



Validation of Symmetric Truth Detection Models Using Examination Dishonesty Research

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Abstract: Examinations across the world play a vital role in the education system. Unfortunately, the process of examinations is greatly affected by the act of cheating hence giving a wrong impression on the results. The research on examination dishonesty among secondary school students is considered to be a sensitive issue, thus direct questioning techniques are not useful as the respondents will either refuse to answer the survey questions or even if they do, may give false answers for fear of being known to have been involved in the cheating. In this paper we have tested the validity of Symmetric truth detection models using examination dishonesty research. This research was done in a national Secondary school in Kenya. The results were used to validate the Symmetric Truth detection models by comparing the results with the results of the Asymmetric questioning technique. We have shown that the Symmetric truth detection models are more reliable when investigating sensitive information compared to Asymmetric truth detection models.

Keywords: Randomized response, Symmetric questioning technique, Sensitive questions, Asymmetric questioning technique, examination dishonesty.

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1. Introduction

In research, the validity of the information gathered is very important for decision making. When sensitive topics such as examination dishonesty are studied, respondents often react in ways that negatively affect the validity of the data. This is because in such research, the respondents' have a tendency to give socially desirable answers to avoid social embarrassment and to project a positive self-image Sudman, & Bradburn [7]. In such situations, there is often a need for more efficient questioning techniques for collecting data. One such technique is the randomized response which was introduced by Warner [8]. Warner [8] argued that the reluctance of the respondents to reveal sensitive or probably harmful information would diminish if respondents were convinced that their anonymity was guaranteed. The basic assumption in randomized response is that incriminating answers could be covered from the interviewer, if the need to present oneself in a positive way would decrease and honest answering would increase. Following this assumption, a randomized response device should be designed in a way that the respondents' answer is hidden in the questioning technique used.

2. Literature Review

Randomized response methods have been used in many studies in different fields. Studies were conducted in the areas of health care Chaudhuri [2], alcohol and drug abuse Jarman [4], attitudes Antonak and Livneh [1]; Jarman [4] and on welfare

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Heijden [3] Meta-analysis on 42 comparative studies by Lensvelt-Mulders, [5] showed that randomized response conditions resulted in more valid population estimates than direct question–answer conditions, where direct question–answer conditions is the umbrella term for research methods in which the (sensitive) question is asked directly to the respondent Lensvelt-Mulders [5]. However, the questioning technique determines the degree of privacy of the respondents. The earlier randomized response techniques discussed above used Asymmetric truth detection models. This questioning technique offered less privacy protection since it used only one randomization device hence many respondents denied having the sensitive attribute for fear of being identified by the interviewee. The results by Asymmetric questioning technique also had high level of non response and large variance hence not reliable for decision making. However no effort has been made to estimate the proportion of sensitive attribute using Symmetric truth detection models. In this paper we have used examination dishonesty research to validate the model Symmetric truth detection models.

3. The Asymmetric Questioning

The Asymmetric truth detection models questioning was formulated by use of one randomization device to collect sensitive attribute Martin, [8]. In this method, a single box containing cards with two different questions is used as a randomization device to collect the information. The respondents are then presented with a box containing two types of cards labeled A and B. A respondent is instructed to draw a card at random and select one of the statements on the card as given below;

A. I have ever cheated in examination.

B. I never cheated in examination.

where A is the sensitive attribute and B is the non sensitive attribute.

The respondents then have the option of responding ‘yes’ or ‘no’ according to whether or not they belong to the group of sensitive attribute. The researcher will then count the number of “yes” responses and subtract the number of yes for question B to determine the proportion of the sample that engages in the examination dishonesty.

4. Symmetric Questioning Technique

In the Asymmetric questioning, there was less privacy leading to less compliance to the instructions given by the researcher. This would lead to low number of respondents admitting possession of the sensitive attribute even if they have it. This would lead to invalid data and wrong decision making.

The Symmetric questioning technique uses unrelated questioning technique to collect sensitive data hence improving the privacy of the respondent. Using symmetric questioning technique, the researchers uses two randomization devices to collect the sensitive information hence increasing the privacy of the respondents leading to more honest response. In this paper we have validated the Symmetric truth detection models by estimating the proportion of secondary school students engaged in examination dishonesty. Each participant was presented with two randomization devices like two different boxes. The respondents were required to pick a box, then a card from the box and respond according to the given information. Each participant would be asked his or her gender and their type of their admission number which would be used as the randomization devices. The respondent is then given the instructions on how to use the number in answering the questions. The participants would be told to answer that question according to their admission number and the following rule:

“If your admission number is even, then answer the question truthfully, if it is odd, then ignore the question altogether and just say ‘yes’ no matter what you would have answered to the question.” An affirmative response could mean either that

the respondent had engaged in examination dishonesty behavior or simply that he had an odd admission number. Even if a participant’s answer is known, his or her actual behavior could not be deduced from the answer, thus confidentiality would be guaranteed. Nevertheless, the investigator can determine the proportion of the sample that engages in any behavior using an equation derived as follows.

Let α be the proportion of the population that would privately admit to having engaged in the sensitive behavior and λ be the proportion of affirmative responses given. The respondents who engaged in the sensitive behavior (α) will have answered “yes” regardless of the outcome of their admission number and if the numbers are well distributed, half of the participants who have not engaged in the behavior given by $0.5(1 - \alpha)$, will have also answered “yes” because their admission number is odd. The total number of “yes” denoted by λ will be given by;

$$\lambda = \alpha + 0.5(1 - \alpha) \tag{1}$$

If we multiply by 2 both sides we get;

$$2\lambda = 2\alpha + 1 - \alpha \tag{2}$$

Which simplifies to;

$$2\lambda = \alpha + 1 \tag{3}$$

This implies that,

$$\alpha = 2\lambda - 1 \tag{4}$$

Equation (4) is the equation which will be used to calculate the for proportion of the population that would privately admit to having engaged in the sensitive behavior. If for example $\lambda = 0.57$, it would mean that; $\alpha = 0.14$, which implies that, 14% of the respondents engaged in the examination dishonesty.

4.1. Expected Results

The expected results are presented in Table 1 below.

Characteristic	True yes	True no	Cheater
Engaged in sensitive behavior	Yes	No	Unknown
Proportion in sample	α	$1 - \alpha$	β
Response to even number	Yes	No	No
Response to odd number	Yes	Yes	No

Table 1. Expected results in Symmetric questioning

Although the authors first concern was to help respondents to answer more truthfully, this method has the added statistical advantage of reducing the variance in the Asymmetric truth detection models. When the occurrence in the population of the non-sensitive attribute is not known beforehand two independent non-overlapping random samples are needed to compute an unbiased estimate of the sensitive attribute.

5. Methodology

Data for this study was collected form thee secondary schools in Muthale girls’ in Kitui County, Kenya. The students completed the questionnaires in groups and on an anonymous and voluntary basis. Among some basic demographic ques- tions and questions unrelated to the current study, the questionnaire included the sensitive question concerning academic

dishonesty. In the Asymmetric questioning baseline condition, respondents were simply asked to reply “yes” or “no” to the sensitive question. In the symmetric questioning, the sensitive question was asked in the following way;

“If your admission number is odd number, then please reply “yes” to the following question independently of its content. If, however, your admission number is even, then please answer truthfully.” The probability of being forced to say “yes” was thus approximated as $p_1 = \alpha$, where α , was confirmed by admission statistics collected from the admission register. In the second group the instructions read as: “If your admission number is a odd number, then please reply “no” to the following question independently of its content. If, however, your admission number is an even number, then please answer truthfully.” The survey data obtained by Asymmetric questioning were compared to the corresponding information obtained by the Symmetric questioning technique. The questions used in this study were as follows;

(1). What is your gender?

(a). Male ()

(b). Female ()

(2). What is the type of your admission number?

(a). Even number ()

(b). Odd number ()

(3). If your admission number is odd, then please reply “yes” to the following question independently of its content, if however, your admission number is an even, then please answer truthfully the question below;

Have you ever cheated in examination? Yes () No ()

(4). If your admission number is a odd number, then please reply “no” to the following question independently of its content.

If, however, your admission number is even number, then please answer truthfully to the question below;

Have you ever cheated in examination? Yes () No ()

The responses for the Symmetric questioning were analyzed using Asymmetric truth detection models and were compared with the corresponding responses obtained by the Symmetric truth detection models. Since the actual instances of the examination decisions is not known, in this validity assessment, it was assumed that higher instances of “yes” responses in examination dishonesty reflect more honest responses.

6. Results and Discussion

Based on the number of “yes” and “no” responses in the different conditions, we computed the frequencies that were observed. Table 1 below shows the proportion of “yes” and “no” responses by both Symmetric truth detection models and Asymmetric truth detection models.

	Asymmetric Questioning	Symmetric questioning
	Frequency (%)	Frequency (%)
Number of Yes responses	70(53.8%)	85(65.4%)
Number of No responses	60(46.2%)	45(34.6%)
Total	130(100%)	130(100%)

Table 2. Results by questioning technique

Table 2 shows that the number of “yes” obtained using Symmetric questioning technique were significantly higher (65.4%) compared to the “yes” responses under Asymmetric questioning technique (53.8%). After analyzing these results using Symmetric truth detection models and Asymmetric truth detection models, it was observed that 30.8% of the respondents under symmetric questioning technique cheated in the exams while 7.6% of the responded under Asymmetric questioning cheated in the examinations. This shows that fact that the “yes” responses under Symmetric questioning technique were more than in Asymmetric questioning technique thus the Symmetric truth detection models are valid and reliable compare to Symmetric truth detection models. We do therefore conclude that, when investigating a sensitive information Symmetric truth detection models should be used.

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