

Work Problems Chapter 15

Suppose that I wanted to examine the attitudes of college students regarding their concerns for the future. I asked a sample of college students to complete a survey that contained four questions about the environment (e.g., “I am worried about climate change”), four questions about their own economic security (e.g., “I hope I am able to find a good job after graduation”), and four questions about their social relationships (e.g., “I am worried I will lose touch with my friends from college after I graduate”).¹ I suspect that students will respond similarly to all of the items within each particular category. In other words, I believe that students who are very concerned about one aspect of the environment will be concerned about all aspects of the environment, and will therefore answer all four of the survey items about the environment similarly. To see whether students’ responses to my survey items grouped together, I conducted an exploratory principal components factor analysis and the reliability analysis. Some of the results of these analyses are summarized in Tables 15.9 and 15.10. Please answer the following questions, some of them based on the information provided in these tables.

¹ This example is based on a real study by John J. Cullen and John W. Hoopes (1990).

Table 15.9: Eigenvalues, percentage of variance explained, and rotated factor matrix for work problems.

Rotation Sums of Squared Loadings			Rotated Factor Matrix				
Factor	Total (Eigenvalue)	% of Variance	Survey items	1	2	3	4
1	1.92	23.8	Enviro 1	.88			
2	1.54	19.2	Enviro 2	.86			
3	.83	8.4	Enviro 4	.81			
4	.71	6.3	Enviro 3	.53			.36
			Money 4		.92		
			Money 2		.84		
			Money 3		.74		
			Money 1		.32	.76	
			Social 1			.62	
			Social 2			.42	
			Social 3				.64
			Social 4				.57

Table 15.10: Reliability Statistics for Environmental Items for Work Problem

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	<i>N</i> of Items
.68	.67	4

	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha If Item Deleted
Enviro 1: "I am worried about climate change."	.61	.37	.58
Enviro 2: "Rising sea levels are a serious problem."	.58	.34	.60
Enviro 3: "My friends and I volunteer to clean up the environment."	.41	.17	.76
Enviro 4: "I am concerned about how humans are harming the planet."	.55	.30	.62

1. What is the purpose of conducting a factor analysis?

The primary purpose of conducting a factor analysis is to see how the data can be grouped together based on the correlations among the variables in the dataset. Variables or items that are highly correlated with each other may represent a unifying construct that is not directly measured but is indicated by multiple, measured variables. The factors that emerge from a factor analyses represent these unifying constructs, often called latent constructs or latent factors.

2. What does a reliability analysis tell you?

A reliability analysis provides information about how well a group of measured items or variables hold together in a single construct.

3. Using the information about eigenvalues and percentage of variance explained in Table 15.9, how many solid factors do you think emerged from the factor analysis of the survey items? Why do you think so?

According to the eigenvalues and percentage of variance explained, it appears that there are two solid factors in Table 15.9. Two of them have eigenvalues greater than 1.0 and each explain more than 10% of the total variance in the items.

4. Using the information from the Rotated Factor Matrix in Table 15.9, which items are cross-loading on more than one factor? What does this tell you about these items?

It appears that Enviro 3 and Money 1 each have factor loadings of greater than .30 on two separate factors. This tells us that these two items are not doing a good job of discriminating between two factors and therefore create some confusion about the conceptual clarity of each of these items.

5. Looking at the factor loadings from the Rotated Factor Matrix in Table 15.9, what would you predict the Cronbach's alpha to be for the four Social items? Why?

Two of the Social items load on Factor 3, and the other two Social items load on Factor 4. In addition, none of the four Social items load very strongly (i.e., over .70) on either factor. In addition, the eigenvalues for Factor 3 and Factor 4 are below 1.0. All of this suggests that these four items do not go very well together (i.e., are not strongly correlated with each other), so the Cronbach's alpha for these items will be quite low.

6. What does the information provided in Table 15.10 suggest regarding which

item, if any, might be eliminated from the Environmental items to create a good scale?

The “Enviro 3” item, if eliminated, would raise the Cronbach’s alpha from .68 to .76. This suggests that this item should perhaps be eliminated from this scale.

7. From a conceptual standpoint, how is the Environmental survey item with the weakest contribution to the Cronbach’s alpha different from the other three Environmental items? And how is this difference reflected in the cross-loading of this item on two factors?

Remember that items should not be eliminated from scales simply because they weaken its statistical properties. Conceptual fit among the items should also be considered. Notice that “Enviro 3” is quite different, conceptually, from the other three items. This item is about behavior (i.e., volunteering) but the other three items are about concerns.