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Survey methods for educators: Analysis and reporting of survey data (part 3 of 3)

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Summary

This guide describes a five-step process that educators can use to analyze survey data and report the results in a way that is accessible and useful to interested stakeholders. When conducted appropriately, these analysis and reporting procedures can provide accurate and timely information about a large population that may be otherwise unavailable, which can help stakeholders make decisions about policy or practice in schools and local or state education agencies. Examples from a Regional Educational Laboratory Northeast & Islands survey project illustrate each step.

The five-step survey analysis and reporting process is:

- Step 1: Review the analysis plan.
- Step 2: Prepare and check data files.
- Step 3: Calculate response rates.
- Step 4: Calculate summary statistics.
- Step 5: Present the results in tables or figures.

This guide is the third in a three-part series of survey method guides for educators. The first guide in the series covers survey development, and the second guide in the series covers sample selection and survey administration.

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Why this guide?

Increasingly, state and local educators are using data to inform policy decisions (Hamilton et al., 2009; Knapp, Swinnerton, Copland, & Monpas-Huber, 2006; U.S. Department of Education, 2010). Educators need access to a wide variety of data, some of which may not be in their data systems. Survey data can be particularly useful for educators by offering a relatively inexpensive and flexible way to describe the characteristics of a population. To obtain such information, educators may need to conduct their own survey research.

Survey research process

The survey research process includes survey development, sample selection and survey administration, and data analysis and reporting (figure 1). The activities undertaken in each stage may vary depending on the type of information being collected (Fink, 2013). For example, if educators want to conduct a survey on a topic that has been widely surveyed in similar settings, they may be able to use an existing survey instrument and skip the survey development stage altogether. Or they may decide to use an existing survey but add survey items of particular interest in their context. If no surveys exist for the topic, educators will need to develop a new survey in stage 1 (see figure 1).

The three guides in this series correspond to the three stages in figure 1 and provide an overview of survey methodologies for a nontechnical audience of educators. However, the resources needed to complete some of the activities may make the series most relevant to larger school districts, state departments of education, and other large agencies. The first guide in the series covers survey development (Irwin & Stafford, 2016), the second guide in the series covers sample selection and survey administration (Pazzaglia, Stafford, & Rodriguez, 2016), and this third guide in the series covers data analysis and reporting.

These guides are intended to lead to the use of survey findings in decisions about policy and practice in schools and local or state education agencies; however, offering guidance on how decisionmakers can use the results is not the focus.

Because this series is an overview, readers seeking a comprehensive guide to survey methods or to complex analyses of survey items are encouraged to explore other resources, such as textbooks, journal articles, and websites dedicated to these topics or to engage consultants who have this type of expertise. For useful references on analyzing and reporting survey data, see appendix A.

Figure 1. Three stages in the survey research process



Source: Authors' construction.

In providing guidance on data analysis and reporting, this guide draws on examples from a survey project conducted with educators in the Northeast Rural Districts Research Alliance of the Regional Educational Laboratory (REL) Northeast & Islands (Clements, Pazzaglia, & Zweig, 2015; Clements, Zweig, & Pazzaglia, 2015). See box 1 for an overview of that project.

Analysis and reporting of survey data

Educators engaged in survey research should develop a detailed analysis plan during the survey development stage, which is covered in part 1 of this series (Irwin & Stafford, 2016). It provides the structure for the statistical analysis of the survey data that will be presented in reports or presentations. The analysis plan ensures that the survey results will address the topics of interest. The analysis plan maps survey questions (items) to the topics of interest and proposes the type of analysis and presentation (such as a table or graph) for each result.

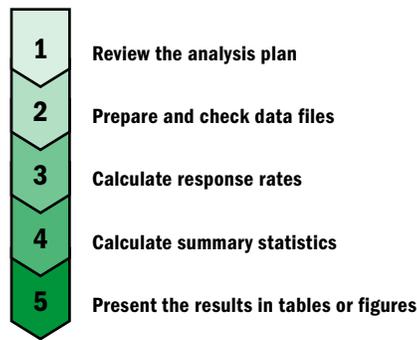
For data analysis, educators can calculate common summary statistics, such as frequencies and means, for each survey item using specialized statistical software, such as IBM SPSS Statistics, or spreadsheet software, such as Microsoft Excel. In drawing conclusions from the survey data, educators must consider the size of the sample, the sampling procedures used, and the response rates (U.S. Department of Education, 2012). The final step is presenting the results to stakeholders.

Research literature and textbooks often provide technical descriptions of complex issues rather than simple explanations of analysis and reporting procedures. This guide explains the basic procedures for analyzing and reporting survey data using a five-step process: reviewing the analysis plan, preparing and checking data files, calculating response rates, calculating summary statistics, and presenting results in tables or figures (figure 2). See box 2 for definitions of key terms.

Box 1. Overview of a survey project from the Northeast Rural Districts Research Alliance

A partnership of education stakeholders in New York wanted to know whether they should encourage state leaders to invest in initiatives designed to support online learning. Because the state's existing longitudinal data system did not distinguish online courses from face-to-face courses, stakeholders had no data on the extent to which online courses were being used and for what purposes. The stakeholders wanted to administer a survey to schools to collect basic information on online course use, such as the number of online course enrollments by course type (Advanced Placement, core, credit recovery, dual credit, or elective), the reasons schools were using online courses, and the challenges they faced in offering online courses to their students.

Figure 2. Five steps in the collaborative survey development process



Source: Authors' construction.

Box 2. Definitions of key terms

Analysis plan. A preparatory survey tool that maps topics of interest to survey items and suggests types of data analyses and results presentation.

Data coding. The process of categorizing data for the purposes of analysis, such as assigning numeric codes or category labels to individual responses.

Generalize. The extension of results from a survey or other study conducted on a sample to the larger target population.

Infographic. Visual presentation of data or other information that is intended to attract a reader's attention and quickly and clearly convey meaning.

Item. A question on a survey; see *survey items*.

Item nonresponse. When those selected for survey administration respond to some survey items but not others, or stop taking the survey before responding to all items.

Item nonresponse bias. Occurs when those who respond to an individual item are different in meaningful ways from those who do not respond to that item. For example, teachers in more affluent districts might be more likely to complete certain school climate survey items. Item nonresponse bias can result in survey statistics that do not provide valid approximations of the population (that is, the statistics from the survey respondents do not match the statistics that would have resulted if the entire population had responded to the survey).

Item response rate. The percentage of respondents who responded to each survey item.

Missing data. Occurs when survey responses are not available for a particular item or individual. In survey research, missing data can be caused by item nonresponse as well as data collection errors.

Multiple-choice response option. A type of survey response option in which a respondent is presented with a set of possible responses and is asked to choose one or more of them.

Nonrespondents. People selected for survey administration who do not respond to the survey.

(continued)

Box 2. Definitions of key terms *(continued)*

Open response option. A type of survey response option in which a respondent is asked to write a response to a question.

Probability sampling. Sampling procedures in which each unit in the population has a known chance (but not necessarily an equal chance) of being included in the sample. This type of sampling allows researchers to estimate the accuracy of the sample statistics as approximations of the population (that is, the extent to which the sample statistics match the statistics that would have resulted if the entire population had been surveyed).

Rating scale response option. A type of response option in which a respondent is asked to characterize his or her response to a statement or question using an ordered scale (such as “1, 2, 3, 4” or “Very satisfied, satisfied, unsatisfied, very unsatisfied”).

Response option. The types of answers a respondent can provide to a survey item. Common response option types include multiple choice, rating scales, and open response.

Sample. A subgroup of the target population from which data are collected and used to generalize to the larger population.

Sampling unit. Students, teachers, schools, or some other unit or element considered for selection to receive a survey questionnaire.

Summary statistics. Values used to summarize survey responses in a manner that is simple but communicates important information, such as common features of the sample and variation across responses. Common examples include frequencies, percentages, minimums, maximums, totals, medians, means, standard deviations, and standard errors.

Survey administration. The process of distributing the survey to the people (sampling units) selected to receive it, encouraging them to fill it out, and collecting it. A survey can be administered by paper and pencil, online, over the phone, or by some other mode.

Survey items. Questions or statements that make up the survey and are used to gather information.

Survey nonresponse bias. Occurs when those who respond to the survey are different in meaningful ways from those who do not. For example, students who enjoy math might be more likely to respond to a survey asking about a math game used in their classroom than students who do not like math. Nonresponse bias can result in the survey statistics not providing valid approximations of the population (that is, the respondent statistics do not match the statistics that would have resulted if the entire population had responded to the survey).

Survey nonresponse rate. The percentage of potential respondents selected for the survey who do not respond. Nonresponse can occur if individuals refuse or are not able to respond to the survey, or if the survey team is not able to contact them to request their response. Survey nonresponse is distinguished from item nonresponse, which occurs when a respondent returns the survey but skips individual questions.

Survey research. A research method that uses questions to collect data.

Survey response rate. The percentage of sampled individuals who responded to the survey.

Target population. The entire group the survey team wants to obtain information about by generalizing from the survey results.

Step 1: Review the analysis plan

A survey analysis plan, which maps survey questions (items) to the topics of interest and suggests types of analysis and presentation, should be prepared during survey development as described in part 1 of this survey methods series (Irwin & Stafford, 2016). Once the survey has been administered, the first step is to review the analysis plan and update it to ensure that the survey analysis will address the topics of interest in the analysis plan. The original analysis plan from the Northeast Rural Districts Research Alliance’s survey project is shown in table 1, and a description of how this plan was reviewed and updated to guide the calculation of summary statistics for the project is given in box 3. This section describes how to complete this task.

- Update the original analysis plan as necessary based on problematic responses or missing data identified in checks of data during survey administration (see box 3 for an example of an update to an analysis plan). For example, if respondents skipped certain items or provided responses that did not make sense for an item, the survey team may decide to exclude these items from the results. Updating the plan ensures that the survey results address the original questions of interest and can inform policy and practice as intended.

Table 1. Original analysis plan for online course use survey, Northeast Rural Districts Research Alliance

Research question	Survey item	Potential analysis methods	Potential method of presentation
1a: How are rural and nonrural high schools in the Greater Capital Region of New York using online learning in the 2012/13 school year? Specifically, what is the number of student enrollments?	Items 1–4 Example item: For school year 2012/13, report the number of students in your school who were enrolled in online courses.	Mean; standard error	Table
1b: What percentage of students successfully complete the online courses?	Item 5 Example item: Of these enrollments, how many resulted in successful course completions with a passing grade?	Mean; standard error	Table
1c: What are the academic domains for which online courses are being utilized (for example, math, science, foreign language)?	Item 6 Example item: For each box, report the number of online course enrollments in school year 2012/13 in each of the following academic areas.	Mean; standard error	Table; stacked bar graph
1d: What is the academic purpose for which students are taking these courses (for example, to recover credit, access advanced placement courses)?	Items 8–9 Example item: For each box, report the number of online course enrollments in school year 2012/13 in each of the following course categories.	Mean; standard error	Table; stacked bar graph
2: Why are rural and nonrural schools using online course options?	Item 7 Example item: How important were the following reasons for having online courses in your school in 2012/13? (Check one on each line.)	Mean; standard error	Table; pie chart
3: What are the policies and practices these schools employ to monitor students enrolled in online courses?	Items 11–18 Example item: In 2011/12, did your school monitor student progress in online courses in any of the following ways (check one on each line.)	Mean; standard error	Table

Source: Irwin & Stafford, 2016.

Box 3. Step 1 in practice: Reviewing and updating the online course use survey analysis plan

Prior to analyzing the survey data, the Northeast Rural Districts Research Alliance survey team met to review the analysis plan it had created during the survey development phase of the project (see table 1). The team discussed which summary statistics would be calculated for each survey item, including any changes needed based on an early check of data during survey administration. For example, the team compared the reported number of online course enrollments to the total number of student enrollments at each school. In some cases, schools were reporting more online course enrollments than their entire student population, so there was reason to believe that respondents were estimating their enrollments in an online course rather than providing exact enrollments based on their school records. In response, the team decided that the percentage of schools that reported at least one enrollment in an online course might be a more accurate representation of the prevalence of online learning in the region than the minimum, maximum, total, and mean number of enrollments, as was initially laid out in the analysis plan.

- Update the analysis plan to guide the types of statistical calculations (such as total, mean, and standard deviation) that will be performed for each survey item (see step 4 for more on summary statistics).
- Update the analysis plan to designate the types of tables and figures that will appear in reports and presentations to best communicate the results to stakeholders (see step 5 for more on tables and figures).

Step 2: Prepare and check data files

Preparing and checking the survey data files includes compiling paper surveys in an electronic file, merging data files, checking for data entry errors, and coding the data. See box 4 for a description of the process for preparing and checking the Northeast Rural Districts Research Alliance online course use survey data file. This section describes the tasks involved.

- If the survey collected demographic information, respondent names, emails, or other unique identifiers, respondents could be identified by their answers. In this case, it is important to securely transfer and store data files to prevent the disclosure of personally identifiable information through security breaches. School districts often have security procedures that need to be followed. Other recommended protections include restricting data access to the survey team, replacing identifying variables with new ID numbers, storing data on encrypted hard drives or in locked filing cabinets, and avoiding nonsecure email for transferring data files.
- If multiple data files exist (for example, a demographic data file used to select the sample and a survey response data file), merge the files.
 - Use a consistent linking variable across files, such as student or teacher ID numbers or names. Merging can then be accomplished using Microsoft Excel or a number of other statistical packages, as long as the linking variables match exactly across files.
 - After merging the files, look at the data in the new file to ensure that the files merged correctly (for example, did the survey data match up with the correct

Box 4. Step 2 in practice: Preparing and checking the online course use survey data file

Prior to calculating summary statistics, the Northeast Rural Districts Research Alliance survey team merged the survey data files with data files from the Common Core of Data (U.S. Department of Education, 2011) containing school information such as locale (city/suburban, town, or rural). The survey team used “school name” as the linking variable, which required first comparing responses to the survey item that asked respondents for their school name with the school names in the Common Core of Data file. The survey team assigned unique ID numbers to each school name to address any inconsistencies in school names across files (for example, if one file used “Mansfield High School” and the other used “Mansfield HS”).

After merging the data files and conducting a spot check to ensure that the files merged correctly, the survey team coded data from several survey items. For example, several of the multiple-choice options in the survey had an “other” option that prompted respondents to enter information. The survey team reviewed these responses to see if any fit in an existing category or if multiple responses fell into a new category.

- demographic data?). Check the total number of respondents in the old and new files to make sure all data are included.
- Check for data entry errors. Look through the data file and run frequencies to examine the responses for each item (see step 4 for how to run frequencies). For example, when compiling paper survey responses into an electronic file, a value may have been entered that does not make sense for a particular survey question (for example, 100 years of teaching experience rather than 10). Responses that appear to be entered in error should be flagged, reviewed more closely, and either replaced with the correct response if it is available or considered for deletion if the team agrees that the response was an error.
 - To prepare for analysis, code data to make the results easier to understand. For example:
 - Rather than reporting the mean and standard deviation for a variable such as years of teaching experience, you might break the responses into categories (for example, less than 2 years, 2–5 years, 6–10 years, and more than 10 years) and present the frequency of each response category. This approach requires coding the data into a new variable (see appendix B for screenshots depicting the recoding procedure in SPSS).
 - With open response options, respondents often write the same information in different ways that are difficult to combine in analysis. For example, teachers asked to specify the age of the oldest child in their classroom may write “three,” “3,” “3-yrs-old,” “three years old,” and so on. The survey team must code all data in a consistent format to allow for calculation of the desired summary statistics (for example, changing all of these values to “3” will allow calculation of summary statistics).
 - Open response options may be coded into categories of responses (see Jansen, 2010, for information about coding and analyzing this type of qualitative data). For example, a survey item asking teachers to list the subjects they teach could later be coded into categories such as English, science, social studies, and math.

Step 3: Calculate response rates

Prior to calculating summary statistics, the survey team should determine whether the survey results will generalize to the target population, not just to those who responded to the survey. For nonprobability samples, survey results cannot generalize to a target population, so this step can be skipped. For probability sampling procedures, calculating two types of response rates—survey response rates and item response rates—provides information about the likelihood of what is called survey and item nonresponse bias, which can limit generalizability. Nonresponse bias occurs when survey respondents are different from nonrespondents in meaningful ways. If nonresponse bias is likely, the survey statistics may not provide valid approximations of the population (that is, the respondent statistics may not match the statistics that would have resulted if the entire population had responded to the survey).

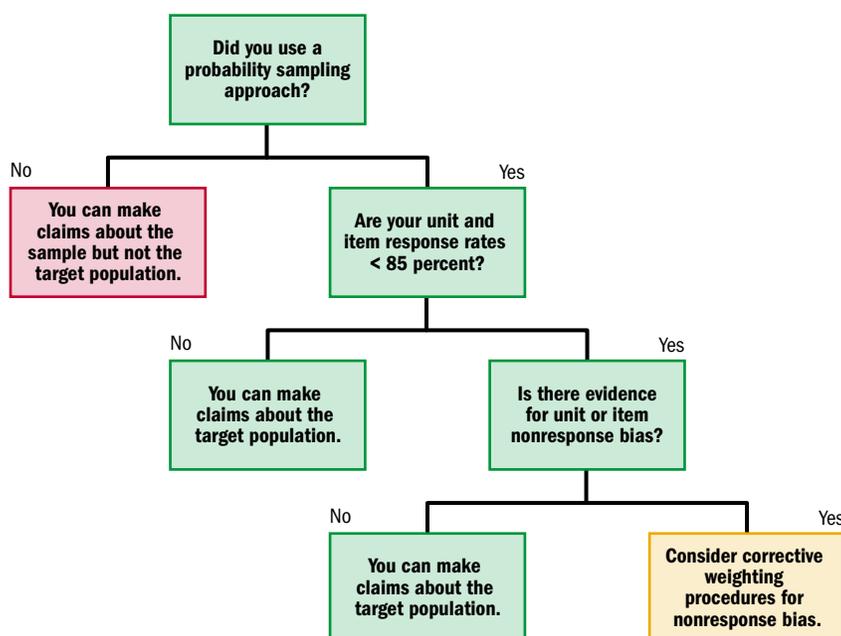
If nonresponse bias is found, the survey team may consider extending the survey administration period to increase response rates. Otherwise, it should not draw conclusions about the larger target population from the survey results; however, it can still make claims about the respondents. A decision tree to determine whether results from the survey can be used to make claims about the target population is shown in figure 3.

This guide uses the National Center for Education Statistics guideline that adequate response rates are greater than or equal to 85 percent (U.S. Department of Education, 2012). The statistics literature gives differing standards for response rates, some of which are lower in some situations.

A description of how the Northeast Rural Districts Research Alliance online course use survey team calculated response rates is shown in box 5, and directions are given below.

- To calculate the survey response rate, divide the number of individuals who responded to the survey by the number of individuals to whom the survey was administered (the sample size).
 - If the survey response rate is greater than or equal to 85 percent, it is not necessary to complete any further steps to assess potential nonresponse bias, though it is still advisable to check the characteristics of the respondents and nonrespondents.
 - If the survey response rate is less than 85 percent, survey nonresponse bias may be present, and the conclusions drawn from the respondents may not represent or reflect the traits or views of the target population (U.S. Department of Education, 2012). Survey nonresponse bias might be present if particular types of respondents are more likely to complete the survey. In this case, caution must be taken in drawing conclusions about the target population as a whole.
- To calculate the item response rate for each item in the survey, divide the number of individuals who responded to an item by the total number of survey respondents. This calculation measures the extent to which individuals skipped items or terminated the survey before responding to all items.
 - For items with response rates greater than or equal to 85 percent, it is not necessary to complete any further steps to assess potential nonresponse bias.
 - Items with response rates lower than 85 percent are subject to concerns about nonresponse bias. Particular types of respondents might be more likely to respond to specific items, while other types of respondents might skip those items. Caution must be taken in drawing conclusions about the target population as a whole based on these items.

Figure 3. Decision tree for making claims about the target population



Source: Authors' construction.

Box 5. Step 3 in practice: Calculating response rates for the online course use survey

The Northeast Rural Districts Research Alliance survey team first calculated the survey response rate by dividing the number of schools that responded to at least one item on the survey (59 schools) by the total number of schools that were selected for administration (99 schools) to get a survey response rate of 60 percent. Because this survey response rate was less than 85 percent, the survey team compared the characteristics of respondents to the characteristics of the larger target population (see table C1 in appendix C). The respondent characteristics were similar to those of the population (that is, the respondent and target population means for available demographics did not vary by more than the corresponding standard deviations, which the team confirmed with a nonresponse bias analysis; see Clements, Pazzaglia, et al., 2015, for details). The team concluded that there was no evidence of survey nonresponse bias.

Next, the survey team calculated response rates for each survey item. Item response rates were less than 85 percent for eight survey items. As with the survey nonresponse bias analysis, the survey team confirmed that the respondents to these eight survey items were similar to the target population on the available characteristics. The team concluded that there was no evidence of item nonresponse bias and calculated summary statistics, knowing it could draw conclusions about the target population from the results.

- If the survey or item response rates are less than 85 percent, conduct these basic checks for potential nonresponse bias:
 - For survey nonresponse, compare the mean of the respondents to the mean of the target population on any available demographic or other characteristic (see table C1 in appendix C for an example). A difference of larger than one

- standard deviation in the means of respondents and the target population may be indicative of nonresponse bias. For example, the mean student enrollment for respondent schools could be compared with the mean student enrollment for target population schools, and the size of the difference compared with the standard deviation of student enrollment in the target population. If the target population statistics are not available, compare the characteristics of the individuals in the selected sample with those of the respondents.
- For item nonresponse, for each item, compare any available demographic or other characteristic of the respondents with the same characteristic of the target population. Use the same process as used for survey nonresponse to determine whether there is a difference between characteristic means, which may indicate the presence of nonresponse bias.
 - If these simple preliminary tests show potential nonresponse bias, consult technical resources for further analysis, possibly using corrective weighting procedures (see Fowler, 2008; Groves, Dillman, Eltinge, & Little, 2002; U.S. Department of Education, 2012).
 - If there is evidence of item nonresponse bias and corrective weighting procedures are not used, consider excluding those items.
 - Consider these approaches for handling missing data resulting from nonresponse:
 - If some respondents skipped a particular survey item, calculate summary statistics using only the available data (for example, calculate the percentage of schools that provided online credit recovery courses out of the schools that answered that item). This approach is appropriate if the item response rate is above 85 percent or if there is limited evidence of nonresponse bias.
 - Consider imputation approaches to replace missing values (see Brick and Kalton, 1996, or Schafer and Graham, 2002, for more information). Rather than discarding respondents with missing data, imputation approaches replace missing data with values that are predicted from other information in the dataset.

Step 4: Calculate summary statistics

The survey team should calculate the summary statistics that will be most useful in answering the topics of interest, are appropriate for the type of survey response option (multiple-choice, rating scale, or open response; see box 2 for definitions), and are understandable to multiple audiences. Descriptions and considerations for each summary statistic are given in table 2, and a description of how summary statistics were calculated for the Northeast Rural Districts Research Alliance survey project is shown in box 6. Calculating summary statistics is described below.

- Use either specialized statistical software or spreadsheet software to calculate summary statistics (see appendix D for screenshots depicting the procedure for using SPSS to calculate each summary statistic described in table 2).
- For open response items with text responses, consult additional resources for qualitative analysis procedures (Jansen, 2010).
- Review the summary statistics to ensure that the statistics were computed correctly (for example, are all calculated percentages between 0 and 100 percent?).
- Discuss what the results tell you about the topics of interest. Remember that whether you can draw conclusions about the target population depends on the sampling procedures used (see part 2 of this series, Pazzaglia et al., 2016) and whether there is evidence of nonresponse bias.

Table 2. Summary statistics, calculations, and considerations

Statistic	Calculation	Considerations
Frequency	A count of the respondents who selected a survey response.	Frequencies are more meaningful when reported with the corresponding percentages of respondents. They are most often reported for multiple-choice and rating scale survey response options.
Percentage	A count of the respondents who selected a survey response divided by the total number of respondents.	Percentages provide a straightforward summary statistic that can be easily understood by multiple audiences. They are most often used for multiple-choice and rating scale survey response options. They are often more meaningful if reported with the corresponding frequencies of respondents.
Minimum	The smallest value reported for a survey item.	Minimums are usually presented along with the maximum to provide information about the range of survey responses. They are most often used for open response options that ask respondents to enter a numeric value (for example, years of teaching experience).
Maximum	The largest value reported for a survey item.	Maximums are usually presented along with the minimum to provide information about the range of survey responses. They are most often used for open response options that ask respondents to enter a numeric value.
Total	The sum of the values reported for a survey item across respondents.	Totals may be of interest in some situations (for example, the total number of students enrolled in online courses across the state), though medians and means are more frequently reported. Totals are most often used for open response options that ask respondents to enter a numeric value.
Median	The middle value (or average of the two middle values for an even number of values) when the values are listed from smallest to largest.	Medians are especially useful when there are extreme values, resulting in a mean that is not a good representation of a typical value. They are most often used for open response options that ask respondents to enter a numeric value. Nontechnical audiences may not be familiar with medians, so means may be preferable if the data are appropriate (see below).
Mean (average)	The sum of the values reported for a survey item divided by the total number of respondents.	The mean is the average of the item values. If the responses include outliers or extreme values (for example, one teacher in the sample has 50 years of teaching experience while all others have less than 5), the mean will not be a good representation of a typical value. In this case, the median is more appropriate. The mean is used for open response options that ask respondents to enter a numeric value.
Standard deviation ^a	A measure of how much individual values differ from the sample mean, calculated as the square root of the average of the squared deviations of each value from the mean. Smaller standard deviations (close to zero) imply that most values are close to the mean.	Standard deviations provide information about the variation within the sample. They are often presented along with the mean for open response options that ask respondents to enter a numeric value. Standard deviations may be more appropriate for technical audiences.
Standard error ^a	A measure of how close the sample mean is likely to be to the target population mean, calculated as the standard deviation divided by the square root of the sample size.	Standard errors provide information about the accuracy of the sample mean in estimating the target population mean. They are often presented along with the mean for open response options that ask respondents to enter a numeric value. Standard errors may be more appropriate for technical audiences.

a. Further information about the distinction between standard deviations and standard errors and when to use each can be found in Streiner (1996).

Source: Authors' construction.

Box 6. Step 4 in practice: Calculating summary statistics for the online course use survey

The Northeast Rural Districts Research Alliance survey team calculated summary statistics using statistical software. As outlined in the analysis plan, they calculated the percentage of respondents who selected each option and the associated standard errors for the multiple-choice and rating scale items. For open response items that asked for the number of students enrolled in online courses, the survey team calculated the minimum, maximum, total, mean, and standard error.

Step 5: Present the results in tables or figures

Next the survey team should consider how to present the results in a way that will help the audience understand and interpret the findings and their implications. The Northeast Rural Districts Research Alliance survey team's approach to presenting the results of the online course use survey is described in box 7, and examples of different types of tables and figures using data from the survey are shown in appendix E. Considerations in deciding how to present the findings are given below:

- Select the overall message and presentation format with the target audience in mind.
 - Multiple reports for different audiences may be necessary depending on how each audience needs to use the information. For example, a summary of survey results in a parent newsletter may focus on the survey questions of interest to parents, while a report for administrators may include data from all survey questions.
 - Different statistics and presentation formats are appropriate for different audiences (for example, figures that focus on percentages, frequencies, or means may be ideal for less technical audiences, while tables that include both means and standard deviations may be appropriate for more technical audiences).

Box 7. Step 5 in practice: Presenting the results of the online course use survey

Guided by the analysis plan, the Northeast Rural Districts Research Alliance survey team prepared tables and figures for each survey item using templates in Microsoft Word (see appendix E for examples). Tables included multiple summary statistics, such as both means and standard errors or percentages and standard errors. Stacked bar graphs and pie charts provided visually appealing and accessible summaries of percentages. Since these figures did not include standard errors, notes referred interested readers to the tables in the appendix of the report for additional statistical information.

To ensure that the survey results were understandable to stakeholders, the survey team presented preliminary summary statistics in tables and figures to New York stakeholders who advised the survey project. These stakeholders provided helpful information about the key takeaways, which were then highlighted in the written report. The stakeholders also posed questions that had not been included in the original analysis plan for the survey team to consider addressing with additional summary statistics or future research.

- Be thoughtful about the best way to present data in tables and figures.
 - Take advantage of table and figure templates available in spreadsheet, word processing, and statistical software packages to ensure consistent formatting throughout reports.
 - Consider using visually appealing figures, such as bar graphs (see figure E1 in appendix E) and pie charts (see figure E2 in appendix E). Figures attract readers' attention and present information in a more easily digested form than tables. (For example, compare figure E1 and table E1, which present the same data in different ways.)
 - Ensure that tables and figures include enough information to be understood on their own without reference to the report text (for example, include the survey question that resulted in the data, label the response options, and tell how many respondents completed the survey item; see tables E1 and E2 in appendix E).
 - Though it is important to include enough information, do not clutter the figures or tables with unnecessary information that may detract from the message or confuse the reader.
- Infographics are visual presentations of data or other information that attract attention and quickly and clearly convey meaning (see figure F1 in appendix F for a sample infographic from the Northeast Rural Districts Research Alliance online course use survey). This type of presentation is particularly useful for highlighting key takeaways in websites or newsletters.
- Consider asking individuals from several stakeholder groups (for example, teachers, parent groups, and school administrators) to review the preliminary survey findings and their presentation to ensure that the presentation is clear and complete.

Using this guide

This guide (the third in a three-part series) provides educators with an overview of commonly used analysis and reporting procedures for surveys conducted in practical education contexts. Educators can use it to review their analysis plans, prepare and check data files, calculate response rates, calculate summary statistics, and present their survey results. When conducted appropriately, these procedures can lead to the use of survey findings to make decisions about policy or practice at schools and local or state education agencies. The first guide in the series covers survey development, and the second guide in the series covers sample selection and survey administration.

Limitations of this guide

This guide has two limitations. First, it does not discuss more complex analysis procedures (for example, multiple regression analysis) or the assessment of survey reliability and validity. Educators and policymakers interested in these topics should seek additional resources (see appendix A).

Second, the process for analyzing and reporting survey data shown in this guide can be time and resource intensive. Some of the activities may require additional resources such as specialized statistical software, though the summary statistics can be calculated using spreadsheet software such as Microsoft Excel.

Appendix A. Additional resources for analyzing and reporting survey data

Additional resources for analyzing and reporting survey data include textbooks, journal articles, and professional organizations with expertise in these topics.

Potentially useful texts

Brick, J. M., & Kalton, G. (1996). Handling missing data in survey research. *Statistical Methods in Medical Research*, 5, 215–238.

Fuller, W. A. (2009). *Sampling statistics*. Hoboken, NJ: Wiley.

Groves, R. M., Dillman, D. A., Eltinge, J. L., & Little, R. J. A. (Eds.). (2002). *Survey non-response*. Hoboken, NJ: Wiley.

Kelley, K., Clark, B., Brown, V., & Sitzia, J. (2003). Good practice in the conduct and reporting of survey research. *International Journal for Quality in Health Care*, 15(3), 261–266.

Lee, E. S., and Forthofer, R. N. (2006). *Analyzing complex survey data* (2nd ed.). Thousand Oaks, CA: Sage.

Osborne, J. W. (2013). *Best practices in data cleaning*. Thousand Oaks, CA: Sage.

Pfeffermann, D. (1996). The use of sampling weights for survey data analysis. *Statistical Methods in Medical Research*, 5, 239–261.

Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological Methods*, 7(2), 147–177.

Tufte, E. (2006). *Beautiful evidence*. Cheshire, CT: Graphics Press.

Other potentially useful resources

Center for Teaching and Learning

<http://ctl.utexas.edu/teaching/professional-development/assess-teaching/resources>

University of Wisconsin-Extension Cooperative: Using Excel for Analyzing Survey Questionnaires

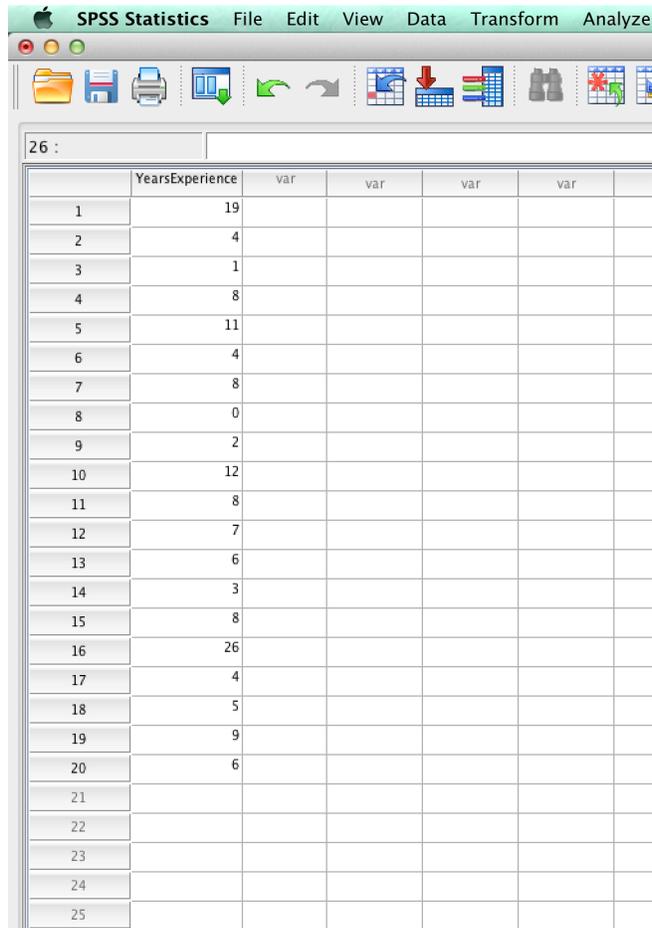
<https://learningstore.uwex.edu/assets/pdfs/G3658-14.pdf>

Appendix B. Using SPSS to code data

Steps for coding ranges of data into a new variable for analysis are shown here using screenshots from IBM SPSS Statistics (version 19).

In this example, rather than reporting the mean and standard deviation for a variable such as years of teaching experience, the survey team broke the responses into categories of ranges of responses: less than 2 years, 2–5 years, 6–10 years, and more than 10 years.

This example uses the following SPSS survey data file:

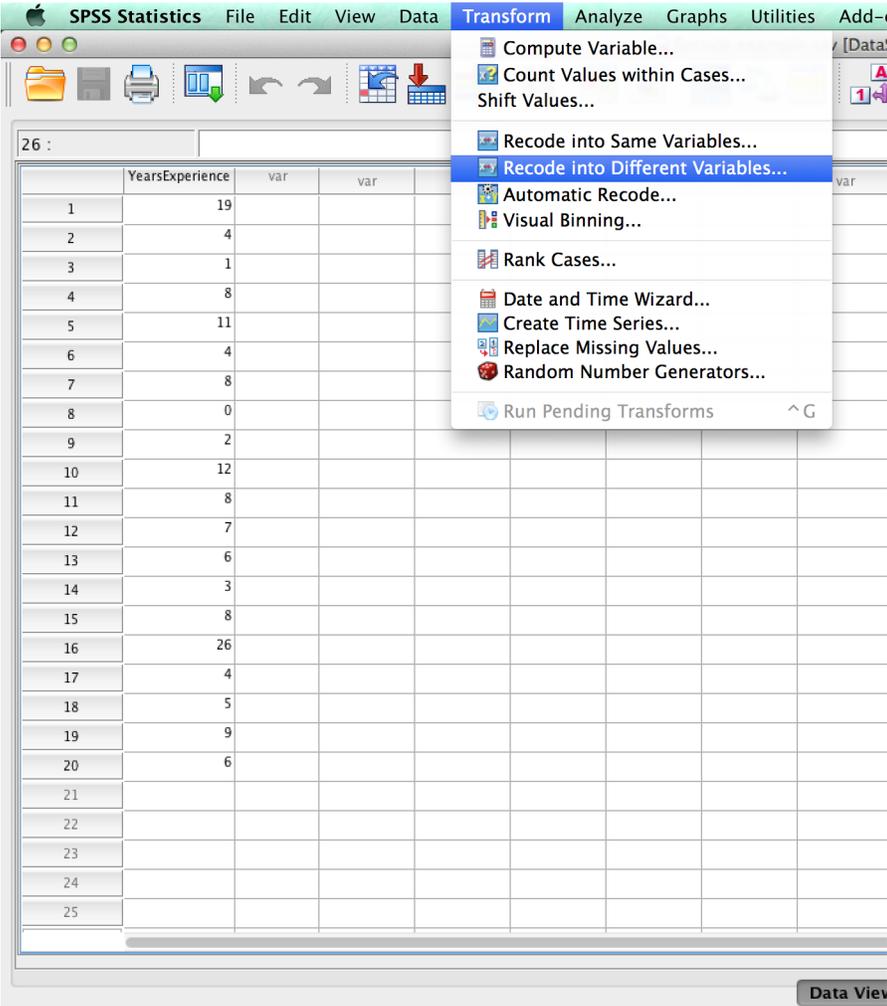


The screenshot shows the SPSS Statistics software interface. The title bar reads "SPSS Statistics" and the menu bar includes "File", "Edit", "View", "Data", "Transform", and "Analyze". Below the menu bar is a toolbar with various icons. The main window displays a data editor with a table containing 26 rows and several columns. The first column is labeled "YearsExperience" and contains numerical values. The other columns are labeled "var".

	YearsExperience	var	var	var	var
1	19				
2	4				
3	1				
4	8				
5	11				
6	4				
7	8				
8	0				
9	2				
10	12				
11	8				
12	7				
13	6				
14	3				
15	8				
16	26				
17	4				
18	5				
19	9				
20	6				
21					
22					
23					
24					
25					

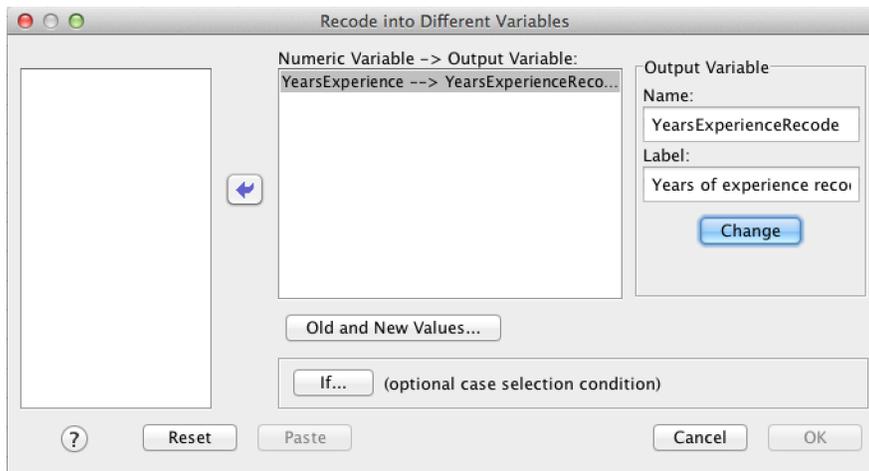
Step 1: Start setting up categories of ranges of responses

Click Transform, then select Recode into Different Variables...



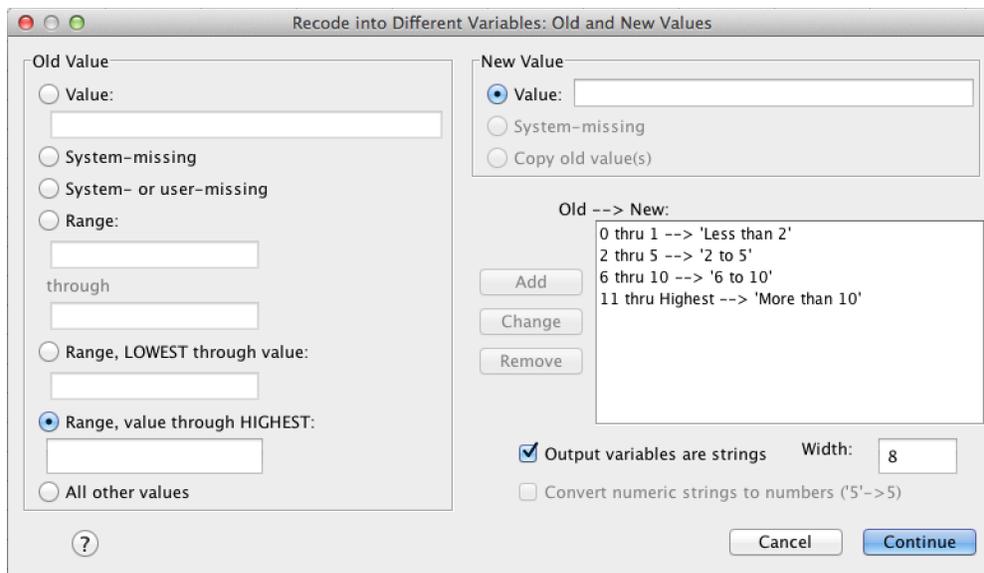
Step 2: Create a name for the output variable

Click on YearsExperience, then click the arrow to move the variable into the Numeric Variable → Output Variable box. Enter text for the Name and Label for the Output Variable. Click Change. The Output Variable Name should now appear in the Numeric Variable → Output Variable box. Click Old and New Values... .



Step 3: Set the ranges for the new variable

Check the Output variables are strings box. In the Old Value box, click the Range option and enter “0” and “1” in the boxes, respectively. In the New Value box, enter “Less than 2.” Click Add. Repeat this procedure for 2 through 5 and 6 through 10. Next, click the Range, value through HIGHEST option. Enter “11,” and enter “More than 10” in the New Value box. Click Add. Check to make sure all recoded values appear and are correctly coded in the Old → New box. Click Continue. Click OK.



Step 4: Check that the recoded variable now appears in the data file

The screenshot shows the SPSS Statistics interface with a data file named 'Untitled2 [DataSet1]'. The data is displayed in a grid with the following columns: 'YearsExperience' and 'YearsExperienceRecode'. The 'YearsExperience' column contains numerical values, and the 'YearsExperienceRecode' column contains categorical labels. The rows are numbered 1 through 24.

	YearsExperience	YearsExperienceRecode	var	var	var	var	va
1	19	More than 10					
2	4	2 to 5					
3	1	Less than 2					
4	8	6 to 10					
5	11	More than 10					
6	4	2 to 5					
7	8	6 to 10					
8	0	Less than 2					
9	2	2 to 5					
10	12	More than 10					
11	8	6 to 10					
12	7	6 to 10					
13	6	6 to 10					
14	3	2 to 5					
15	8	6 to 10					
16	26	More than 10					
17	4	2 to 5					
18	5	2 to 5					
19	9	6 to 10					
20	6	6 to 10					
21							
22							
23							
24							

Appendix C. Sample response rate table

The survey team for the Northeast Rural Districts Research Alliance online course use survey did a preliminary check for survey nonresponse bias by comparing the characteristics of the target population and respondents. The average (mean) characteristics of these two groups are shown in table C1. A difference in the means between respondents and the target population for a given characteristic may be meaningful if it is larger than the target population's standard deviation. For example, the mean student enrollment for respondent schools (751) is compared to the mean student enrollment for target population schools (655), and the size of the difference (96) is compared to the standard deviation of student enrollment in the target population (555). In this case, the difference is smaller than the standard deviation. Thus, there does not appear to be a meaningful difference between the schools that responded to the survey and those that did not.

Survey teams that find evidence of nonresponse bias should consult additional resources for information about nonresponse bias analysis and corrective weighting procedures (for example, Fowler, 2008; Groves et al., 2002; U.S. Department of Education, 2012).

Table C1. Checking for survey nonresponse bias by comparing target population and respondent characteristics

School characteristic	Target population				Respondents			
	Number of schools	Percent	Mean	Standard deviation	Number of schools	Percent	Mean	Standard deviation
All schools	98	100			59	60		
Locale								
City/suburban	26	27			20	34		
Town	17	17			9	15		
Rural	55	56			30	51		
Grade span								
Pre-K/K-12	16	16			9	15		
7-12	22	22			13	22		
9-12	54	55			34	58		
Other	6	6			3	5		
Title 1 eligibility								
Eligible	88	90			51	86		
Not eligible	9	9			7	12		
Race/ethnicity (percent of students)								
American Indian or Alaskan Native			0	0			0	0
Asian			2	3			2	3
Black			4	8			5	11
White			91	15			88	18
Hawaiian Native or Pacific Islander			0	0			0	0
Hispanic			3	6			3	7
Two or more races			0	1			1	1
Other characteristics								
Percent of students eligible for free lunch			22	12			21	13
Total enrollment			655	555			751	604
Full-time teachers			52	38			57	39
Pupil-teacher ratio			12	3			13	2

Note: Percentages may not sum to 100 because of rounding. Demographic data were not available for one school from the total of 99 that received the survey invitation, so it is excluded from these calculations.

Source: Clements, Pazzaglia, et al., 2015.

Appendix D. Using SPSS to calculate summary statistics

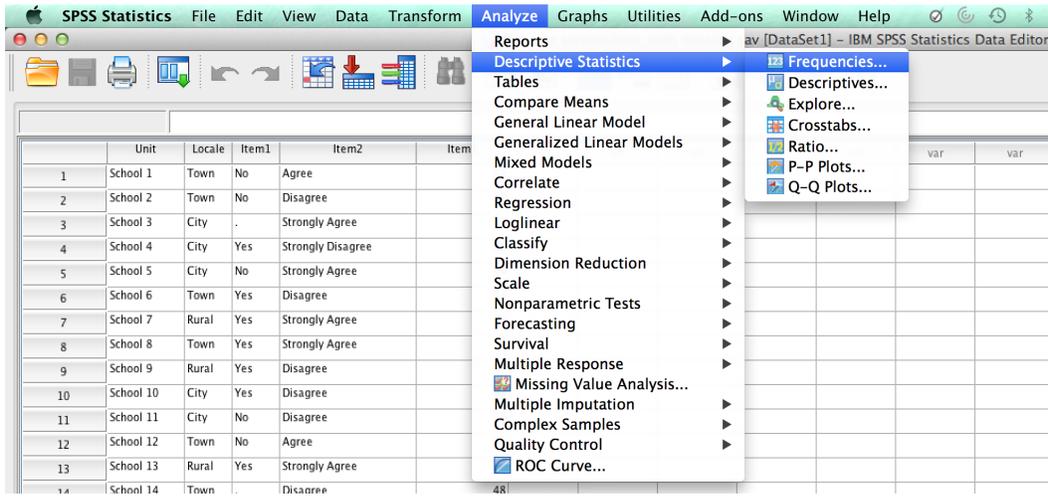
Steps for calculating the most commonly reported summary statistics (see table 2 in the main text) are depicted below using screenshots from IBM SPSS Statistics (version 19). These calculations can also be conducted using any common statistical software (for example, R, SAS, or Stata) or spreadsheet software (for example, Microsoft Excel). This example uses the following abbreviated analysis plan and SPSS survey data file:

Survey item	Summary statistic	Method of presentation
Item 1	Frequency; percentage	Table; bar graph
Item 2	Frequency; percentage	Table; pie chart
Item 3	Minimum; maximum; total; median; mean; standard deviation; standard error	Table

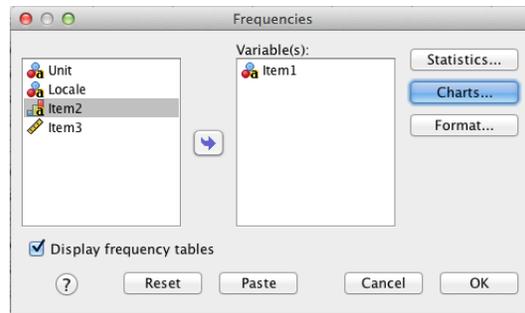
	Unit	Locale	Item1	Item2	Item3	var	var	var	var	var
1	School 1	Town	No	Agree	22					
2	School 2	Town	No	Disagree	17					
3	School 3	City	Yes	Strongly Agree	9					
4	School 4	City	Yes	Strongly Disagree	88					
5	School 5	City	No	Strongly Agree	14					
6	School 6	Town	Yes	Disagree	11					
7	School 7	Rural	Yes	Strongly Agree	82					
8	School 8	Town	Yes	Strongly Agree	30					
9	School 9	Rural	Yes	Disagree	40					
10	School 10	City	Yes	Disagree	68					
11	School 11	City	No	Disagree	14					
12	School 12	Town	No	Agree	31					
13	School 13	Rural	Yes	Strongly Agree	50					
14	School 14	Town	No	Disagree	48					
15	School 15	Rural	Yes	Disagree	32					
16	School 16	City	No	Agree	9					
17	School 17	City	Yes	Strongly Disagree	76					
18	School 18	Town	Yes	Strongly Disagree	93					
19	School 19	Rural	Yes	Strongly Agree	28					
20	School 20	Rural	No	Strongly Agree	96					
21	School 21	Rural	Yes	Strongly Agree	60					
22	School 22	City	Yes	Agree	8					
23	School 23	City	Yes	Strongly Disagree	19					
24	School 24	Town	No	Disagree	79					
25	School 25	Town	Yes	Strongly Agree	24					
26										

Calculating frequencies, percentages, and bar graphs for multiple-choice items (Item 1)

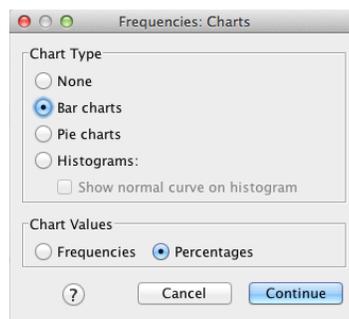
Step 1: Click Analyze, then Descriptive Statistics, then Frequencies...



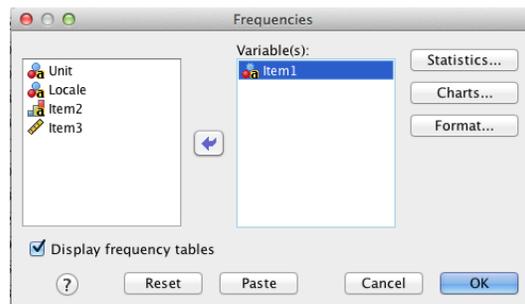
Step 2: Click on Item1, then click the arrow to move Item1 into the Variable(s): box. Click Charts...



Step 3: Click Bar charts, then Percentages, then Continue.



Step 4: Click OK.

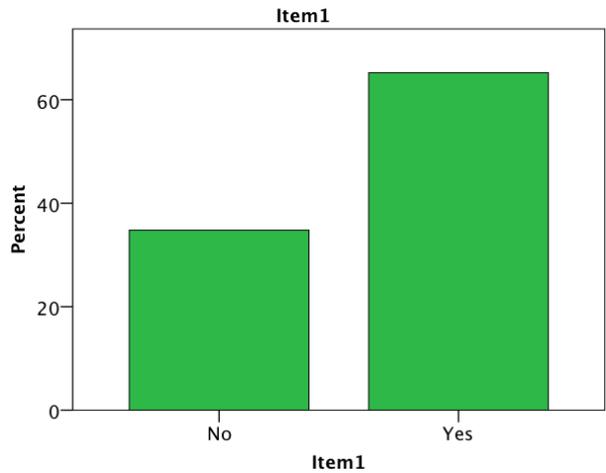


Step 5: Review the output file. SPSS provides both the percentage based on all cases and the valid percentage, which excludes cases with missing values. This example includes two missing values as evident in the Statistics table, below. The valid percentage in the second table below is the percentage of individuals who picked a particular item divided by all individuals who provided a response to that item. The valid percentage is the value that is typically reported and is the basis of the charts that SPSS provides.

Statistics

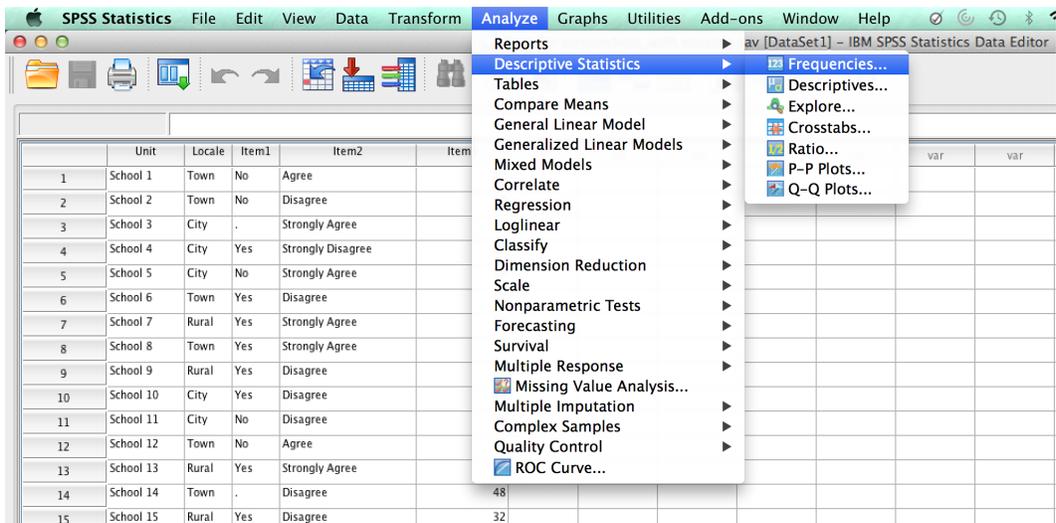
Item1		
N	Valid	23
	Missing	2

Item1					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	8	32.0	34.8	34.8
	Yes	15	60.0	65.2	100.0
	Total	23	92.0	100.0	
Missing	.	2	8.0		
Total		25	100.0		

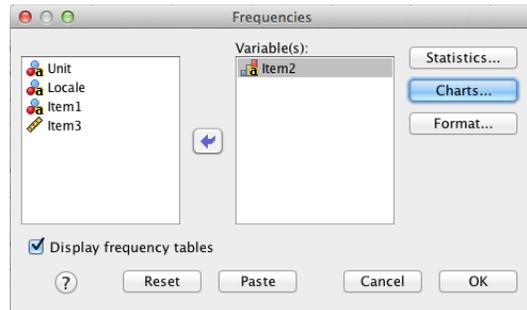


Calculating frequencies, percentages, and pie charts for rating scale response items (Item 2)

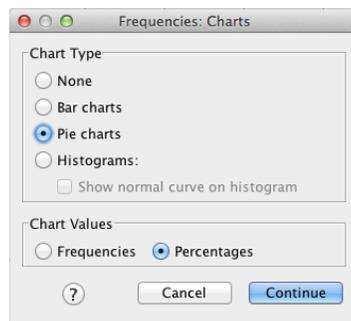
Step 1: Click Analyze, then Descriptive Statistics, then Frequencies...



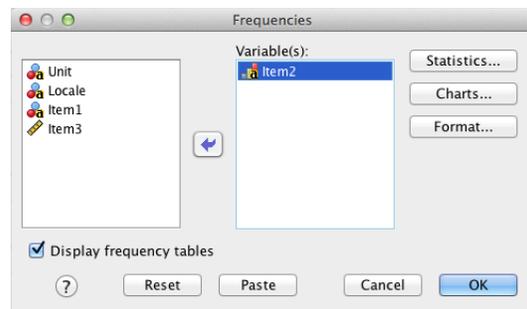
Step 2: Click on Item2, then click the arrow to move Item2 into the Variable(s): box.
Click Charts... .



Step 3: Click Pie charts, Percentages, then Continue.

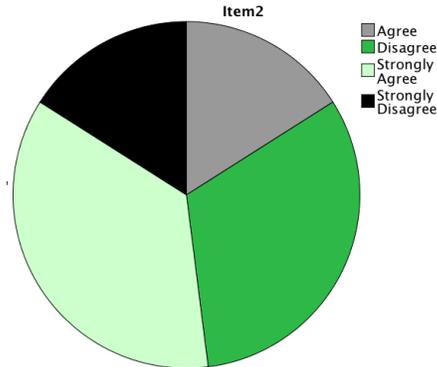


Step 4: Click OK.



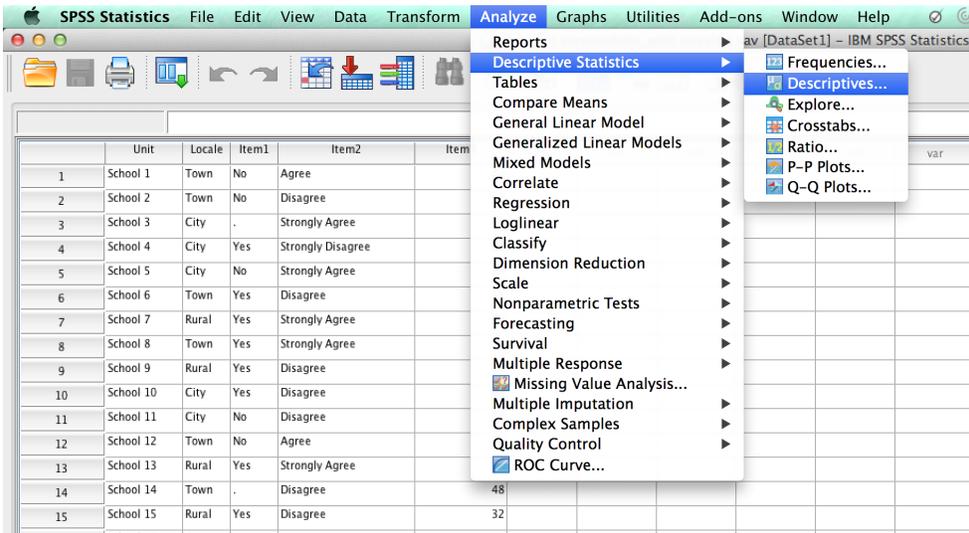
Step 5: Review the output file. SPSS provides both the percentage based on all cases and the valid percentage, which excludes cases with missing values.

		Item2			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	4	16.0	16.0	16.0
	Disagree	8	32.0	32.0	48.0
	Strongly Agree	9	36.0	36.0	84.0
	Strongly Disagree	4	16.0	16.0	100.0
	Total	25	100.0	100.0	

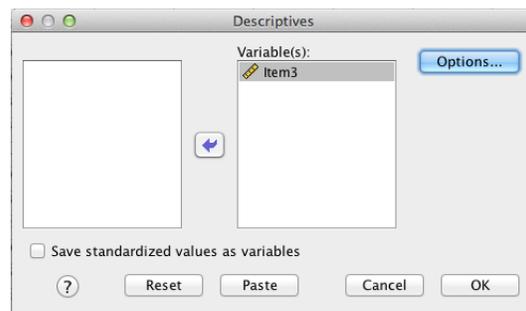


Calculating minimums, maximums, totals, medians, means, standard deviations, and standard errors for open response items (Item 3)

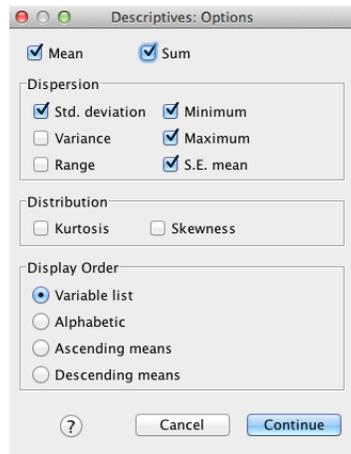
Step 1: Click Analyze, then Descriptive Statistics, then Descriptives...



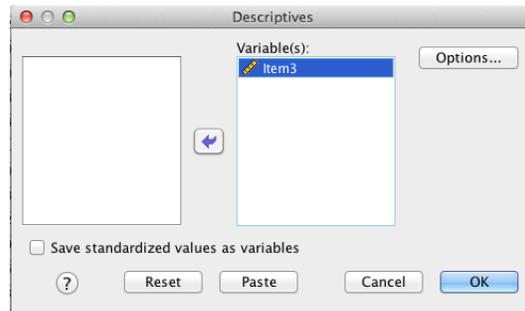
Step 2: Click on Item3, then click the arrow to move Item3 into the Variable(s): box. Click Options...



Step 3: Check all statistics of interest. For this example, check Mean, Sum (total), Std. deviation, Minimum, Maximum, and S.E. mean. Click Continue.



Step 4: Click OK.



Step 5: Review the output.

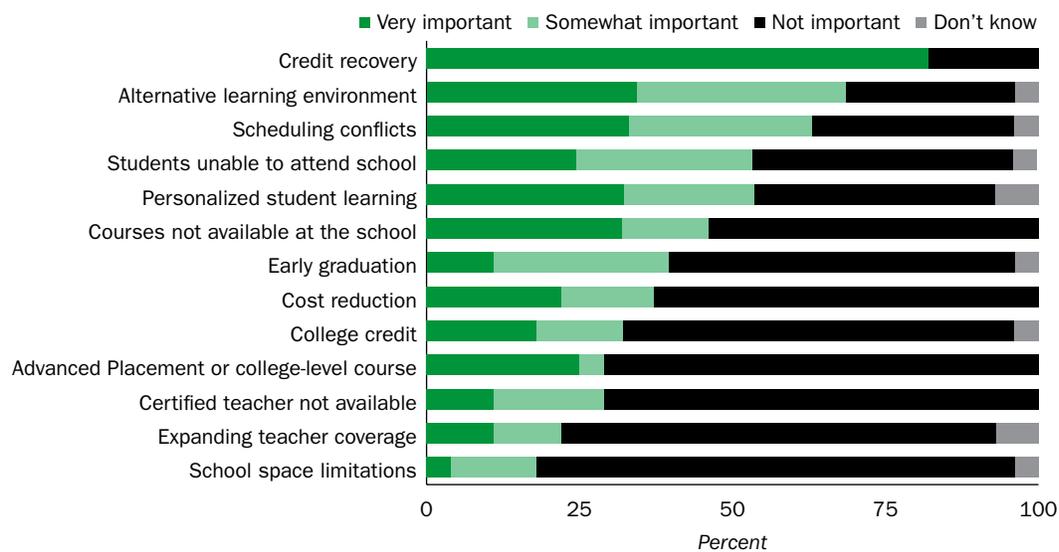
Descriptive Statistics

	N	Minimum	Maximum	Sum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Item3	25	8	96	1048	41.92	5.939	29.696
Valid N (listwise)	25						

Appendix E. Sample figures and tables

This appendix provides examples of figures and tables commonly used to report survey data, including a stacked bar graph (figure E1), pie chart (figure E2), a table reporting percentages (table E1), and a table reporting percentages and standard errors (table E2). Stacked bar graphs or pie charts are appropriate for reporting percentages for multiple-choice or scale response items. Bar graphs are appropriate for comparing percentages or means of two subgroups of respondents (for example, males and females) for multiple-choice, scale, or open response items. Tables are appropriate for reporting the minimum, maximum, total, mean, standard deviation, and/or standard error for open response items.

Figure E1. Sample stacked bar graph displaying responses to the survey question, “How important were the following reasons for having online courses in your school in 2012/13?”

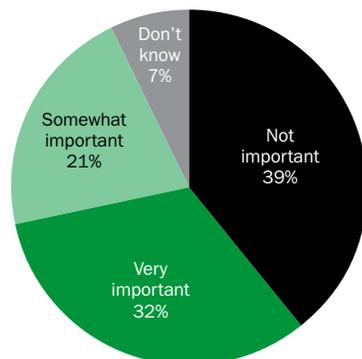


Note: N= 28 high schools responded.

Source: Adapted from Clements, Pazzaglia, et al. (2015).

Figure E2. Sample pie chart displaying responses to the survey question, “How important were the following reasons for having online courses in your school in 2012/13?” (percent of respondents)

a. To personalize student learning:



Note: N = 28 high schools responded. Percentages do not sum to 100 because of rounding

Source: Adapted from Clements, Pazzaglia, et al. (2015).

Table E1. Sample results table displaying responses to the survey question, “How important were the following reasons for having online courses in your school in 2012/13?” (percent, unless otherwise noted)

Reason	Very important	Somewhat important	Not important	Don't know	Total number of respondents
Credit recovery	82	0	18	0	28
Alternative learning environment	36	36	29	0	28
Scheduling conflicts	33	30	33	4	27
Students unable to attend school	25	29	43	4	28
Personalized student learning	32	21	39	7	28
Courses not available at the school	32	14	54	0	28
Early graduation	11	29	57	4	28
Cost reduction	22	15	63	0	27
College credit	18	14	64	4	28
Advanced Placement or college-level course	25	4	71	0	28
Certified teacher not available	11	18	71	0	28
Expanding teacher coverage	11	11	71	7	28
School space limitations	4	14	79	4	28

Note: N = 28 high schools responded. Percentages may not sum to 100 because of rounding.

Source: Adapted from Clements, Pazzaglia, et al. (2015).

Table E2. Sample results table displaying responses to the survey question, “Report the number of online course enrollments in school year 2012/13 in each of the following academic areas.”

Academic domain	Percent	Standard error	Number of respondents
History/social studies	72	9.2	25
Math	68	9.5	25
English/language arts	64	9.8	25
Science	52	10.2	25
Health/physical education	40	1.0	25
Fine arts	20	8.2	25
Languages other than English/world languages	12	6.6	25
Vocational/technical	4	4.0	25
Other	12	6.6	25

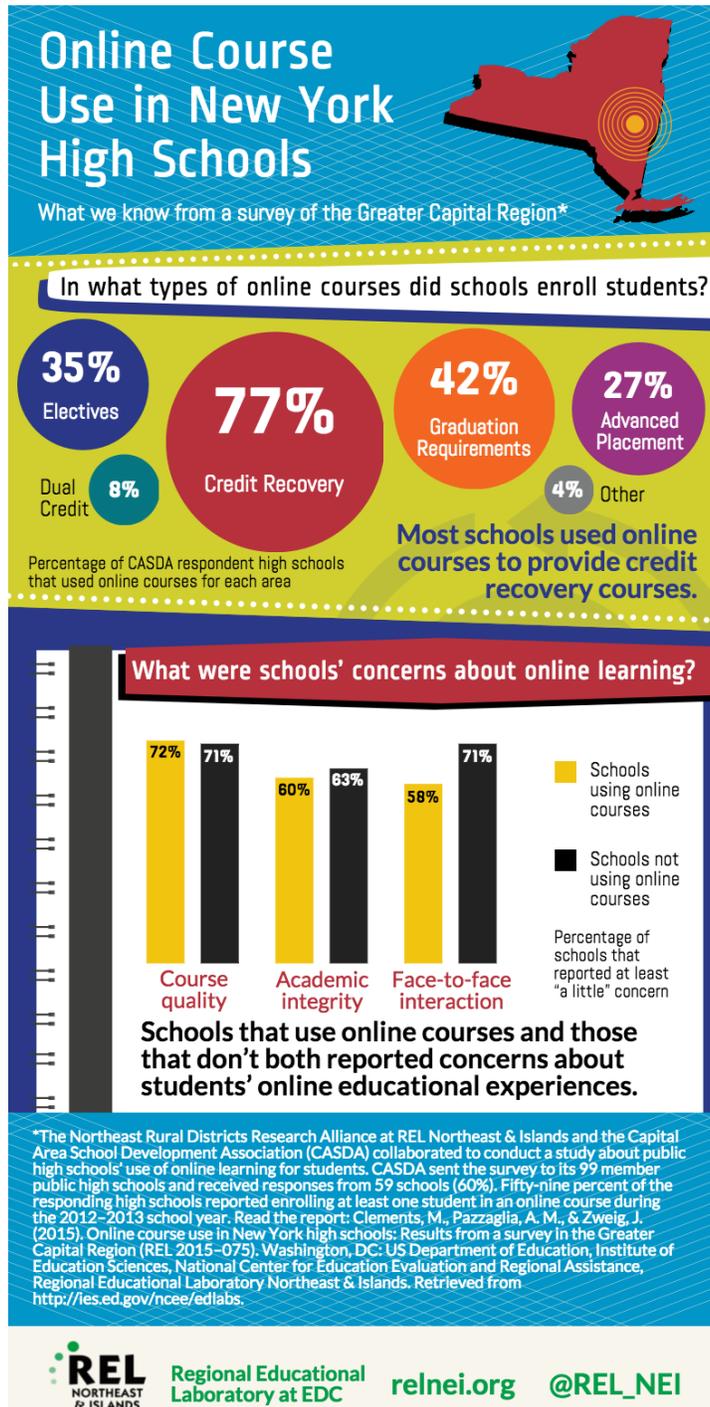
Note: N = 25 high schools that reported at least one online course enrollment for an academic subject in 2012/13. Some schools enrolled students in online courses for more than one academic subject.

Source: Adapted from Clements, Pazzaglia, et al. (2015).

Appendix F. Sample infographic

Infographics are visual presentations of data or other information that attract a reader's attention and quickly and clearly convey meaning. Infographics may be particularly useful for highlighting the key takeaways from a survey for websites or newsletters. A sample infographic from the online course use survey is shown in figure F1.

Figure F1. Sample infographic from the online course use survey project



Source: Regional Educational Laboratory Northeast & Islands website (<http://www.relnei.org/news/infographics.html>).

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Applied Research Methods

Research methods for educational settings



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