An exploration of the role of Likert items in school-based survey analysis

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Abstract

This paper explores Likert item treatment in school-based surveys. It is common to treat Likert items on education surveys as interval data and perform arithmetic analyses reserved for interval data on this ordinal data. To explore the treatment of Likert items in school-based surveys the items are analyzed as interval and ordinal in two different use cases, 1) survey design and 2) analysis of results. Scale creation is analyzed using principle component analysis (PCA) and categorical principle component analysis (CATPCA). Both CATPCA and PCA yielded comparable results. Survey results are analyzed using a stratified sample t-test and ordinal regression. The t-test approach examines the difference in means. Conversely, the ordinal regression approach treats the data as ordinal. The ordinal regression approach yielded results that are largely consistent with the results from the stratified sample approach.

An exploration of the role of Likert items in school-based survey analysis

Objectives

The purpose of this paper is to explore approaches to school-based survey design and analysis that accurately and appropriately treat Likert items. Exploratory factor analysis, using principle component analysis with Pearson correlations and a separate categorical principal components analysis, are used to examine scale constructs while stratified sample t-tests and ordinal regression results are contrasted to explore the impact of treating Likert items as an interval scale.

Perspective

Likert items (Likert, 1932) asking students and teachers to indicate agreement with statements on a variety of topics by selecting a range of terms ordered based on agreeableness, such as ‘agree’, ‘somewhat agree’, ‘somewhat disagree’, and ‘disagree’, are often assumed to be spaced with a constant interval between the options. However, this is not the case. Converting an ‘agree’ to a numeric score of 4 and a ‘disagree’ to a numeric score of 1 assigns equal spacing based on an assumption, not the scale design. It is common to treat Likert items as interval data and perform arithmetic analyses reserved for interval data on this ordinal data. While common, this practice violates mathematical principles. It has been established as a common and problematic practice across multiple disciplines (Kuzon, Urbanchek, & Mccabe, 1996), while also debated (Pell, 2005), and justified depending on the structure and use case (see Carifio & Perla, 2007; Wu & Leung, 2017). Carifo and Perla (2007) note the distinction between a Likert scale and a Likert style format and the treatment of the responses is essential to understanding the appropriate arithmetic analysis for the items. It has been argued that treating the Likert items like interval scales for a specific purpose, such as factor analysis, does not then grant the liberty to continue to treat the items like an interval scale (Wu & Leung, 2017). It has been suggested that increasing the number of points on the scale mitigates the risk of treating the ordinal scale as interval because the increase in points forces the scale to behave more like an interval scale (Wu & Leung, 2017). Wu and Leung (2017) argue that practitioners should use 11-point Likert scales from 0 to 10 to mimic an interval scale. However, in practice for school-based researchers this is challenging because younger students can find a 11-point scale confusing and for interpretability scale categories are often combined during analysis. Rhemtulla (2012) suggests that scales with at least 5 points can be treated as interval for factor analysis purposes. It has also been argued that factor analysis applied to ordinal data results in over-dimensionalisation (van Der Eijk & Rose, 2015). The focus of this exploration is in the treatment of Likert items when items are hypothesized to create constructs.

Analysis of Likert items

In survey design researchers often rely on data reduction techniques to sort factors and identify the model structure for scales. Methods are used to explore the underlying pattern of relationships among variables. The identification of factors and the creation of scales are common practice in survey design (Baglin, 2014). Likert scales are a common design feature and are often analyzed using data reduction techniques, such as principle component analysis (PCA). PCA is a technique that transforms correlated variables into a group of uncorrelated variables and then the first few components are used to explain variation (Deane, 1992). A common procedure involves using the Pearson correlation matrix. Pearson correlations assume items are derived from an interval scale (Baglin, 2014). Therefore, this assumption is often violated when Likert items are analyzed. This issue is documented in the literature (see Baglin, 2014) and in the SPSS support guide (IBM, 2018):

> The Factor procedure actually ignores the measurement scale of the variables as declared in the Measure column of the Variable view and treats the variables as if they are on an interval scale. (String variables are not accepted.) It is not uncommon for researchers to factor analyze ordinal variables as if they were interval scale variables, particularly as the number of levels for the variables increases, but this approach is controversial and prone to particular problems.

Researchers therefore have the choice of continuing to treat Likert items as interval for survey design or using alternative methods. However, in the pursuit of increasing access to analysis techniques, using procedures available in standard statistical software packages, like SPSS, is of great interest to the field. One such alternative, categorical principal components analysis (CATPCA) is explored and compared to traditional PCA techniques that rely on Pearson's correlation matrix.

School-based surveys require special attention because the participants are often young children with limited response skills and the results have immediate practical implications. Therefore, survey design and communication are priorities. Surveys must be doable for young learners, and communicating results efficiently, easily, and clearly is critical. The treatment of Likert items impacts both these areas directly. School-based surveys are often implemented and co-designed with psychologists and, while the treatment of Likert items is fairly well established in some fields, it is not as commonly established in all fields. Therefore, this paper is intended to connect researchers from different fields who work on school-based surveys.

Methods

To explore the treatment of Likert items comprising scales in school-based surveys, this paper explores two school-based surveys. The first survey, the Theory of Knowledge Teacher Survey (TOK Survey) (Bergeron & Rogers, 2015), explores the role of Likert items in survey design procedures, and the second survey, Youth Truth Survey (Youth Truth, 2017), explores the role of Likert items in communicating results. The aspect of survey design explored in this paper is scale construction. The aspect of communicating results explored is comparing student outcomes between two groups.

Theory of Knowledge Teacher Survey. Theory of Knowledge (TOK) is a course taught in IB Schools. As a part of the International Baccalaureate (IB) Diploma Programme (DP), students participate in the Theory of Knowledge (TOK) course. This interdisciplinary course is designed as an epistemological course. The TOK Teacher survey was sent to IB teachers to collect data about their beliefs, perspectives, and confidence teaching this subject. The online survey was sent to all school TOK teachers. Survey responses were received from 2,079 participants, but 545 responses were not included because role was not identified. Items 31-41 of the TOK Survey were designed to measure teacher confidence teaching TOK and use a 4-point Likert scale. Procedures to evaluate the use of these items as a scale were performed.

Exploratory Factor Analysis using Pearson's correlation matrix. Analysis of internal reliability suggests that the items measure the same characteristic (see Table 1) and could be evaluated as a scale. It is suggested that removing items would not improve the reliability (see Table 2), therefore the 11 items tested were all included on the Confidence Teaching TOK (CTT) scale. Exploratory factor analysis (EFA) with principle component extraction (PCA) and pre-screening tests were performed. The Kaiser-Meyer-Olkin (KMO) statistic (.801) (Hutcheson & Sofroniou, 1999) confirms adequate sample size. Bartlett's test of sphericity produced significant results; singularity is not an issue. The determinant of the correlation matrix (.059) was greater than 0.00001, suggesting there is no multicollinearity (Mertler and

Vannatta, 2009). The values on the diagonal of the anti-image matrix of covariances and correlations (Figure 1) are greater than 0.5, suggesting adequate sample.

Categorical Principal Components Analysis. Optimal scaling procedures in SPSS version 25 were used to perform a CATPCA. All 11 items were included. The procedure was performed three times with different dimension forcing to explore the possibility of more than 1 factor emerging.
Internal consistency of dimension 1 with all 11 items, as measured by Cronbach's alpha, is .872 (Table 3). The total model accounts for 44% of the variance in the optimally scaled items. The variance accounted for table (Table 4) yields information about coordinates for each item on each dimension in relation to the centroid (0, 0). The means are used to interpret the extent the items contribute to the principal components, with a small mean coordinate indicating items may not contribute significantly. Only item 1 is considered small and may not be suitably contributing to the principal components (Starkweather & Herrington, 2016).

Youth Truth student survey. Six schools offering Project-Based Learning (PBL) conducted the Youth Truth survey to gather feedback on students' perceptions of their school experience within six themes (student engagement, academic rigor, relevance, instructional methods, personal relationships, and culture). Youth Truth is a non-profit organization dedicated to providing student and stakeholder feedback for school improvement by providing student and teacher surveys. The elementary student survey was used in this analysis and has been subjected to continuous validity testing, via factor analysis, and reliability testing, via internal consistency, suggesting the instrument is reliable and valid for upper elementary school students in U.S. public schools (see Youth Truth, 2018). The Youth Truth Elementary Survey is designed for upper elementary school students (grades 3-5) and was created using an extensive review of 1) research about teaching practice that supports positive student learning outcomes (such as John W. Gardener center at Stanford and studies by the Chicago Consortium on School Research), 2) existing well-validated survey instruments (such as the three-year Measures of Effective Teaching (MET) study by the Bill and Melinda Gates Foundation), and 3) best practices for surveying young children. These best practices include non-biased survey question structure (avoiding negative wording, using neutral framing, and focusing on individual experience), accessible Lexile level, shorter survey length, and a three-point scale. In addition, focus groups and field tests were used to assess face validity.

Complete responses were received from 1,671 upper elementary students in grades 3-6 from six elementary schools. A series of analyses was conducted to determine whether elementary school students at the Project-Based Learning schools (PBL) perceive their school experience differently than do students attending other schools. First, a normal stratified sample t-test was performed and then validated using a stratified sample t-test with paired matching on demographics. Second, an ordinal regression was used to better isolate the effect of the PBL program on student perceptions.

Stratified Sample. The first method utilized in this analysis was a stratified sample t-test to examine the differences between PBL schools and non-PBL schools as perceived by their students. The stratified sample analysis included two different series of tests. The first series of tests used a t-test to compare data from PBL schools to a random sample from comparable non-PBL schools based on school characteristics of student population size, geographic locale, and poverty level. The second series of tests used the same method but, in addition, it matched students at PBL schools to their peers at non-PBL schools based on student level demographics including grade level and gender. We used these two versions of a stratified sample t-test to assess survey items as well as survey factors. In analyzing items as factors, the items are treated as an interval scale and arithmetically averaged, which is not valid with an ordinal scale. The exploration of factors is an example of treating an ordinal scale like an interval scale.

Ordinal Regression. The second method used to assess differences between students' perceptions at PBL schools and non-PBL schools was a series of ordinal regressions. Regression analysis provided greater flexibility than the stratified sample t-tests in that the effect of each predictor variable, such as student or school characteristics, could be examined independently, allowing us to include in the model only the predictor variables that were seen to have an important impact on a given survey item. This kind of model is used to predict a dependent variable that is categorical and follows a defined order. The Youth Truth elementary school survey uses a 1 to 3 answer scale, where 1 is "No, hardly ever", 2 is "Sometimes", and 3 is "Yes, very often." Because the intervals between answer choices may not be equal, this data cannot be said to be strictly continuous. Unlike the stratified sample approach, the ordinal regression approach only analyzed survey items, not factors. Factors are means of multiple items and are not ordinal variables, therefore only items were examined using an ordinal regression model (see Figure 2).

Model description. Where $prob(event)$ is the likelihood for the respondent to choose a score of 2 (Sometimes) over 1(No, hardly ever) or 3 (Yes, very often) over 2 (Sometimes) for a certain item. β_0 is the constant coefficient (y-intercept). $\chi_1, \chi_2 \dots \chi_k$ are the relevant independent variables such as school and respondent demographics that are decided stepwise for each question item. $\beta_1, \beta_2, \dots \beta_k$ are the coefficients of each respective variable that determine the likelihood of the event occurring. A positive coefficient means that the variable is associated with a higher likelihood of an event occurring. Table 5 shows a summary of the ordinal regression results. The odds ratio is used to show the effect of attending a PBL school. The odds ratio is the exponent of the coefficient for each independent variable. It represents the effect of the independent variable on the likelihood of a respondent choosing a 2 over a 1 and a 3 over a 2 in the survey.

Results

Theory of Knowledge Teacher Survey. Three methods of interpretation of the analysis were considered: 1) Kaiser's rule, 2) scree plot, and 3) total variance. Kaiser's rule states that only components with eigenvalues greater than 1 should be retained. Three components have eigenvalues greater than 1. However, Kaiser's rule can overestimate the number of factors (Bandalos & Boehm-Kaufman, 2009). Examination of the scree plot (Figure 3) suggests that one to two components could be retained. Examination of the factors that account for total variance suggests that up to 5 factors should be retained (Figure 4). The scree plot is an appropriate determinant because not all the communalities are greater than .70 nor is the average greater than .60. Given that the first factor[1] is nearly 3 times the size of the second factor[2] and the sharp drop in the scree plot between factor 1 and 2 it is reasonable to retain 1 factor. Component 1, also factor 1, included all 11 items (items 31-41). This suggests that the CTT scale is organized by one underlying component. The internal reliability testing also suggested all items measure the same characteristic. Therefore, based on the traditional PCA the analysis of TOK teaching confidence will examine confidence using a scale score of all 11 CTT items. The results of the CATPCA also suggest that the 11 items can be evaluated as a scale measuring 1 dimension, teacher confidence teaching TOK. The eigenvalues are helpful in examining the interpretation of the dimensionality with the CATPCA and also in comparing CATPCA to the traditional PCA. The first eigenvalue to examine is the reported value in the correlation matrix after optimal scaling, this is the eigenvalue used in the CATPCA and is 4.772. The second and third eigenvalues to examine are displayed

[1] 3.810
[2] 1.333

in the iteration history. The standard PCA solution is available as iteration 0, and is 3.79. The CATPCA eigen value is 3.88. As larger eigenvalues are preferred, it is evident that that when the ordinal nature of items is accounted for the result improves slightly but does not change substantially (the difference between 3.79 and 3.88). The practical implications remain, the items can be used as a scale, while the degree of suitability is slightly improved with the CATPCA.

Youth Truth. The student perception data for Youth Truth's elementary survey is on a 1 to 3 Likert scale, with '1' being the least favorable and '3' the most favorable. Traditionally, Likert scales are treated as ordinal, or categorical, data because the difference between answer choices is not necessarily equal. However, recent findings show that treating Likert data as continuous can be valid in certain scenarios, for example if the population size is sufficiently large, if the data is normal, or if there is a larger number of intervals on the Likert scale.

There are important distinctions in understanding the results of the two approaches used for this analysis. The t-test approach examines the difference in means. Thus, we are able to make claims about the mean results of the PBL students. Treating the data as continuous also allows us to study PBL student perceptions of entire factors, which are mean scores of a group of items that are correlated with each other. Conversely, the ordinal regression approach treats the data as ordinal, or categorical, and tests the likelihood of a PBL student choosing a more favorable response choice. Ordinal data cannot be analyzed as a mean, and instead the values that are interpretable are the log-odds.
The stratified sample analysis found that the factor "Instructional Methods" was rated higher by students at PBL schools than by their peers at non-PBL schools with statistical significance at the 99 percent confidence level. This factor "[d]escribes the degree to which the teacher uses techniques that probe for absorption and understanding, providing effective support to students when needed." Therefore, holding school demographic variables constant, students at PBL schools rated the group of four items that make up the "Instructional Methods" factor higher than do students at non-PBL schools. Additionally, this analysis found that students at PBL schools rated the following items higher than students at non-PBL schools: 1) Does your teacher ask you about your life at home? (from the relevance factor) 2) Does your teacher let you explain your ideas? (from the student engagement factor)

The ordinal regression approach yielded results that are largely consistent with the results from the stratified sample approach. The two items reported in the previous section as likely to be rated higher due to the “PBL effect” were associated with higher scores in the regression approach as well. However, the regression models found more differences between PBL and non-PBL than did the stratified sample approach. Table 6 displays the results of these two analyses. It lists the items and factors for which attending a PBL school was associated with a statistically significant positive effect in at least one of the two types of analysis. The two rightmost columns display with an “X” which analysis found a statistically significant positive effect. We have only reported on statistically significant results at a 99 percent confidence level (p-value < .01).

Scholarly significance

This exploration suggests that treating Likert scales as interval scales in school-based surveys can yield practically significant results, even with 3 and 4-point scales. When designing surveys and creating scales, researchers can use either traditional PCA models or the CATPCA, with similar results. This increases access to EFA tools and enables a wider use of EFA techniques, resulting in more, higher quality surveys that can be easily implemented, and that schools can rely on for timely information from students and teachers. The CATPCA procedure at the time of this research is only available in premium versions of SPSS, while traditional PCA techniques are available in student and standard versions. Enabling the use of the more accessible technique will assist many school-based researchers.

These findings also suggest that school-based surveys using Likert scales do not need to contain the large number of points previously assumed (see Wu & Leung, 2017) and in fact a scale with only 3 points used at the elementary level can behave like an interval scale. This will enable school-based researchers to perform the necessary analyses to communicate results from young learners. Collecting data in schools has many challenges and being able to use a survey tool with fewer Likert scale points will increase ease of implementation and accuracy in the analysis of school-based surveys, especially for young learners.

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Tables

Table 1

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	# of Items
.798	.808	11

Table 2

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
item31	32.64	21.51	.433	.227	.785
item32	33.13	21.43	.331	.134	.794
item33	32.76	21.27	.418	.215	.785
item34	33.24	19.63	.442	.364	.785
item35	32.76	20.40	.487	.463	.778
item36	32.49	20.66	.586	.469	.772
item37	32.50	20.94	.488	.368	.779
item38	32.59	20.44	.499	.335	.777
item39	32.48	20.95	.483	.326	.780
item40	32.90	19.30	.510	.430	.776
item41	33.36	19.22	.442	.359	.787

Table 3

Reliability Statistics from the CATPCA

Cronbach's Alpha Dimension 1	# of Items
.872	11

Table 4

Variance Accounted For Table from SPSS Output

	Centroid Coordinates		Total (Vector Coordinates)	
	Dimension		Dimension	
	1	Mean	1	Total
Item 1	.004	.004	.003	.003
Item 2	.093	.093	.092	.092
Item 3	.197	.197	.196	.196
Item 4	.636	.636	.635	.635

Item 5	.543	.543	.541	.541
Item 6	.683	.683	.683	.683
Item 7	.559	.559	.557	.557
Item 8	.652	.652	.651	.651
Item 9	.577	.577	.576	.576
Item 10	.482	.482	.481	.481
Item 11	.400	.400	.400	.400

Table 5

Ordinal Regression Summary Table

Factors	Items┼	t statistic	p-value	Odds Ratio
Student Engagement				
	Does your teacher want you to do your best?	1.727	8.42E-02*	1.279
	Does your teacher let you explain your ideas?	4.378	1.20E-05***	1.267
Personal Relationships				
	Is your teacher fair to you?	2.073	3.82E-02**	1.136
	Does your teacher give you extra help if you need it?	2.667	7.64E-03***	1.154
	Does your teacher tell you that you can do well if you work hard?	2.416	1.57E-02**	1.164
	Does your teacher treat you with respect?	3.784	1.55E-04***	1.340
	Do you like the way your teacher treats you when you need help?	0.379	7.04E-01	1.025
Relevance				
	Do you think your teacher cares about you?	4.769	1.85E-06***	1.415
	Does what you learn in class help you outside of school?	1.586	1.13E-01	1.080
	Does your teacher ask you about your life at home?	8.370	5.78E-17***	1.506
Classroom Culture				
	Can you find the things you need in your classroom?	0.277	7.82E-01	1.016
Academic Rigor & Expectations				
	Does the work you do in this class make you really think?	0.339	7.35E-01	1.018
	Does your homework help you learn?	1.980	4.77E-02**	1.240
	Do you learn a lot in your class?	1.960	5.00E-02*	1.135
Instructional Methods				
	Does your teacher ask you if you understand what you are learning?	1.435	1.51E-01	1.083
	Does your teacher explain things in ways you can understand?	2.453	1.42E-02**	1.150
	Does your teacher ask you to show your work?	2.762	5.74E-03***	1.190
	When you make a mistake, does your teacher help you correct it?	4.302	1.69E-05***	1.258
Student Motivation				
	Do you care about how much your classmates learn?	0.384	7.01E-01	1.023
	Can you concentrate in class?	0.253	8.00E-01	1.015
	Do you explain your work to other students?	2.211	2.71E-02**	1.143
	I know what it takes to get good grades in school.	2.834	4.59E-03***	1.278
	Do you help other kids in class when they don't know what to do?	2.325	2.01E-02**	1.148
	Do you do your schoolwork, even if no one tells you to?	4.046	5.22E-05***	1.278
	I believe I can learn new things, but I can’t really change how smart I am.	6.330	2.45E-10***	1.465

┼ *Only items with a higher mean for PBL respondents than for non-PBL respondents are included here.*

**Statistically Significant at a 90 percent confidence level.*
***Statistically Significant at a 95 percent confidence level.*
****Statistically Significant at a 99 percent confidence level.*

Table 6
Youth Truth Comparison

	Stratified Sample	**Ordinal Regression**
Instructional Methods (Factor)	X	Not measured
Does your teacher let you explain your ideas?	X	X
Does your teacher ask you about your life at home?	X	X
Does your teacher give you extra help if you need it?		X
Does your teacher treat you with respect?		X
Do you think your teacher cares about you?		X
Does your teacher ask you to show your work?		X
When you make a mistake, does your teacher help you correct it?		X
I know what it takes to get good grades in school*		X
Do you do your schoolwork, even if no one tells you to?*		X

Figures

Anti-image Matrices

		q31N	q32N	q33N	q34N	q35N	q36N	q37N	q38N	q39N	q40N	q41N
Anti-image Covariance	q31N	.773	-.116	-.109	-.054	-.062	-.034	-.068	-.054	-.030	-.037	.045
	q32N	-.116	.866	-.099	-.055	-.009	-.004	-.010	.006	-.033	.007	-.100
	q33N	-.109	-.099	.785	-.051	-.054	-.033	-.068	-.093	-.002	.012	-.006
	q34N	-.054	-.055	-.051	.636	-.280	.030	.010	-.040	.016	-.055	-.017
	q35N	-.062	-.009	-.054	-.280	.537	-.201	.035	.037	.001	.037	-.033
	q36N	-.034	-.004	-.033	.030	-.201	.531	-.202	-.035	-.104	-.017	-.027
	q37N	-.068	-.010	-.068	.010	.035	-.202	.632	-.154	-.030	-.034	.006
	q38N	-.054	.006	-.093	-.040	.037	-.035	-.154	.665	-.161	-.039	-.048
	q39N	-.030	-.033	-.002	.016	.001	-.104	-.030	-.161	.674	-.163	.022
	q40N	-.037	.007	.012	-.055	.037	-.017	-.034	-.039	-.163	.570	-.298
	q41N	.045	-.100	-.006	-.017	-.033	-.027	.006	-.048	.022	-.298	.641
Anti-image Correlation	q31N	.899[a]	-.142	-.140	-.076	-.096	-.053	-.098	-.075	-.042	-.056	.064
	q32N	-.142	.870[a]	-.121	-.074	-.013	-.006	-.014	.008	-.043	.010	-.134
	q33N	-.140	-.121	.901[a]	-.072	-.083	-.051	-.097	-.129	-.003	.017	-.009
	q34N	-.076	-.074	-.072	.756[a]	-.479	.052	.015	-.062	.024	-.092	-.026
	q35N	-.096	-.013	-.083	-.479	.714[a]	-.376	.060	.062	.001	.066	-.056
	q36N	-.053	-.006	-.051	.052	-.376	.809[a]	-.349	-.058	-.174	-.031	-.047
	q37N	-.098	-.014	-.097	.015	.060	-.349	.830[a]	-.238	-.046	-.057	.010
	q38N	-.075	.008	-.129	-.062	.062	-.058	-.238	.863[a]	-.241	-.064	-.074
	q39N	-.042	-.043	-.003	.024	.001	-.174	-.046	-.241	.849[a]	-.263	.033
	q40N	-.056	.010	.017	-.092	.066	-.031	-.057	-.064	-.263	.746[a]	-.493
	q41N	.064	-.134	-.009	-.026	-.056	-.047	.010	-.074	.033	-.493	.734[a]

a. Measures of Sampling Adequacy(MSA)

Figure 1. Anti-image Matrices

$$\ln\left(\frac{prob(event)}{1-prob(event)}\right) = \beta_0 + \beta_1\chi_1 + \beta_2\chi_2 + \cdots + \beta_k\chi_k$$

Figure 2. Ordinal Regression Model

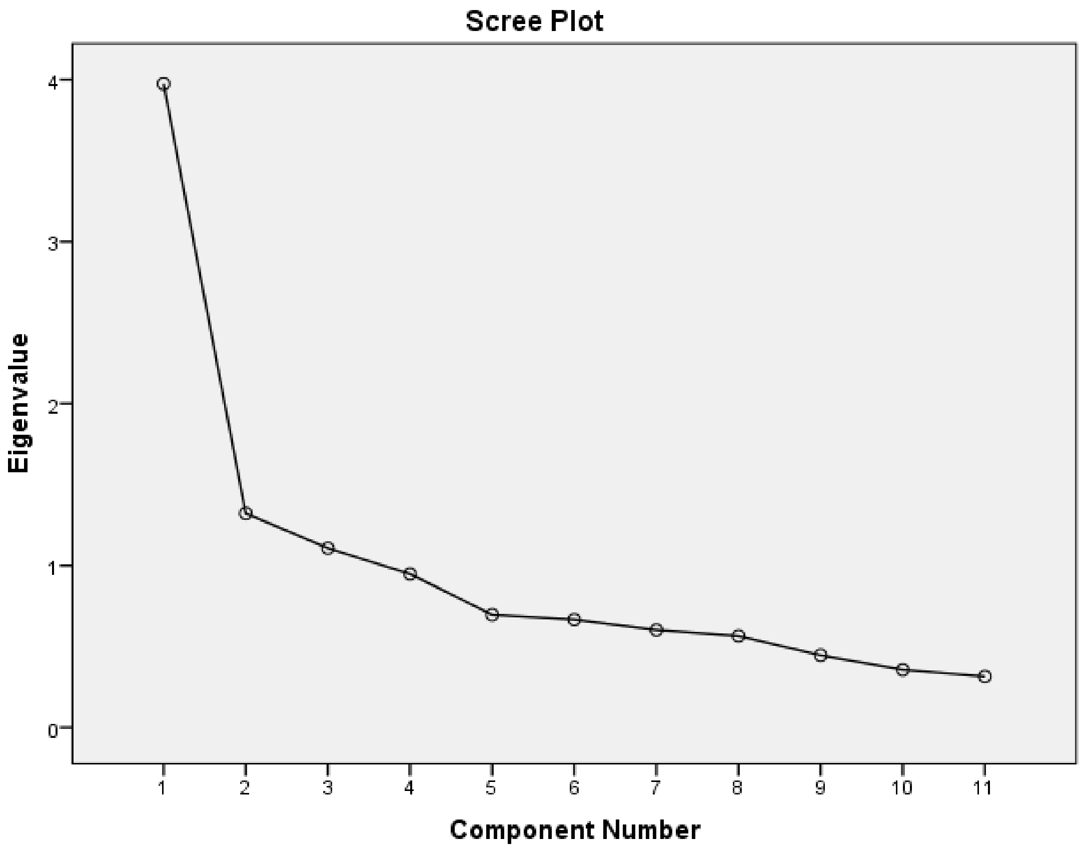

Figure 3. Scree Plot

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.810	34.639	34.639	3.810	34.639	34.639	2.395	21.771	21.771
2	1.333	12.119	46.758	1.333	12.119	46.758	2.107	19.152	40.923
3	1.093	9.936	56.694	1.093	9.936	56.694	1.735	15.771	56.694
4	.937	8.515	65.209						
5	.715	6.501	71.710						
6	.696	6.329	78.039						
7	.657	5.969	84.008						
8	.589	5.351	89.359						
9	.472	4.294	93.653						
10	.372	3.379	97.032						
11	.326	2.968	100.000						

Extraction Method: Principal Component Analysis.

Figure 4. Total Variance