Obtaining Item Analysis Statistics for Noncognitive Items Using SPSS Syntax

In this document I explain how to use SPSS syntax to obtain item analysis statistics for noncognitive items. See the document "Obtaining Item Analysis Statistics for Noncognitive Items Using SPSS Dropdown Menus" for instructions on using menus.

The data for this example are from a scale measuring Attitudes Toward Same Sex Marriage that was developed as a class project. Some of the items were deliberately written to violate the item writing guidelines on pages 90-93 of the book. The items are shown at the end of this document. Items that were recoded are indicated with "R."

The data are in the file "Same-sex.sav." Items have already been recoded, if necessary. Recoded items are denoted with the suffix "r" in the dataset. Missing values are coded as -9.

For noncognitive items, a thorough item analysis includes examination of item frequency distributions, descriptive statistics, including the mean, standard deviation, skewness, and kurtosis values, inter-item correlations, corrected item-total correlations, and values of alpha-if-item-deleted.

Obtaining Descriptive Statistics and Frequency Distributions Using the *Frequencies* Command

Both descriptive statistics and frequency distributions can be obtained from the **FREQUENCIES** command using the syntax below:

FREQUENCIES VARIABLES=att1 att2 att3r att4 att5 att6r att7 att8r att9 att10r att11 att12 att13r att14 att15r att16 att17 att18r att19r att20r att21 att22 att23r
  /STATISTICS=STDDEV MEAN SKEWNESS SESKEW KURTOSIS SEKURT.

This syntax will produce the output below. I first show the descriptive statistics and then show selected frequency tables.

Note that I have broken the descriptive statistics output into three sections so it will fit on the page.

Statistics

		att1	att2	att3r	att4	att5	att6r	att7	att8r
N	Valid	95	95	95	95	94	95	93	94
	Missing	0	0	0	0	1	0	2	1
Mean		3.52	3.25	3.49	2.81	3.48	3.63	3.59	3.24
Std. Deviation		1.443	1.480	1.501	1.386	1.358	1.407	1.353	1.493
Skewness		-.640	-.267	-.530	.177	-.533	-.650	-.642	-.273
Std. Error of Skewness		.247	.247	.247	.247	.249	.247	.250	.249
Kurtosis		-.988	-1.319	-1.184	-1.188	-.815	-.934	-.835	-1.376

Statistics

		att9	att10r	att11	att12	att13r	att14	att15r	att16
N	Valid	95	95	89	95	94	95	95	94
	Missing	0	0	6	0	1	0	0	1
Mean		3.08	3.61	3.17	3.39	3.33	2.89	1.96	3.44
Std. Deviation		1.492	1.274	1.272	1.424	1.248	1.477	.784	1.364
Skewness		-.029	-.521	-.223	-.472	-.179	.124	.615	-.421
Std. Error of Skewness		.247	.247	.255	.247	.249	.247	.247	.249
Kurtosis		-1.479	-.811	-.806	-1.122	-.917	-1.371	.197	-1.061

Statistics

		att17	att18r	att19r	att20r	att21	att22	att23r
N	Valid	95	94	94	95	95	94	95
	Missing	0	1	1	0	0	1	0
Mean		3.48	1.74	3.61	3.05	3.23	3.91	4.21
Std. Deviation		1.359	.702	1.408	1.546	1.387	1.188	1.119
Skewness		-.524	.783	-.517	-.072	-.158	-.893	-1.358
Std. Error of Skewness		.247	.249	.249	.247	.247	.249	.247
Kurtosis		-.904	.808	-1.145	-1.530	-1.238	-.086	1.048

Items with small standard deviations, relative to the other items, may be problematic because a small standard deviation indicates a lack of variability. The purpose of most noncognitive scales is to spread responses out along the entire range of the construct. By definition, items that lack variability do not have a good spread of responses. A lack of variability means that respondents' answers are very similar, and the item is therefore not doing its job of spreading people out across the construct's continuum.

Items 15r and 18r have standard deviations that are approximately half those of the other items. These two items read:

15r. There is more support for same-sex civil unions in today's society then there was 30 years ago.

18r. Many people disapprove of same-sex marriages.

Item 15r violates two item writing principles: *Avoid items that refer to the past* and *Avoid statements that are factual.* Respondents may not be familiar with attitudes from 30 years ago. And, the level of support today versus 30 years ago is, presumably, a matter of historical record and therefore factual. For both these reasons, many respondents may simply agree with the item or choose the neutral option.

Item 18r can also be interpreted as factual in the sense that data could supply an answer, if such data were available. However, respondents are unlikely to have access to these data. Also, the item is written in such a wishy-washy way that it is difficult to disagree with it. Its low standard deviation is likely due to the fact that most respondents did agree with it.

High values of skewness indicate that most respondents have answered on the same side of the scale (either agree or disagree). This can be problematic for the same reason that low standard deviations can be problematic: high skewness indicates that responses are not well spread out.

High positive values of kurtosis indicate that responses are piled up at one response options. Again, this lack of spread may be problematic. In contrast, high negative values for kurtosis indicate that items are spread fairly evenly across the response options, which is generally a good thing.

A common cutoff value for "high" skew and kurtosis is |2.0|. Using this value, none of the values in the tables above are problematic. The highest value for skew is for item 23r at -1.358. A negative skewness value indicates that responses are mainly at the positive, or agreement, end of the scale. However, this item has been recoded such that the values 1,2,3,4, and 5 have been changed to 5,4,3,2, and 1 (see the document "Recoding Items Using SAS" for more information on this topic). So, the negative skew in this case means most respondents answered at the *disagree* end of the scale. The item reads:

Gay people are incapable of monogamous relationships.

Based on the item's skewness value, respondents tended to disagree with this item.

Items 2, 8r, 9, and 20r have the highest values of kurtosis, although the values are not above the |2.0| cutoff. However, these values are all negative, indicating a fairly even spread of responses across the five response options. The frequency distribution for item 2 is presented below to illustrate this. The values under "valid percent" are the percentage of *non-missing* respondents who chose a particular response option. These values are

preferred to those under "percent," which do not filter out missing responses. In the table below, there are no missing responses, so the two sets of values are identical.

att2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	18	18.9	18.9	18.9
	2	13	13.7	13.7	32.6
	3	18	18.9	18.9	51.6
	4	19	20.0	20.0	71.6
	5	27	28.4	28.4	100.0
	Total	95	100.0	100.0	

In the interest of saving space, I do not present all the frequency distributions. Instead, I show those that indicate common problems.

The distribution for item 11 illustrates two related problems. First, a large percentage (34.8%) of respondents chose option 3, labeled as *neutral.* This is often an indication that respondents are confused by the item. This interpretation is supported by the fact that 6 respondents did not answer the item. The item reads:

To ensure equal rights and to satisfy the heterosexual population who is against gay marriage, civil unions should be legal in all 50 states.

This is a classic example of a double-barreled item, and it is easy to see why it may have been confusing to some respondents. And frankly, the item does not make much sense.

att11

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	13	13.7	14.6	14.6
	2	10	10.5	11.2	25.8
	3	31	32.6	34.8	60.7
	4	19	20.0	21.3	82.0
	5	16	16.8	18.0	100.0
	Total	89	93.7	100.0	
Missing	-9	6	6.3		
Total		95	100.0		

Item 15r was earlier flagged for its low standard deviation, and its frequency distribution reveals why. Nearly 96% of respondents answered 1, 2, or 3, or, because the item was recoded, these answers were actually 5, 4, or 3, indicating strong agreement with the item, which was worded:

There is more support for same-sex civil unions in today's society then there was 30 years ago.

att15r

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	27	28.4	28.4	28.4
	2	49	51.6	51.6	80.0
	3	15	15.8	15.8	95.8
	4	4	4.2	4.2	100.0
	Total	95	100.0	100.0	

Item 23r (*Gay people are incapable of monogamous relationships*) had a moderate negative skew, indicating (because of its recoding) that most responses were at the negative end of the scale. Its frequency distribution is shown below:

att23r

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	4	4.2	4.2	4.2
	2	4	4.2	4.2	8.4
	3	15	15.8	15.8	24.2
	4	17	17.9	17.9	42.1
	5	55	57.9	57.9	100.0
	Total	95	100.0	100.0	

Keeping in mind the item's recoding, nearly 76% of respondents chose options 1 (*strongly disagree)* or 2 (*disagree).*

Obtaining Correlations, Corrected Item-total Correlations, and Alpha-if-item-deleted values Using the *Reliability* Command

These statistics can all be obtained using the *reliability analysis* command with the following syntax:

RELIABILITY
 /VARIABLES=att1 att2 att3r att4 att5 att6r att7 att8r att9 att10r att11 att12 att13r att14
  att16 att17 att18r att19r att20r att21 att22 att23r
 /SCALE('ALL VARIABLES') ALL
 /MODEL=ALPHA
 /STATISTICS=DESCRIPTIVE CORR
 /SUMMARY=TOTAL VARIANCE CORR.

The **SCALE** subcommand indicates that all variables listed should be included in the analysis. This is the default for this subcommand.

The **MODEL** subcommand indicates that coefficient alpha should be used in reliability calculations. This is the default for this subcommand.

The **STATISTICS** subcommand requests descriptive statistics (mean and standard deviation) and an inter-item correlation matrix.

The **SUMMARY** subcommand requests the average (across items) item variance and correlation.

The **TOTAL** subcommand requests the corrected item-total correlations, alpha-if-item-deleted values, and other statistics shown in the table labeled "**Item-total Statistics**" shown below.

I show only part of the correlation matrix in the interest of space. Note the extremely low correlations of items 13r, 15r, and 18r with most of the other items. The latter two items were flagged in our earlier evaluations because of their low standard deviations and lack of spread across response options.

att13r	-.114	-.042	.008	-.003	-.080	-.104	-.105	.056	.180	.066
att14	.723	.657	.625	.531	.585	.738	.611	.729	.734	.668
att15r	.062	.044	.196	.119	.044	-.009	.074	.161	-.022
att16	.792	.715	.654		.831	.811	.798	.712	.632	.660
att17	.808	.836	.567	.440	.715	.794	.698	.664	.617	.731
att18r	.168	.153	.202	-.136	.112	.144	.121	.217	.182	.159
att19r	.642	.544	.666	.559	.611	.721	.626	.697	.699	.579

Values of the summary statistics are shown next:

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Variances	1.774	.516	2.376	1.860	4.603	.223	23
Inter-Item Correlations	.463	-.406	.947	1.353	-2.330	.073	23

The average variance, across all items, is 1.774. This confirms our earlier interpretation that the standard deviations of items 15r and 18r are quite low.

The average correlation between pairs of items is .463. This confirms our observation that the correlations of items 13r,15r, and 18r are extremely low.

The output below shows the corrected item-total correlation, or discrimination value, and the value of alpha-if-item-deleted.

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
att1	71.23	429.075	.878	.950	.953
att2	71.51	432.770	.784	.826	.954
att3r	71.29	435.173	.734	.864	.955
att4	71.94	448.926	.573	.600	.957
att5	71.30	438.166	.767	.759	.954
att6r	71.15	428.530	.901	.949	.953
att7	71.17	438.005	.771	.734	.954
att8r	71.52	428.888	.852	.920	.953
att9	71.67	433.399	.777	.720	.954
att10r	71.16	439.291	.805	.797	.954
att11	71.57	449.613	.604	.753	.956
att12	71.36	430.892	.865	.929	.953
att13r	71.42	481.305	.010	.554	.962
att14	71.86	430.474	.844	.843	.953
att15r	72.77	480.298	.070	.364	.960
att16	71.36	433.316	.854	.859	.953
att17	71.31	434.853	.824	.843	.954
att18r	72.99	477.070	.185	.314	.959
att19r	71.14	435.651	.794	.751	.954
att20r	71.72	428.792	.818	.858	.954
att21	71.50	447.853	.580	.527	.957
att22	70.87	455.666	.515	.515	.957
att23r	70.53	454.040	.602	.638	.956

The value of coefficient alpha for the 23-item scale is .957, which is quite high given the poor quality of many of the items. The high value for alpha is likely driven by the large number of items.

Based on the corrected item-total correlation and alpha-if-item deleted values, the three worst-performing items on the scale are 13r, 15r, and 18r. All three items have low corrected item-total correlations, supporting our earlier observation that they appear to have low correlations with most of the other items. The value of coefficient alpha would increase slightly if any of the three items were removed from the scale, indicating that the three items are decreasing, rather than increasing, reliability.

Interestingly, all three items were reverse coded. Items 15r and 18r were flagged previously because of their low standard deviations. Item 13r reads:

Same-sex marriage should not be legalized, but civil unions that provide tax benefits should be allowed in order to be fair.

The wording is somewhat double-barreled and may have been confusing to respondents, as evidenced by its frequency distribution. As can be seen from the distribution, nearly 31% of respondents chose the neutral response option. Such large percentages of neutral response often signal a confusing item.

att13r

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	8	8.4	8.5	8.5
	2	16	16.8	17.0	25.5
	3	29	30.5	30.9	56.4
	4	19	20.0	20.2	76.6
	5	22	23.2	23.4	100.0
	Total	94	98.9	100.0	
Missing	-9	1	1.1		
Total		95	100.0		

Attitudes Toward Same Sex Marriage Items

Please respond to the following questions using the scale below. Place the number that best corresponds to your answer in the space next to each statement.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

_____ 1. Civil unions between same-sex couples should be legal.

_____ 2. Same-sex couples should be able to adopt children together.

__R__ 3. I believe homosexuality is sinful.

_____ 4. I feel that same-sex marriage should be legal, but should be left up to the individual church.

_____ 5. Same-sex couples should be recognized under Domestic Partnership laws.

__R__ 6. Same-sex civil unions should **not** be legal in the United States.

_____ 7. People in same-sex civil unions should have the same benefits as those in heterosexual marriages.

__R__ 8. Same-sex marriage is morally wrong.

_____ 9. Same-sex marriage should be legal in order to allow homosexual partners to have the same rights as heterosexual partners.

__R__ 10. The homosexual culture has a negative effect on society.

_____ 11. To ensure equal rights and to satisfy the heterosexual population who is against gay marriage, civil unions should be legal in all 50 states.

_____ 12. I believe that same-sex civil unions should be allowed in all 50 states in the U.S.

_R___ 13. Same-sex marriage should not be legalized, but civil unions that provide tax benefits should be allowed in order to be fair.

_____14. I believe that same-sex marriage should be allowed in all 50 states in the U.S.

__R__ 15. There is more support for same-sex civil unions in today's society then there was 30 years ago.

_____ 16. A civil union should be granted the same rights as a heterosexual marriage.

_____ 17. The partner of a gay person who has children should be allowed to legally adopt those children.

__R__ 18. Many people disapprove of same-sex marriages.

__R__ 19. I do not believe that same-sex marriages should be allowed in any state or country, or that same-sex partners should be allowed any tax or health benefits.

__R__ 20. Marriage should be legal only between a man and a woman.

_____ 21. Prohibiting same-sex marriages strips away the constitutional rights of homosexuals.

_____22. Everyone should have the right to marriage.

__R__23. Gay people are incapable of monogamous relationships.