IMPROVED ESTIMATION OF ACADEMIC CHEATING BEHAVIOR USING THE RANDOMIZED RESPONSE TECHNIQUE

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Academic cheating behavior by university students was surveyed using the randomized response technique (RRT) and by conventional anonymous questionnaire methods. RRT is a survey method that permits sensitive information to be collected but that precludes associating the respondent with a particular response to a survey item. The estimated proportions of students who have engaged in cheating behaviors were, in general, larger using RRT. Moreover, this result is consistent with earlier findings for other sensitive behaviors. That underreporting is a serious problem with anonymous questionnaires is supported by the fact that the anonymous questionnaire estimates ranged from 39% to 83% below the RRT estimates. Furthermore, using a covariate modification of RRT, there was a distinct inverse relation between students' estimated grade-point average and the tendency to engage in cheating behavior. While these results have direct implications for estimating cheating behavior in higher education, more broadly, they raise serious concerns about the use of anonymous questionnaires when survey topics are sensitive.

While academic cheating has been recognized as a serious problem in American higher education, the magnitude of the problem may be larger than previously reported because of severe underestimation resulting from methodological limitations. Typically, researchers have relied on anonymous questionnaires in studies of academic cheating, but such questionnaires have been found to result in underestimation of sensitive behaviors and to have large nonsampling errors (Sudman and Bradburn, 1974). In addition, aggregate estimates of academic cheating behaviors may be misleading. A consistent finding from more than 50 years of research is that cheating is more frequent among students with lower academic achievement (Baird, 1980; Bronzaft et al., 1973; Campbell, 1933; Hartshorne and May, 1928; Howells,

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1938; Parr, 1936; Vitro, 1971). Therefore, aggregate estimates of cheating tend to overestimate the frequency of this behavior at the higher achievement levels and underestimate its frequency at the lower achievement levels.

The purpose of the present study was to attack both of the above concerns by the following:

1. Providing estimates of five academic cheating behaviors using the randomized response technique (RRT), which is designed to increase reporting of sensitive behaviors;
2. Comparing estimates obtained by RRT methods to those obtained by anonymous questionnaire;
3. Examining the relationship between grade-point average (GPA) and cheating behaviors using a covariate modification of the unrelated-question RRT technique.

THE RANDOMIZED RESPONSE TECHNIQUE

RRT is a survey method developed by Warner (1965) that allows sensitive information to be collected without associating an individual with any particular response. Because the respondent does not reveal his/her personal situation, any potential embarrassment or stigma has been removed, and with it, the primary reason for lying or for refusing to respond. RRT procedures have been found to produce higher estimates of many sensitive characteristics when compared to anonymous questionnaires and to yield lower refusal rates (Goodstadt and Gruson, 1975; Krotki and Fox, 1974; Lamb and Stem, 1978; Shimizu and Bonham, 1978; Zdep and Rhodes, 1977).

The Warner randomized response technique requires that the respondent select a statement by chance from two mutually exclusive statements. The statements are of the general form:

A: I have sensitive characteristic A
$\bar{A}$: I do not have sensitive characteristic A

The selection is made in private with the aid of a randomizing device, such as a box containing beads of two different colors, and without indicating to the interviewer which statement was selected. The probability of selecting the sensitive statement is determined by the construction of the randomizing device (i.e., set by the researcher). The response options for the two forms of the statement must be the same (e.g., yes/no or agree/disagree) so that the interviewer is unable to determine which statement was selected by a given individual. However, there is sufficient information from the sample as a whole (i.e., the total number of "yes" or "agree" responses and the prob-

ability of selecting the sensitive statement) to estimate the proportion of the population with the sensitive characteristic as well as to estimate the standard error of this proportion.

Greenberg et al. (1969) modified the Warner technique so that the statements presented to respondents were unrelated rather than being mutually exclusive. The procedure is the same as for the Warner technique except that the statements are of the general form:

A: I have sensitive characteristic A
Y: I have nonsensitive characteristic Y

If the probability of occurrence of the nonsensitive statement (Y) is known *a priori,* then this model is the so-called π_Y-known version of the unrelated-question RRT technique. This was the model used in the present study. If the probability of occurrence of the nonsensitive statement is not known, then two samples are necessary in order to estimate proportions for both the sensitive and nonsensitive characteristics. However, this form of the model is not developed in this paper. For the π_Y-known model, the probability of a "yes" or "agree" response, λ, is

$$\lambda = P \cdot \pi_A + (1 - P) \cdot \pi_Y$$

where π_A is the proportion of people with the sensitive characteristic, π_Y is the proportion of people with the nonsensitive characteristic, and P is the probability of selecting the sensitive statement. The maximum likelihood estimator of π_A *is*

$$\hat{\pi}_A = [\hat{\lambda} - (1 - P) \cdot \pi_Y]/P$$

where $\hat{\lambda}$ is the proportion of "yes" or "agree" responses in the sample. The estimate must be restricted to the 0, 1 interval (Fligner et al., 1977; Devore, 1977) and the sampling variance of the estimate is

$$\text{Var}(\hat{\pi}_A \mid \pi_Y) = [\lambda \cdot (1 - \lambda)]/(n \cdot P^2)$$

This variance can be estimated by substituting $\hat{\lambda}$ for λ.

For the covariate modification of the π_Y-known unrelated-question RRT, an additional, nonsensitive statement, X, is answered anonymously by each respondent. A typical statement is:

X: Estimate your grade-point average

Assuming that the relationship between X, the covariate, and π_A, the pro-

portion with the sensitive behavior, follows a logistic function, estimates of the proportion with the sensitive behavior, as well as standard errors, can be determined for each level of the covariate (Scheers and Dayton, 1982). The logistic function was chosen because (1) it allows the covariate, which, theoretically, has infinite range to map estimates onto the 0 to 1 interval and (2) it has been widely used in social science research. The model for a "yes" or "agree" response, conditional on level i of the covariate, X, is:

$$\lambda_i = P/[1 + \exp(-\beta_0 - \beta_1 X_i)] + (1 - P) \cdot \pi_Y$$

where β_0 and β_1 are parameters of the logistic function that must be estimated from the data. A FORTRAN computer program (Scheers and Dayton, 1986) has been developed to provide the logistic parameter estimates and associated statistics for the covariate extension of the unrelated-question RRT model. An IBM PC version of the program, along with a source listing and user's manual, is available free from either author if a double-sided, double-density 5.25″ floppy diskette is supplied.

METHOD

Estimates for five academic cheating behaviors were obtained from a group of university students using the covariate modification of the unrelated-question, π_Y-known randomized response technique and for a group of university students that was questioned anonymously. For the anonymous questionnaire, respondents circled "true" or "false" after each statement. For the unrelated-question technique, a pair of statements was presented to respondents, one of which was sensitive (A) and one of which was nonsensitive (Y). For example:

A: I have cheated on an exam by copying the answers from someone sitting near me.
Y: I was born in January, February, or March.

Only one statement in each pair was answered by a given respondent, and the choice of A or Y was determined by use of a spinner which was constructed so that the probability, P, of selecting the sensitive statement was .70. Respondents selected statements in private so that the interviewer knew only the response (i.e., "true" or "false"). The statements related to cheating are given in Table 1.

Nonsensitive statements were constructed from students' Social Security numbers, birth months, and numbers of credit hours taken in spring semester, 1981. The proportion of respondents with each nonsensitive characteris-

TABLE 1. RRT and Anonymous Questionnaire Estimates and Standard Errors (SE) for Cheating Behaviors at 5 GPA Levels

	Randomized Response		Anonymous Questionnaire	
GPA	Estimate	SE	Estimate	SE
1. I have lied to a teacher to avoid taking an exam.				
3.76–4.00	.13	.05	.00	
3.51–3.75	.18	.04	.08	.05
3.26–3.50	.23	.04	.06	.04
3.00–3.25	.30	.06	.33	.08
2.99 or less	.37	.09	.24	.06
2. I have lied to a teacher to avoid handing in a term paper on time.				
3.76–4.00	.16	.07	.05	.09
3.51–3.75	.22	.06	.00	
3.26–3.50	.30	.06	.15	.06
3.00–3.25	.38	.07	.33	.09
2.99 or less	.48	.03	.20	.06
3. I have turned in a term paper which was purchased from someone else.				
3.76–4.00	.14	.06	.00	
3.51–3.75	.15	.04	.00	
3.26–3.50	.16	.04	.00	
3.00–3.25	.17	.06	.10	.05
2.99 or less	.18	.08	.04	.03
4. I have cheated on an exam by obtaining a copy of the exam before taking it.				
3.76–4.00	.17	.07	.05	.03
3.51–3.75	.20	.06	.00	
3.26–3.50	.22	.05	.06	.04
3.00–3.25	.25	.07	.10	.05
2.99 or less	.28	.10	.20	.06
5. I have cheated on an examination by copying the answers from someone sitting near me.				
3.76–4.00	.21	.07	.13	.04
3.51–3.75	.37	.07	.19	.08
3.26–3.50	.56	.07	.36	.08
3.00–3.25	.74	.07	.37	.09
2.99 or less	.86	.06	.47	.07

tic was obtained from available records on a group basis before the survey was administered. Covariate information was provided anonymously by respondents who reported their GPA in the categories: (5) 3.76–4.00, (4) 3.51–3.75, (3) 3.26–3.5, (2) 3.00–3.25, or (1) 2.99 or less.

SAMPLE

A convenience sample of 378 students from 16 graduate and undergraduate education classes at a large eastern university volunteered for the study (there were 3 individuals who refused to participate). The type of questionnaire, RRT or anonymous, was randomly assigned to classes with the restriction that each method was assigned to an equal number of classes. Overall, 184 students responded using RRT, while 194 responded to the anonymous questionnaire. It should be noted that some bias may exist, since both types of questionnaires were administered to intact groups, but there is no reason to believe that this factor influences the comparison between the RRT and anonymous questionnaire groups.

RESULTS

Estimates for the five cheating behaviors were determined from the RRT questionnaire and from the anonymous questionnaire across the five GPA levels (Table 1). RRT estimates were larger than estimates found with the anonymous questionnaire in 24 out of the 25 cases reported in Table 1 and all observed differences are statistically significant. The weighted average of the estimates of cheating behavior was calculated across the five GPA levels for each cheating behavior (Table 2). Differences between the estimates for the RRT and the anonymous questionnaire were found to range from .10 to .19. Since the estimated proportions were in a range from .15 to .48, this indicates relatively severe underreporting. In percentage terms, apparent underreporting ranged from 39% to 83%, suggesting that statements about academic cheating were sensitive for this sample of respondents. Parenthetically, the topic of academic cheating appears to be sensitive to faculty members and university administrators as well, since certain units within the university have strongly discouraged the authors from collecting additional data.

Examining the results from the RRT questionnaire as a function of GPA (Table 1) shows that substantially different estimates of cheating behaviors occur at the various GPA levels. This implies that ignoring GPA produces misleading results, and this discrepancy is greater for some cheating behaviors than for others. The most dramatic variation in the estimates occurred in statement 5 where the percentage of students who admitted to copying

TABLE 2. RRT and Anonymous Questionnaire Cheating Estimates: Weighted Average over GPA Levels

Statement Summary	Covariate RRT Estimate	Anonymous Questionnaire Estimate	Percent of Underreporting
1. Lied to avoid exam	.224	.128	42.9
2. Lied to avoid term paper	.281	.139	50.5
3. Purchased term paper	.154	.026	83.1
4. Obtained copy of exam	.215	.088	59.1
5. Copied answers on exam	.482	.294	39.0

answers on examinations ranged from 21% at the highest GPA level to 86% at the lowest GPA level for the covariate model.

The logistic function was found to be a parsimonious representation of the relation between π_A, the proportion of people with the sensitive characteristic, and the covariate, GPA. Chi-square goodness-of-fit tests were conducted for each of the five questions and the resulting chi-square statistics, with 3 degrees of freedom, were 1.36, 3.66, 0.14, 1.18, and 3.10, respectively. Since each chi-square statistic is nonsignificant, this can be interpreted as meaning that the logistic covariate model fits the observed data as well as separate estimates at each covariate level using the usual unrelated-question model.

SUMMARY AND CONCLUSIONS

The present study of academic cheating behaviors in a university setting found large discrepancies between estimates determined by responses to an anonymous questionnaire and responses to the same questionnaire using the randomized response technique. Higher estimates of these sensitive behaviors were found consistently when RRT was compared to anonymous questionnaire, suggesting that more respondents were not truthful when responding to the anonymous questionnaire.

It has been clear from other studies using randomized response that sensitive behaviors are underestimated by anonymous questionnaires. This study found academic cheating behaviors to be so sensitive that the percentage of underreporting ranged from 39% to 83% for aggregate estimates. Results from both the RRT and anonymous questionnaire showed an inverse relationship between GPA and the proportion of people who admitted to cheating behaviors. Thus, generalizing aggregate estimates of cheating behaviors across GPA levels results in misleading estimates for those individuals at the extremes of the GPA distribution.

While the results of this study have direct implications for the design of surveys to assess cheating among university students, there are much broader implications that must be drawn with respect to assessing behaviors which may be sensitive to students. Current evidence, as exemplified by this study, suggests that the anonymous questionnaire is an inadequate data collection device when a survey involves sensitive issues. Since it is reasonable to assume that many other topics of current interest, such as drug use, sexual behavior, may be sensitive for students in higher education, the implication is that survey results are negatively biased and that this bias may be serious in magnitude. It is apparent that the promise of anonymity does not eliminate serious underreporting of sensitive behaviors, and researchers in higher education should consider alternate procedures, such as the randomized response technique, in order to cope with these underreporting tendencies.

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