

AP[®] STATISTICS

2008 SCORING GUIDELINES

Question 2

Intent of Question

The primary goals of this question were to assess a student's ability to (1) identify a potential source of nonresponse bias and recognize a possible consequence for interpreting the results of a survey; (2) recognize that increasing sample size does not remove bias; and (3) recommend an appropriate course of action to solve a practical problem with the use of a survey.

Solution

Part (a):

Responses were received from only 98 of the 500 (or 19.6 percent) of the randomly selected families. In other words, 80.4 percent of the randomly selected families did not respond to the survey. To obtain a nearly unbiased estimate of the proportion of families with at least one child in elementary school in this school district who support year-round school, we would need to assume that the families that did not respond would have a similar level of support for year-round school as those who did respond. This would not be the case, for example, if families who support year-round school were more likely to respond than families who do not support year-round school. In such a case, the estimate of the proportion of families who support year-round school calculated from the responses would tend to be higher than the population proportion of families who favor year-round school.

Part (b):

No, the nonresponse bias still exists. Combining the results from the original sample with a new random sample of 500 families will not solve the problem. Regardless of what happens in the second sample, the problem of nonresponse bias will still exist in the combined sample because there would be at least 402 nonresponses included from the original sample.

Part (c):

Contact the 402 families from whom responses were not received and ask their opinion on the proposal. This may require additional mailings or telephone calls, but it will provide better information about support for year-round school among all families in the school district with at least one child in elementary school.

OR

Take a new random sample or take a census and use an alternative strategy, such as telephone calls or in-person interviews, to help increase the response rate.

Scoring

Parts (a), (b), and (c) are each scored as essentially correct (E), partially correct (P), or incorrect (I).

Part (a) is scored as follows:

Essentially correct (E) if the student clearly links the effect of nonresponse to biased estimation by explaining why population support for year-round school would be overestimated (or underestimated) from the sample results.

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Question 2 (continued)

Partially correct (P) if the student describes a reasonable consequence in the context of the study *OR* describes a difference related to the issue between families who are likely to respond and families who are not likely to respond.

Incorrect (I) otherwise.

Part (b) is scored as follows:

Essentially correct (E) if the student says no, taking another sample will not solve the problem with nonresponse bias *AND* explains that nonresponse bias in the original sample would result in nonresponse bias in the combined sample regardless of the results from the second sample.

Partially correct (P) if the student says no, taking another sample will not solve the problem with nonresponse bias, but provides a weak explanation *OR* says that the second sample will produce similar results to the first sample.

Incorrect (I) if the student says yes, combining results from the original sample and a new random sample will solve the problem *OR* says no but provides no explanation or an incorrect argument *OR* does not respond to the question.

Part (c) is scored as follows:

Essentially correct (E) if the student provides an explicit description of a reasonable strategy for reducing nonresponse in a new survey or census or by following up with families who did not respond to the original study.

Partially correct (P) if a student suggests that nonresponse should be reduced or response should be mandatory without providing an explicit description of a reasonable strategy.

Incorrect (I) if the student does not provide a strategy to increase response rates or suggests a strategy that would result in other biases.

4 Complete Response

All three parts essentially correct

3 Substantial Response

Two parts essentially correct and one part partially correct

2 Developing Response

Two parts essentially correct and no parts partially correct

OR

One part essentially correct and one or two parts partially correct

OR

Three parts partially correct

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Question 2 (continued)

1 Minimal Response

One part essentially correct and no parts partially correct

OR

No parts essentially correct and two parts partially correct

2. A local school board plans to conduct a survey of parents' opinions about year-round schooling in elementary schools. The school board obtains a list of all families in the district with at least one child in an elementary school and sends the survey to a random sample of 500 of the families. The survey question is provided below.

A proposal has been submitted that would require students in elementary schools to attend school on a year-round basis. Do you support this proposal? (Yes or No)

The school board received responses from 98 of the families, with 76 of the responses indicating support for year-round schools. Based on this outcome, the local school board concludes that most of the families with at least one child in elementary school prefer year-round schooling.

- (a) What is a possible consequence of nonresponse bias for interpreting the results of this survey?

It is probable that the parents who are excited about the proposal and wish to see it succeed are more likely to respond to the survey. So many of those who oppose it did not respond. This would mean that the true proportion of parents who support the proposal is less than $76/98$.

- (b) Someone advised the local school board to take an additional random sample of 500 families and to use the combined results to make their decision. Would this be a suitable solution to the issue raised in part (a)? Explain.

No. If the first sample had problems because of nonresponse bias, then that bias still exists in those samples even if it is combined with the new results. The responses still show faulty conclusions. Also, nonresponse bias might still exist in the new sample if it is conducted the same way.

- (c) Suggest a different follow-up step from the one suggested in part (b) that the local school board could take to address the issue raised in part (a).

Contact the original 500 families again in a different method. Maybe calling them. Ask those that did not respond initially to give an answer. Combine the newly obtained answers with the original 98.

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2. A local school board plans to conduct a survey of parents' opinions about year-round schooling in elementary schools. The school board obtains a list of all families in the district with at least one child in an elementary school and sends the survey to a random sample of 500 of the families. The survey question is provided below.

A proposal has been submitted that would require students in elementary schools to attend school on a year-round basis. Do you support this proposal? (Yes or No)

The school board received responses from 98 of the families, with 76 of the responses indicating support for year-round schools. Based on this outcome, the local school board concludes that most of the families with at least one child in elementary school prefer year-round schooling.

- (a) What is a possible consequence of nonresponse bias for interpreting the results of this survey?

This survey will conclude that most families with at least one child in elementary school prefer year-round schooling, but it is not a good idea due to nonresponse bias causing a flawed survey. 402 of the 500 families did not reply. Possibly, many do not care about their child's school routine, and those who replied were the ones who strongly took a side.

- (b) Someone advised the local school board to take an additional random sample of 500 families and to use the combined results to make their decision. Would this be a suitable solution to the issue raised in part (a)? Explain.

Combining results when one set of results is biased is not a good idea. The biased results of the first survey will impact the combined results, even if the second survey does not have nonresponse bias. Thus, this is not a suitable solution.

- (c) Suggest a different follow-up step from the one suggested in part (b) that the local school board could take to address the issue raised in part (a).

The school board needs to fix the first survey instead of conducting another and combining results. It could wait for the 402 families to respond or perhaps offer the survey takers some small reward for participating.

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2. A local school board plans to conduct a survey of parents' opinions about year-round schooling in elementary schools. The school board obtains a list of all families in the district with at least one child in an elementary school and sends the survey to a random sample of 500 of the families. The survey question is provided below.

A proposal has been submitted that would require students in elementary schools to attend school on a year-round basis. Do you support this proposal? (Yes or No)

The school board received responses from 98 of the families, with 76 of the responses indicating support for year-round schools. Based on this outcome, the local school board concludes that most of the families with at least one child in elementary school prefer year-round schooling.

(a) What is a possible consequence of nonresponse bias for interpreting the results of this survey?

Because a ^{great} portion of the sample did not respond, a conclusion cannot be made about whether or not the families w/ at least one child in elementary would prefer year-round schooling. Only 98 families out of 500 responded + only 76 of those prefer year round schooling, so it could be possible that the other 402 families did not want it.

(b) Someone advised the local school board to take an additional random sample of 500 families and to use the combined results to make their decision. Would this be a suitable solution to the issue raised in part (a)? Explain.

No because nonresponse bias might also occur again for the 2nd random sample. Because usually, the ones who respond are the ones who feel strongly towards the situation as oppose to those who do not support the proposal but don't feel strongly enough about the situation to speak out.

(c) Suggest a different follow-up step from the one suggested in part (b) that the local school board could take to address the issue raised in part (a).

Randomly select 500 families and go to their houses to survey them, making sure you receive an answer from each of the houses. This eliminates the possibility of nonresponse bias

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2008 SCORING COMMENTARY

Question 2

Overview

The primary goals of this question were to assess a student's ability to (1) identify a potential source of nonresponse bias and recognize a possible consequence for interpreting the results of a survey; (2) recognize that increasing sample size does not remove bias; and (3) recommend an appropriate course of action to solve a practical problem with the use of a survey.

Sample: 2A

Score: 4

The response to part (a) identifies a possible source of nonresponse bias by suggesting that parents who favor the year-round school proposal may be more likely to respond than parents who do not favor the proposal. The consequence is that the sample proportion would tend to be larger than the proportion of the population who favor the proposal. Part (a) was scored as essentially correct. The first part of the response to part (b) argues that nonresponse bias in the first sample would persist in the combined sample. Because this argument does not depend on any particular type of outcome for the second sample, it indicates that the potential for nonresponse bias in the combined sample arises from the low response rate in the first sample regardless of what occurs in the second sample. This is followed by a comment on the possibility of nonresponse bias in the new sample, but the response to part (b) was considered essentially correct without this comment. The response to part (c) provides an explicit strategy to obtain more responses from those who did not respond to the survey. Calling those who did not initially respond is a reasonable way to increase the response rate. Part (c) was scored as essentially correct. The answer as a whole, inclusive of all three parts, was considered a complete response and earned 4 points.

Sample: 2B

Score: 3

The response to part (a) indicates that families with stronger opinions may be more likely to respond to the survey, but it does not explain how this could result in a specific consequence such as the tendency of sample results to overestimate the proportion of the population in favor of year-round school. Part (a) was scored as partially correct. The response to part (b) clearly states that the nonresponse bias in the first sample will carry over into the results from a combined sample, even if the second sample has no nonresponse bias. Part (b) was scored as essentially correct. The response to part (c) suggests that the school board should follow up with those who failed to respond to the original survey and offer a small reward for participating. This is a reasonable way to increase the level of response to the original sample. (Note that simply suggesting that the school board should wait until more people respond to the original survey is not an example of an effective follow-up for reducing nonresponse.) Part (c) was scored as essentially correct. The entire answer was deemed a substantial response and was awarded 3 points.

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Question 2 (continued)

Sample: 2C

Score: 2

The response to part (a) identifies a worse-case scenario in which the 402 families who did not respond to the survey were all opposed to the year-round school proposal, but this source of bias is not clearly linked to a consequence of overestimating the level of support for the proposal in the population. Part (a) was scored as partially correct. The response to part (b) explains that taking a second random sample will not solve the problem of nonresponse bias because the same level of nonresponse is likely to occur in the second sample. This argument relies on a specific feature of the second sample—a similar level of nonresponse—and fails to make the more general point that the low level of response in the first sample will create a nonresponse bias problem in the combined sample regardless of the results of the second sample. Part (b) was scored as partially correct. The response to part (c) suggests that a new random sample should be performed in which survey workers would visit homes to increase the response rate. Part (c) was scored as essentially correct. The overall answer was judged a developing response and received 2 points.