Exploratory Factor Analysis Student Anxiety Questionnaire on Statistics

M Zainudin[1], Konstantine Denny Pareira Meke[2]

[1]IKIP PGRI Bojonegoro, Indonesia
[2]Flores University, Indonesia

Email: zain.akhmad@yahoo.com

Abstract This study aimed to analyze the dimensions of capabilities contained in the questionnaire on statistics student anxiety. This study is a quantitative descriptive exploratory study. The data were derived from responses 123 students of the Faculty of Education and Language Arts Teachers 'Training College PGRI Bojonegoro on students' anxiety questionnaire statistics. Analysis of data to identify the dimensions is done by applying confirmatory factor analysis on the anxiety questionnaire responses of students to statistics. Exploratory factor analysis performed with SPSS version 22. The results showed that the items in the questionnaire anxiety of students to statistical analysis, all of which contain the main dimensions when analyzed using graph method, the variance can be explained.

1. Introduction

Statistics is the study of how to plan, collect, analyze, interpret, and deliver and present data, so that one of the most important parts of the research, especially research conducted with a quantitative approach. Research is the scientific activities to obtain information for a specific purpose and benefit the perkemangan science. Penelitaian become one of the important activities for academics, so that every college must facilitate medalami and master students in research and statistics.

Statistics become part of science that are familiar to the students in a clump inexact, such as mathematics, mathematics education, and statistics. But the statistics into a different subject for students of Indonesian language and literature education, as well as English language education for the study program is dominated by non-exact course.

Statistics is a course that includes about non-routine material for students of Indonesian language and literature and English language education, which can cause anxiety. Anxiety (anxiety) is a response to the perceived unpleasant experience and is followed by the atmosphere of anxiety, worry and fear. Therefore, it can be stated that anxiety is a subjective aspect of one's emotions (involving factors feelings). [1] suggests that anxiety as an unpleasant emotional state characterized by feelings of worry, frozen, scared and confused.

[1] defines anxiety as a feeling of fear accompanied by physiological disorders. This was confirmed by Alloy that defines anxiety as a state of worry, fear that can affect the function of various areas: 1. Subjective explosion of tension, fear and inability of the individual to overcome them. 2. The behavioral responses such as rejection of a scary situation, impaired speech and motor function, and disruption of cognitive tasks. 3. physical responses including muscle tension, increased heart rate and blood pressure, breathing quickened, dry mouth, diarrhea and headache or dizziness. Based on some of these definitions, it can be concluded that anxiety is an individual response to an unpleasant experience. It is characterized by feelings of fear,

While anxiety in mathematics according to [2] as feelings of tension and anxiety that interfere in operating numbers and mathematical problem solving in various situations of everyday life and academic. While [3] mentioned anxiety about mathematics with mathophobia term. According to [3], a

person has anxiety about mathematics if he really did not like math in school, try to avoid it, calculating mathematics as a kind of mystery cabalistik outside access or understanding, or openly expressed aversion to mathematics.

One study of mathematics is statistics. Mastery statistics become one of the important goals in various courses. Efforts should be made to improve skills in statistics. One effort that can be done to improve skills in statistics to minimize student anxiety about statistics. Anxiety statistics of students to be diagnosed with the instrument.

Mastery statistics become one of the important goals in various courses. Efforts should be made to improve skills in statistics. One effort that can be done to improve skills in statistics to minimize student anxiety about statistics. Anxiety statistics of students to be diagnosed with the instrument.

Instruments student anxiety about statistics should be able to precisely measure the dimension, namely the anxiety level of statistics. Good instrument should be designed, assembled, and analyzed by unidimensional test approach. Unidimensional test is one of the assumptions in the analysis based on item response theory. [4, 5] stated that the assumptions in item response theory is unidimensional and local independence. Unidimensional means any item tests only measure one's ability. Assumption of local independence occurs when the factors which influence the achievement becomes constant , so that the subject's response to the item to be independent of other items. unidimensional only be shown if the test only contains one dominant component that measures the achievement of a subject.

The only good instrument to precisely measure one dominant dimension. But in general, the instrument measures more than one dimension, requiring large factor analysis to identify the dimensions of the instrument. Factor analysis was used to reduce the variables to find relationships between variables are mutually independent of each other [6], then assembled in the corresponding variables to determine the structure of the latent dimensions become a factor [7, 8]. This factor is a new variable that is also called the latent variable, the variable construction, and directly unobservable characteristics. Factor analysis can be performed by exploratory factor analysis and confirmatory factor analysis.

Exploratory factor analysis is a technique to detect and investigate sources of variance or konvirmasi latent in the measurement [9]. Analysis of factors associated with the validity [10]. This study was conducted with the aim of exploratory factor analysis to determine the dimensions of the instrument of student anxiety about statistics.

2. Method

Data were obtained on 123 responses student of Indonesian literature and education and vocational education and English language arts faculty IKIP PGRI Bojonegoro. Exploratory factor analysis in this study performed with SPSS version 22. The exploratory factor analysis performed to determine the dimensions of the measurement. Large dimensions known by the graphical method, the variance can be explained, and the ratio of eigenvalues.

3. Results and discussion

Based on the analysis of response patterns were analyzed with SPSS to determine the number of factors that affect the measurement in the questionnaire. The results of the analysis is shown in Table 1 of KMO and Barlett's Test.

Table 1. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.918
Bartlett's Test of Sphericity	Approx. Chi-Square	2593.074
	Df	253
	Sig.	.000

In the table KMO and Bartlett's test above shows the number KMO Measure of Sampling Adequacy (MSA) is 0918. Because the value of 0918 (> 0.5). This indicates the adequacy of the sample. Figures KMO and Bartlet's test (which tanpak the chi-square value) amounted to 2593.074 with a significance value of 0.000 (<0.01). This shows that the correlation between variables and worthy for further proceedings.

Because of MSA value of each variable magnitude > 0.5 then all variables can be processed further. If there is a variable whose value MSA <0.5 then the process is done from scratch by issuing the variable whose value MSA <0.5. Step further analysis:

1. From the menu of SPSS, reopen the factor analysis
2. Press the reset button
3. Put all the variables into variables column (s) for all variable passes the first test.
4. Click the button Descriptive, click Initial solution, KMO and Bartlett's test of Sphericity, anti Image and click Continue.
5. Click Extraction, click the scree plot, click Continue
6. Scores Click, click save as variable Select regression.
7. Click Continue and click OK.

For table communalities, we got extraction 0.411 for item 1. This means that approximately 41.1% of variance of the item 1 can be explained by factors formed. Variable size of 0,483 points 2 this means that 48.3% of the variance of the variable item 2 could be explained by factors formed. Likewise for the other variables. The smaller the value communalities means getting weak connection with that form factor.

Of the total in the table communalities, found that twenty three initial variable has a value communalities large (> 0.5) on items 9, 11, 12, 13, 14, 19, 20, and 21. This may imply that the eight variables used have a stronger relationship than the other items with factors formed. In other words, the greater the value of the better communalities factor analysis, because the larger the original variable characteristics that can be represented by the form factor.

Based on the eigenvalues and variance components factor analysis using SPSS 22, can be explained that the response data of students to the use of SPSS or computer programs for data analysis contains 5 eigenvalues greater than 1, so it can be said that the questionnaire responses of students to the use of SPSS or computer program contains five factors. Of these five factors, there is 43.558% of the variance could be explained. Furthermore, the significance of these factors are tested using the testχ^2.

Eigen value can then be presented with Figure 1. Looking at the results of the plot, it appears Eigen values ranging ramps on both factors (there is 1 curaman). This shows that there is one dominant factor in the questionnaire responses of students to the use of SPSS or computer program, other factors also contribute is not so great against the explained variance components (number of steep slopes on the plot indicates the number of dimensions). Starting the second factor and so on, on the graph show already began to plateau. This shows there is one dominant factor in the questionnaire responses of students to the use of SPSS or computer program.

Another way to do is to look at the percentage of the explained variance exceeds 20% or the ratio of the first to the second eigen value by 5 or 4[11]. Based on data analysis using SPSS 22 showed the following results.

Tabel 2. Communitiies for Initial and extraction item

	Initial	extraction
Item1	.442	.411
item2	.472	.483
Item3	.319	.303
Item4	.435	.432
Item5	.245	.314
Item6	.405	.449
Item7	.350	.339
Item8	.301	.336
Item9	.499	.515
Item10	.386	.369
Item11	.440	.528
Item12	.404	.511
Item13	.442	.501
Item14	.507	.512
Item15	.380	.395
Item16	.391	.445
Item17	.341	.421
Item18	.373	.474
Item19	.418	.540
Item20	.495	.512
Item21	.538	.535
Item22	.279	.314
Item23	.369	.380

Total Variance Explained in the table above shows there are 5 factors formed from 23 variables in the insert. Each factor eigenvalues> 1. Factor 1 eigen value equal to 7.899 with variance (34.341%), Factor 2 eigenvalue equal to 1.534 with variance (6.6710%), Factor 3 eigenvalue equal to 1,260 with (5.480%) and Factor 4 eigenvalue equal 1,088 variance (4.731%). Factor 5 eigenvalue equal to 1.052 with variance (4.573%).

Based on Table 4, found that the percentage of eigenvalues of the first component of the total eigenvalues of 0.34342%, so that more than 20% or it has been said major dimension measuring device. Eigenvalues of the main components and total 7,899 23 001 eigenvalues, so the presentation 0.34342% unexplained variance. It is already more than 20% so that it can be said that the device contains only a single dimension measured or are uni dimensional.
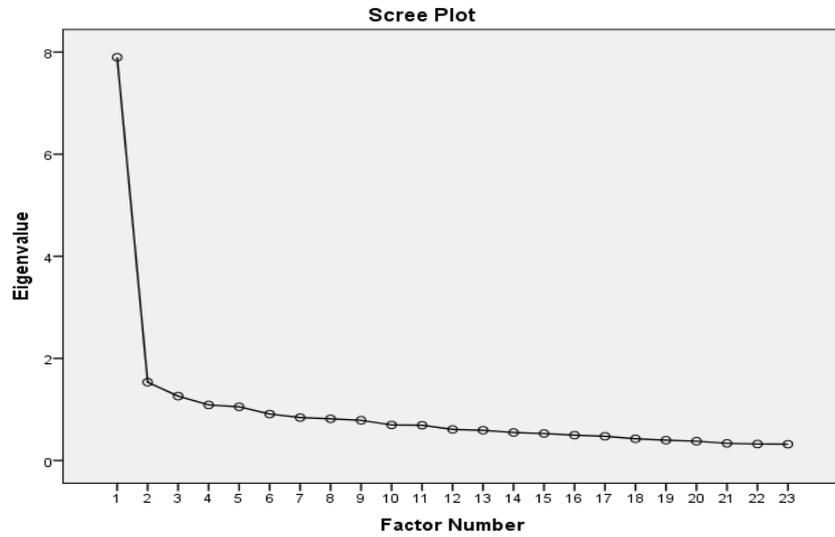
Figure 1. Plot Results of exploratory factor analysis

Tabel 3. Total Variance Explained

Factor	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	7,899	34 341	34 341	7,351	31 961	31 961	2,576	11 201	11 201
2	1,534	6671	41 013	.957	4,163	36 124	2,036	8852	20 053
3	1,260	5,480	46 493	.679	2,950	39 074	1,873	8,144	28 197
4	1,088	4,731	51 224	.532	2,315	41 388	1,789	7,780	35 976
5	1,052	4,573	55 797	.499	2170	43 558	1,744	7582	43 558
6	.910	3,957	59 754						
7	.842	3,659	63 412						
8	.817	3552	66 965						
9	.787	3423	70 387						
10	.697	3029	73 416						
11	.691	3,003	76 419						
12	.608	2,645	79 063						
13	.592	2,574	81 638						
14	.548	2382	84 020						
15	.528	2297	86 316						
16	.496	2,156	88 472						
17	.474	2,062	90 534						
18	.425	1,847	92 381						

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% Of Variance	Cumulative %	Total	% Of Variance	Cumulative %	Total	% Of Variance	Cumulative %
19	.398	1,728	94 109						
20	.377	1,640	95 750						
21	.336	1,460	97 210						
22	.323	1,403	98 613						
23	.319	1,387	100,000						

Table 4. Eigenvalues and Variance Components Factor Analysis Results

Part number	Eigenvalues	difference	Proportion	Cumulative
1	7,899	6365	0.34342	0.34342
2	1,534	0274	0.066693	0.410113
3	1:26	0172	0.05478	0.464893
4	1,088	0036	0.047302	0.512195
5	1,052	0142	0.045737	0.557932
6	0.91	0068	0.039563	0.597496
7	0842	0025	0.036607	0.634103
8	0817	0:03	0.03552	0.669623
9	0787	0:09	0.034216	0.703839
10	0697	0006	0.030303	0.734142
11	0691	0083	0.030042	0.764184
12	0608	0016	0.026434	0.790618
13	0592	0044	0.025738	0.816356
14	0548	0:02	0.023825	0.840181
15	0528	0032	0.022956	0.863136
16	0496	0022	0.021564	0.884701
17	0474	0049	0.020608	0.905308
18	0425	0027	0.018477	0.923786
19	0398	0021	0.017304	0.94109
20	0377	0041	0.016391	0.95748
21	0336	0013	0.014608	0.972088
22	0323	0004	0.014043	0.986131
23	0319	0319	0.013869	1
amount	23 001			

4. Conclusion

Instrument analyzed contained dominant dimension of anxiety to the statistics by the graphical method, the variance can be explained, and Eigen value ratio.

Reference

[1]   Atkinson, Rita L., Atkinson, Richard C., & Hilgard, Ernest R. 1999 Introduction to Psychology (Jakarta: publisher)

[2]   Richardson, KC and Suinn, RM 1972 The Mathematics Anxiety Rating Scale: Psychometric data *Journal of Counseling Pgychology* **28** 373-5

[3]   Lazarus, M. 1974 Mathophobia: Some Personal Speculations *The Education Digest* 51-4

[4]   Hambleton, RK, Swaminathan, H. & Rogers, HJ 1991 Fundamentals of item response theory (Newbury Park, CA: Sage Publications Inc)

[5]   Hullin, CL, et al. 1983 Item response theory: Application to psychological measurement (Homewood, IL: Dow Jones-Irwin)

[6]   Stapleton 1997 Basic concepts and procedures of confirmatory factor analysis. Retrieved on 25 September 2006 from http://ericae.net/ft/Cfa.HTM,

[7]   Anonymous 2001 Factor analysis *Journal of Consumer Psychology* **10** 75-82

[8]   Garson, D. 2006 Factor analysis. Retrieved from http://www2.chass.ncsu.edu/garson/pa765/index.htm access date 24th September 2006

[9]   Joreskog, K. and Sorbom, D. 1993 Lisrel88: Structural equation modeling with the SIMPLIS command language (Hillsdale, NJ: Scientific Software International)

[10]   Nunally, J. 1978 Psychometric theory (New York, NY: McGraw Hill)

[11]   Wells, CS and Purwono, U. 2009 assesing the fit of IRT models to item response data *Psychometric training courses papers UNY Co-operation with USAID*