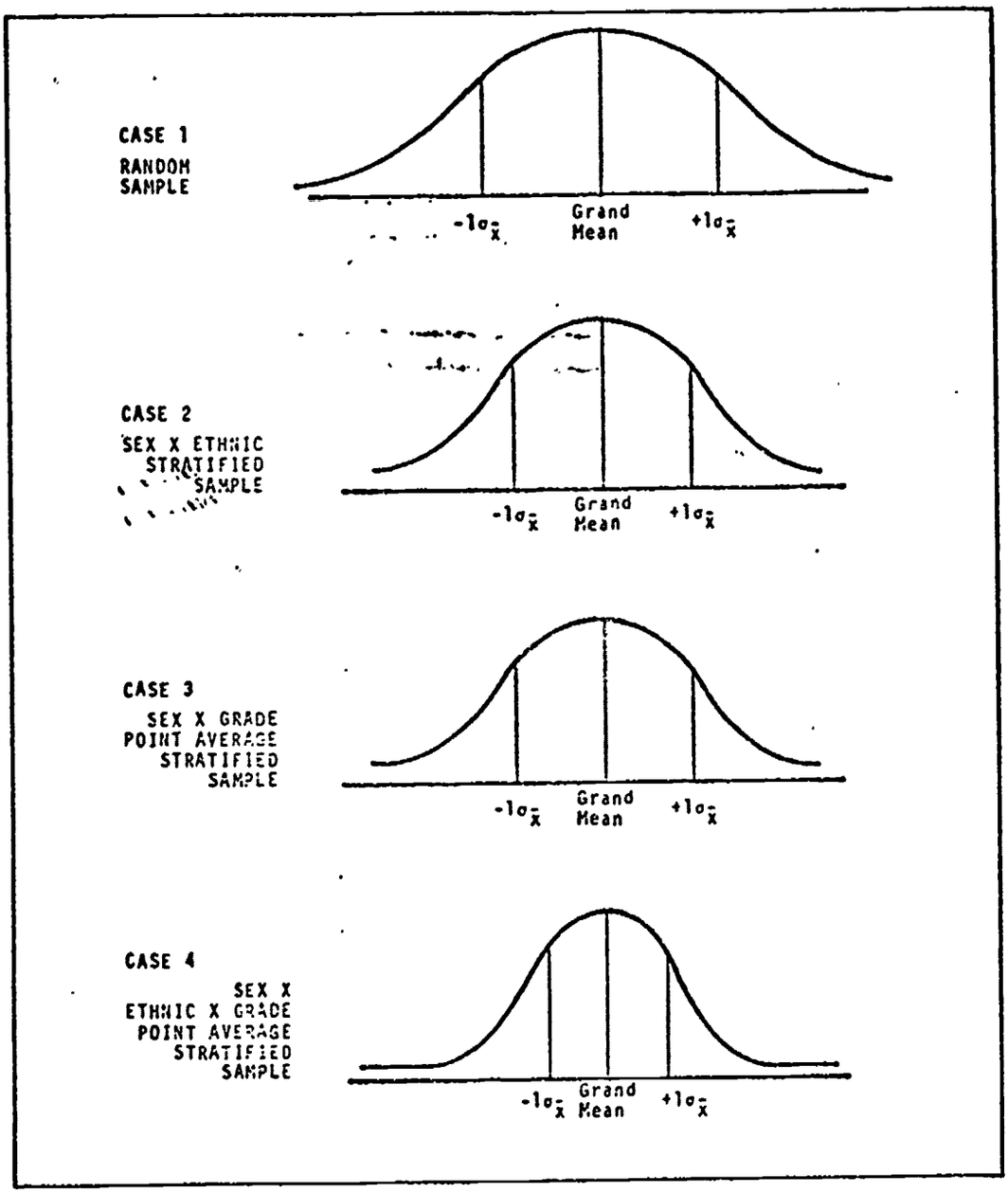


Figure 8. Hypothetical distributions of sample means showing decreases in variability as a result of stratification. Approximately 68 percent of the sample means fall between $\pm 1\sigma_{\bar{x}}$.

There were, however, some exceptions to the general trend. With a sample size of 200, the random model resulted in less error than did the Sex x Ethnic and Sex x Ethnic x G.P.A. models. Among the stratified models, generally less error resulted with the Sex x G.P.A. and Sex x Ethnic x G.P.A. than with the Sex x Ethnic model though here again some reversals

are evident. And, as with the 1970 data, the Sex x G.P.A. model resulted in less error than did the Sex x Ethnic x G.P.A. model. However, the same comments made earlier with respect to the number of samples drawn (one versus some larger number) apply to the 1971 sampling model results as well.

The two separate sub-tables appearing in the margins of Table 10 show the mean errors averaged across the 1970 and 1971 data for the several sample models and sample sizes. The sub-table appearing at the right shows that the mean percent error systematically decreased as sample size was increased. The sub-table appearing at the bottom shows that smaller mean error resulted with the stratified models than with the random models, and that the Sex x G.P.A. model produced the smallest error of all models tested.

DISCUSSION AND CONCLUSIONS

The main objectives of this study were to develop and evaluate procedures to be used in follow-up studies of high school graduates, to develop a self-administerable questionnaire which would provide actionable information and data from these graduates, to isolate pertinent stratification variables, and to evaluate various sampling models with respect to their possible application to follow-up studies. These objectives have been met.

Data Collection Procedures

The data collection procedures used provided excellent return rates from the two populations. Seventy-eight percent of the 1970 graduates and 82 percent of the 1971 graduates responded. These return rates were obtained without benefit of prior orientation of the graduates regarding the follow-up or prior exposure to and instruction for completing the questionnaire. There seems little doubt that even higher return rates would have been obtained had those preparatory steps been possible. It is strongly recommended that they be taken in future follow-up studies.

It is difficult to assess the value of the orientation postcard or the publicity given the project during the 1971 data collection phase of the study but such procedures might not be necessary if the students had an orientation session prior to graduation. No large benefit appeared to accrue from the use of conventional postage on the mailing and return envelopes as opposed to bulk first-class mailing and business reply formats. The latter approach is a more efficient and expeditious method for large mailings. The two mail-outs and telephone interview data collection procedures also appear to be optimal methods. It is unlikely that the mailing of a third questionnaire to previous non-respondents

would have resulted in as large an increment in responses as did the telephone interview procedure.

The Questionnaire

The questionnaire used in the field for the class of 1970 did not appear to be difficult for the graduates to understand and complete. However, examination of the responses to the individual items did suggest that a small number of graduates was confused by two of the items. The instructions for these items were altered slightly for the questionnaire used for the class of 1971. Examination of the responses from that class indicated that the problem had been resolved. The questionnaire shown in the text appears to be completely suitable for field use.

The Stratification Variables

Three pertinent stratification variables--Sex, Grade Point Average, and Ethnic Background--were isolated on the basis of response rates and answer patterns to the questionnaire items. Sex and Grade Point Average are easily obtained from the student record. It was found that Grade Point Average should be stratified into three levels: less than 2.0, 2.0 to 2.9, and 3.0 and greater. Though finer stratification is possible, it would not appreciably enhance the representativeness of a selected sample. Data concerning Ethnic Background were obtained by examining photographs of the graduates and their surnames. In the Santa Barbara schools, the populations were composed mainly of Caucasians and Mexican-Americans. The number of Black and Oriental graduates was small; consequently they were combined with other very small ethnic groups for purposes of analysis. Depending upon the ethnic composition of other schools, it may be desirable to further or differently stratify the ethnic variable.

As was mentioned earlier, high school program did not appear to be a pertinent stratification variable in the present

study. However, it is recommended that this variable be included in future studies. This would ensure an even more representative and precise sample and would allow for an in-depth evaluation of the program curricula. This is particularly important with respect to vocational programs because of the increase in their number and scope and the financial investments in them. It is also recommended that the various courses of study in the vocational program be stratified to permit finer program evaluation. Program stratification data for each student may be readily provided by the school counselor most familiar with the student or by the vocational education coordinator of a school or district. Inclusion of program as a stratification variable would be cost-effective inasmuch as information concerning the accomplishments of vocational students must be obtained as evidence for state and federal funding.

The other classification variables studied do not appear to be pertinent or cost-effective for inclusion as stratification factors. They were found to be either highly correlated with Grade Point Average or difficult to obtain from the student record. The additional expense which would be incurred in obtaining the data and including them in stratification does not appear to be cost-effective.

Sampling Models

Four different sampling models were evaluated and the results validated. The findings obtained indicate that stratified-random sampling models produce more accurate and precise results than does a random sampling model. It is therefore recommended that a stratified-random sampling model be used in follow-up studies. Though in the present study the Sex x Grade Point Average x Ethnic Background stratification did not provide the most accurate percentages when compared to the population values, they did not differ appreciably from the percentages obtained with the other stratified-random

sampling models. It seems likely that in areas where there are larger proportions of other ethnic groups than were encountered in this study, stratification by ethnic group could significantly improve sample representativeness. It must also be emphasized once again that only one sample from each model (within a given sample size) was drawn; if a larger number of samples from each model were drawn, the best results in terms of minimum sampling error might well have been obtained with the three-variable stratification model. This consideration, in addition to the previously discussed ease with which the stratification data can be obtained from the student record, advocates strongly the use of a stratified-random sampling model. We recommend, in fact, a four-variable stratification model where the fourth variable is high school program which was described earlier.

Sampling Error

In the present study, samples were drawn from the combined populations of the participating schools. This was done simply in the interest of economy and procedural convenience. However, similar, or possibly better, results would have been obtained had separate samples been drawn from each of the school populations. This can be shown by briefly discussing the concept of sampling error.

As was seen earlier, the percentages obtained with the various sampling models differed somewhat from the population percentages. This difference is referred to as sampling error. Usually, population values are not known so that sampling errors cannot be determined as was done in this study. But methods have been developed whereby the amount of error resulting from the use of sampling techniques can be estimated. Having examined the results obtained with the four sampling models, it may be worthwhile to consider briefly the benefits which accrue in terms of precision and accuracy from different sampling conditions and models.

Infinite Populations. When random samples are drawn from very large or so-called infinite populations, the sampling error can be estimated using the formula

$$SE_p = \sqrt{\frac{pq}{N}} \quad \text{where}$$

p = the proportion of the sample which is in a given response or descriptive category;

q = 1-p (the proportion of the sample not in the given category);

N = number in the sample.

As an example, assume that 100 high school seniors from across the nation are selected at random (the population from which they are drawn can be considered to be infinite) and asked whether they plan to continue their education after graduation. Fifty reply "yes" and 50 reply "no." How well do these proportions represent the entire high school senior population? The value of p = .50 (those who replied "yes") and q = 1-.50 or .50. Substituting in the formula, we obtain as the standard error of the proportion

$$SE_p = \sqrt{\frac{pq}{N}} = \sqrt{\frac{(.50)\ (.50)}{100}} = .05$$

This can be interpreted as meaning that the odds are about 2 to 1 that the proportion of seniors in the population who plan to continue their education after graduation is between .45 and .55; about 19 to 1 that the population proportion is between .40 and .60; and about 99 to 1 that the population proportion is between .37 and .63.

The results obtained with the formula depend relatively more upon the size of N than of p and q because the product of p and q remains fairly constant (between .20 and .25) for a large range of values of p (from .27 to .73). This means that error resulting from the use of random samples from very large or infinite populations can be reduced most effectively by increasing the size of the sample.

Finite Populations. However, when the population of interest is of a finite size and not many times as large as the sample (as in the case of the populations and samples used in the present study), sampling error is reduced by the inclusion of a correction factor into the previous formula. For finite populations, sampling error can be estimated using the formula

$$SE_{p_F} = \sqrt{\frac{pq}{N}\left(1-\frac{N}{N_p}\right)}$$

where N_p = the number in the population; and the other terms are defined as before.

As an example, assume that the survey described above was conducted at a single high school with a graduating population of 500, i.e., a finite population. As before, the sample size was 100 and p = .50 (those who replied "yes" to the question). Substituting in the formula, we obtain as the standard error

$$SE_{p_F} = \sqrt{\frac{(.50)\ (.50)}{100}\left(1-\frac{100}{500}\right)} = \sqrt{.0025\ (.80)} = .045.$$

Thus, sampling from a finite population as compared to an infinite population results in a reduced standard error (in this case, a 10 percent reduction) and inferences concerning the population are more accurate.

Stratified Sampling. When stratified-random sampling is employed, the standard error can be estimated using the formula

$$SE_{p_S} = \sqrt{\frac{pq}{N} - \frac{\sigma_m^2}{N}} \qquad \text{where}$$

σ_m^2 = weighted variance of strata proportions about the total sample proportion, p, and is computed as follows:

$$\sigma_m^2 = \frac{1}{N}\left[n_1(p_1-p)^2 + n_2\ (p_2-p)^2 + \ldots + n_k\ (p_k-p)^2\right]$$

where n_1, n_2, n_k = number of members in a stratum

p_1, p_2, p_k = proportion of the stratum which is in a given response or descriptive category

p = proportion of the entire sample which is in a given response or descriptive category

N = total sample size.

An example would perhaps best demonstrate the effects of the correction factor for stratified-random sampling. Assume that you are stratifying on Grade Point Average using just two levels, less than 2.0 and greater than 3.0. The question being asked of graduates is whether they are now in college.

Suppose that a sample of 100 graduates is drawn: 50 (n_1) with G.P.A.'s of <2 and 50 (n_2) with G.P.A.'s of >3. Of those with G.P.A.'s of <2, 10 reply that they are now in college (p_1=10/50=.20); of those with G.P.A.'s of >3, 40 reply that they are now in college (p_2=40/50=.80). Substituting in the equation for σ_m^2 we obtain

$$\sigma_m^2 = \frac{1}{100}\left[50(.20-.50)^2 + 50(.80-.50)^2\right] = .09, \text{ and}$$

substituting in the formula for the standard error we obtain

$$SE_{p_S} = \sqrt{\frac{(.5)\ (.5)}{100} - \frac{.09}{100}} = \sqrt{\frac{.25-.09}{100}} = .04$$

Thus the standard error is reduced from .05 (obtained for a sample drawn from an infinite population) to .04 by using a stratified-random sample--a reduction of 20 percent.

This brief discussion of sampling error serves to point up, once again, the benefits of stratified sampling over random sampling. Also, the additional effect of sampling from finite populations has been shown. These benefits were realized, of course, in the results obtained with the sampling models evaluated. They would similarly be realized in results obtained from individual samples drawn from each school population.

Sample Size

It has been shown, both in the discussion of sampling error and in the evaluation of the sampling model, that sample size is

of considerable importance in obtaining precise and accurate results. However, in selecting a sample size to be used in future follow-up studies, several criteria should be considered: the manpower and dollars allocated for the study (costs), the precision desired in the sample statistics, the size of the population, and whether sampling is to be proportionate or disproportionate with respect to certain variables of interest.

No hard or fast rules exist in selecting a sample size and generally some trade-offs or compromises must be made among the criteria mentioned. A typical trade-off is between statistical precision and allocated costs; most often, the costs dictate the precision. Keeping these considerations in mind, the following criteria are recommended for selecting a sample size:

1. The standard error of the sample statistics should be equal to or less than .04; and

2. The sample should contain at least 20 percent of the population members; and

3. The total sample size should not exceed 200 members.

Table 11 shows the recommended sample sizes based upon these criteria for various size populations. The standard errors were computed using the formula $SE = \sqrt{\frac{pq}{N}\left(1 - \frac{N}{N_p}\right)}$ and setting p = .50. As was discussed in the section on sampling error, lower or higher values of p serve to reduce the size of the standard error.

As is evident from Table 11, the recommended sample sizes vary from 76 (for a population of 150 graduates) to 200 (for a population of 1000); the percent of the populations in the samples varies from 51 to 20 percent. For small and moderate size schools (from 150 to 600 graduates), the standard error remains constant at .040 across the range of populations

TABLE 11

SAMPLE SIZES AND ASSOCIATED STANDARD ERRORS FOR GRADUATING CLASS POPULATIONS OF DIFFERENT SIZES

Population Size (N_p)	Sample Size (N)	Percent (N/N_p)	Standard Error
150-199	76-88	51-44	.040
200-249	88-97	44-39	.040
250-299	97-103	39-34	.040
300-349	103-109	34-31	.040
350-399	109-113	31-28	.040
400-449	113-117	28-26	.040
450-499	117-121	26-24	.040
500-549	121-124	24-23	.040
550-599	124-127	23-21	.040-.039
600-649	127-130	21-20	.039
650-699	130-140	20	.039-.038
700-749	140-150	20	.038-.037
750-799	150-160	20	.037-.035
800-849	160-170	20	.035-.034
850-899	170-180	20	.034-.033
900-949	180-190	20	.033-.032
950-999	190-200	20	.032
1000+	200	20-<20	.032-.035

although the percentage N/N_p varies; for larger schools (600 to 1000 graduates), the standard error decreases slightly as the population increases although the percentages N/N_p are constant at 20 percent. The recommended sample sizes thus adhere to the three listed criteria. In the rare instances where the graduating population exceeds 1000, sample sizes of 200 are recommended. Although this recommendation violates the 20 percent criterion, the standard error remains

well below the .040 level; in fact, the standard error will never exceed .035.

It is, of course, possible to reduce in size the samples drawn from the larger populations so that the standard error would remain a constant .040 across the entire population range. However, this is not recommended since reduction of the total sample is based upon proportional reduction of the strata subsamples. Because the strata subsamples are relatively small to begin with, in general, reduction in their sizes would adversely affect the reliability (accuracy) of the inferences which could be made from the strata samples to the analogous strata in the population. Similar reasoning applies to the indicated larger percentage of the population in the samples needed by the smaller schools.

It should also be appreciated that any beneficial effects of correcting for stratified-random sampling are not reflected in the standard errors listed in Table 11. As shown earlier, correction for stratification further increases the accuracy of sample statistics.

The techniques for determining individual stratum sample sizes were described earlier. That description was based on the assumption of proportionate sampling in which the strata sample sizes are based upon the number of members of the population falling into the various strata. It is sometimes necessary or desirable to obtain data from a specific stratum of the population which, because of its size or other considerations, is not sufficiently represented in proportionately drawn samples to permit reliable inferences to the population stratum. It is possible, however, to sample from such a population stratum in a disproportionate manner so that it is overrepresented in the total sample relative to its population proportion. By using this technique, specific inferences to the population stratum may be drawn from the stratum sample which otherwise might not be possible. This of course serves

to increase the overall sample size. If for some reason it is necessary to maintain a fixed sample size, then the other strata in the sample will be underrepresented relative to their population proportion and the sample statistics pertinent to those strata will lose some of the precision that would be obtained with proportionate sampling.

Over-Sampling

Earlier it was mentioned that not all sample members respond and that it is therefore necessary to over-sample to obtain a desired number of study participants. The general equation which can be used to determine the degree to which one over-samples or, put another way, the total number of questionnaires to be mailed out is

$$\text{Number of Mail-Outs Required} = \frac{\text{Sample Size Desired}}{\text{Weighting Factor}}$$

The weighting factor is generally determined from previous experience. Table 12 shows examples of the application of this equation for hypothetical random and stratified-random samples. The weighting factor used for the random samples is the average of the overall response rates from the 1970 and 1971 graduates. Substituting in the general equation, it can be seen that if the desired sample size (or the number of respondents desired) is 100, then questionnaires should be mailed to 125 individuals; if the number of respondents desired is 150, then 188 individuals should be mailed a questionnaire.

The same principles are used in determining the mail-out requirements for strata in the stratified-random sampling model. This is illustrated with the hypothetical Sex x Grade Point Average model described earlier. The desired sample size for each stratum in the model is indicated in the matrix at the left along with the return rates associated with them. The rates indicated are those obtained from the 1970 graduates.

TABLE 12

MAIL-OUT REQUIREMENTS FOR
RANDOM AND STRATIFIED SAMPLES

RANDOM SAMPLE

	SAMPLE SIZE DESIRED	NUMBER OF MAIL-OUTS REQUIRED
Weighting Factor = .80 (Mean of 1970 and 1971 Response Rates)	100	$125 = (\frac{100}{.80})$
	150	$188 = (\frac{150}{.80})$
	200	$250 = (\frac{200}{.80})$
	250	$312 = (\frac{250}{.80})$

SAMPLE STRATIFIED BY SEX AND GRADE POINT AVERAGE

SAMPLE SIZE DESIRED

GPA	*SEX* Male	Female	
<2.0	20 (64%)	14 (66%)	34
2.0-2.9	50 (79%)	46 (79%)	96
3.0+	30 (87%)	40 (91%)	70
	100	100	200

NUMBER OF MAIL-OUTS REQUIRED

GPA	*SEX* Male	Female	
<2.0	31 $(\frac{20}{.64})$	21 $(\frac{14}{.66})$	52
2.0-2.9	62 $(\frac{50}{.79})$	58 $(\frac{46}{.79})$	120
3.0+	34 $(\frac{30}{.87})$	44 $(\frac{40}{.91})$	78
	127	123	250

The matrix at the right shows the number of individuals who would have to be contacted to obtain the desired number of responses in each stratum. Thus, a total of 31 males with grade point averages of less than 2.0 would have to be contacted to ensure the desired 20 respondents; a total of 62 males with grade point averages of 2.0 to 2.9 would have to be contacted to ensure the desired 50 respondents in the second stratum, and so on.

Of course, the total number of individuals who are to be sent questionnaires should be selected from the total population (in the case of stratified-random sampling) according to the sample selection techniques described earlier. It cannot be overemphasized that proper, unbiased, sample selection is the key to the successful application of sampling techniques. An improperly selected or inadvertently biased sample, regardless of its size, will not be representative of the population to which inferences will be made and therefore the validity of the inferences will be open to question.

Conclusions

The findings of this study indicate that sampling techniques can be effectively and economically applied in follow-up studies. The most appropriate sampling model for follow-up studies is a four-variable stratified-random sample model, incorporating Sex, Grade Point Average, Ethnic Background, and High School Program as stratification factors. The procedures outlined and the questionnaire developed also appear to be well-suited for the successful implementation of sampling techniques in follow-up studies.