

## الفصل الثامن عشر

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التحليل العاملي

# *Factor Analysis*

18 .1 .1 مقدمة

18 .2 .1 خطوات التحليل العاملي

18 .3 .1 التحليل العاملي باستخدام نظام SPSS

الفصل الثامن عشر  
التحليل العاملي  
*Factor Analysis*

18.1 مقدمة :

( )

( )

Correlation Matrix (R-matrix)

)

( ) (

R-matrix

.Factor Analysis

R-matrix

factors

" "

loading ( )

.

( ) ( )

factor

( ) classificatory axis

.

factor

8 ( )

factor factor

factor analysis  
 latent ( ) ( ) variables

SPSS

Kim and

. Tabachnick and Fidell (1996) Mueller (1978)

## 2.18. مراحل إجراء التحليل العائلي :

### Stages in Factor Analysis :

:

R-matrix (1)

factors (2)

. Principal Components (PC) "

rotated

(3)

varimax

orthogonal

factor scores

0.3

singularity assumption

multicollinearity

" "

assumption

factors ( )

R-matrix

( ) loadings  
 ( )  
 .  
 ( )  
 ( ) ( )  
 ( )

factor matrix (F-matrix) "

.

rotated factor matrix "

simple structure "

( )

( )

" "

SPSS

" ( )

. varimax

"

( )

( )

( )

" "

)

(

F-matrix

(varimax

)

(quartimax

)

( )

- -  
 " " "

Exploratory factor analysis

" ( )

Confirmatory factor analysis "

( )

.

Structural Equation Modeling "

Confirmatory factor analysis" "

" causal modeling "

path analysis "

covariance structure models "

( )

Confirmatory factor analysis "

SPSS

Bentler, ) EQS

. (Joreskog & Sorbom, 1989 ) LISREL (1993



### 18.3. التحليل العاملي باستخدام نظام SPSS :

#### Factor Analysis with SPSS :

SPSS  
10  
:  
French Literature                      English Literature  
Fine Arts                                  German Language  
1-18                                  Applied Sciences                      Mathematics

SPSS  
SPSS Command language  
SPSS PC+ ver. 6.0

SPSS  
. SPSS PC+  
SPSS Data Editor  
Data Editor                                  2-18

: 1-18

51	53	45	69	72	81	1
81	91	78	32	41	40	2
49	47	50	54	47	46	3
63	65	56	34	33	40	4
47	54	46	76	75	91	5
90	88	92	46	41	48	6
47	45	56	72	67	68	7
37	36	32	41	32	35	8
43	51	44	76	84	92	9
79	67	72	36	45	45	10

Data Reduction

Factor

(8.0 Statistics ) Analyze

3-18

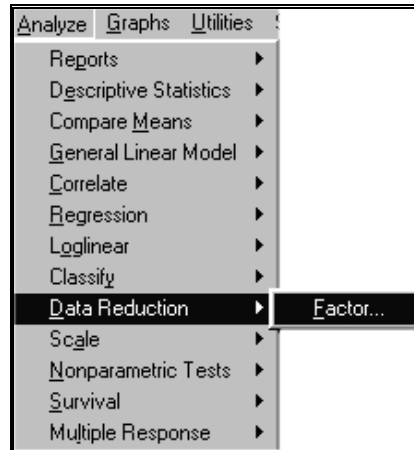
Data Editor

: 2-18

	english	french	german	finearts	maths	sciences
1	81	72	69	45	53	51
2	40	41	32	78	91	81
3	46	47	54	50	47	49
4	40	33	34	56	65	63
5	91	75	76	46	54	47

## . Factor Analysis

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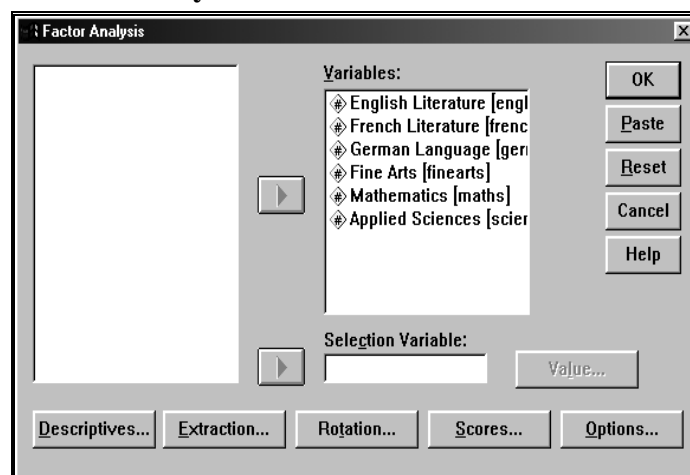
4-18

Factor Analysis

Variables

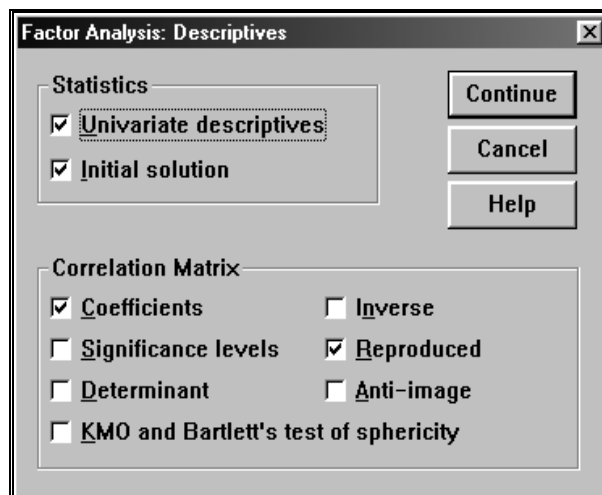
## . Factor Analysis

: 4-18



Descriptives  
 Univariate  
 Coefficients  
 Initial solution  
 R-matrix  
 R<sup>2</sup>  
 Communalities  
 Reproduced  
 .  
 Extraction  
 Scree plot  
 (6-18 ) Extraction  
 Principal  
 .  
 Components  
 Descriptives : 5-18

### .Factor Analysis



**Extraction****: 6-18**

Factor Analysis: Extraction

Method: **Principal components**

Analyze

Correlation matrix

Covariance matrix

Display

Unrotated factor solution

Scree plot

Extract

Eigenvalues over:

Number of factors:

Maximum Iterations for Convergence:

Continue

Cancel

Help

F-matrix

(7-18 )

Rotation

Display:

Varimax

Rotated solution

. OK

Continue

**Rotation****: 7-18**

Factor Analysis: Rotation

Method

None

Varimax

Direct Oblimin

Quartimax

Equamax

Promax

Delta:  Kappa:

Display

Rotated solution

Loading plot(s)

Maximum Iterations for Convergence:

Continue

Cancel

Help

8-18

: 8-18

<b>Descriptive Statistics</b>			
	Mean	Std. Deviation	Analysis N
English Literature	58.60	22.26	10
French Literature	53.70	18.93	10
German Language	53.60	18.12	10
Fine Arts	57.10	18.26	10
Mathematics	59.70	18.12	10
Applied Sciences	58.70	18.42	10

Correlation

9-18

matrix

: 9-18

<b>Correlation Matrix</b>						
	English Literature	French Literature	German Language	Fine Arts	Mathematics	Applied Sciences
English Literature	1.000	.977	.928	-.366	-.310	-.448
French Literature	.977	1.000	.933	-.351	-.335	-.456
German Language	.928	.933	1.000	-.468	-.516	-.612
Fine Arts	-.366	-.351	-.468	1.000	.908	.962
Mathematics	-.310	-.335	-.516	.908	1.000	.939
Applied Sciences	-.448	-.456	-.612	.962	.939	1.000

R-matrix

) ( )  
(

9-18

:

R-matrix

( )

(10-18 )

communalities

communality

factors

(  $R^2$  )

98%

: 10-18

communalities

Communalities		
	Initial	Extraction
English Literature	1.000	.979
French Literature	1.000	.981
German Language	1.000	.957
Fine Arts	1.000	.952
Mathematics	1.000	.947
Applied Sciences	1.000	.984

Extraction Method: Principal Component Analysis

11-18

components

6-3

Initial

Eigenvalues

eigenvalue

(100%)

4.18



×100%) 6

(

(4.18÷6=69.7%)

(% of Variance)

97%

.(Cumulative %

)

Extraction Sums of Squared Loadings

Rotation

Sums of Squared Loadings

varimax

:11-18

**Eigenvalues**

Total Variance Explained									
Comp- onent	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumul- ative %	Total	% of Variance	Cumul- ative %	Total	% of Variance	Cumul- ative %
1	4.179	69.649	69.649	4.179	69.649	69.649	2.904	48.405	48.405
2	1.620	27.007	96.656	1.620	27.007	96.656	2.895	48.252	96.656

Extraction Method: Principal Component Analysis.

Scree plot

11-18

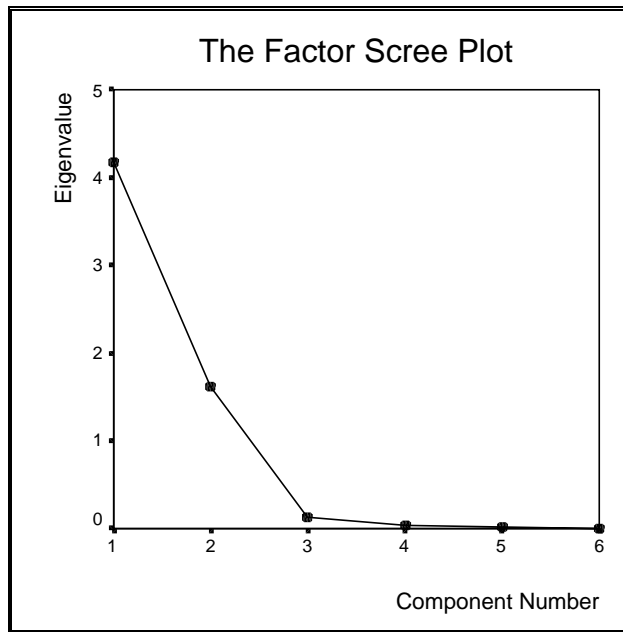
. Extraction

Scree

: 12-18

Eigenvalues

Plot



( )

1

.(11-18 )

(13-18 )

component matrix

: 13-18

**Component matrix**

<b>Component Matrix<sup>a</sup></b>		
	Component	
	1	2
English Literature	.805	.574
French Literature	.810	.570
German Language	.892	.401
Fine Arts	-.810	.545
Mathematics	-.801	.552
Applied Sciences	-.883	.451

Extraction Method: Principal Component Analysis  
a. 2 components extracted.

( ) orthogonal

(1 )

F-matrix

R-matrix

(14-18 )

reproduced correlation matrix

)

[(0.81 \* 0.89) + (0.57 \* 0.40) = 0.95] (13-18 F-matrix

14-18

2%

0.93

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**.Residuals      Reproduced Correlation Matrix**

		Reproduced Correlations					
		English Literature	French Literature	German Language	Fine Arts	Mathematics	Applied Sciences
Reproduced Correlation	English Literature	.979 <sup>b</sup>	.980	.949	-.339	-.328	-.452
	French Literature	.980	.981 <sup>b</sup>	.951	-.346	-.334	-.459
	German Language	.949	.951	.957 <sup>b</sup>	-.504	-.493	-.608
	Fine Arts	-.339	-.346	-.504	.952 <sup>b</sup>	.949	.961
	Mathematics	-.328	-.334	-.493	.949	.947 <sup>b</sup>	.957
	Applied Sciences	-.452	-.459	-.608	.961	.957	.984 <sup>b</sup>
Residual <sup>a</sup>	English Literature		-.002	-.021	-.027	.018	.004
	French Literature	-.002		-.018	-.006	.000	.003
	German Language	-.021	-.018		.037	-.023	-.005
	Fine Arts	-.027	-.006	.037		-.041	.001
	Mathematics	.018	.000	-.023	-.041		-.018
	Applied Sciences	.004	.003	-.005	.001	-.018	

Extraction Method: Principal Component Analysis.

a. Residuals are computed between observed and reproduced correlations. There are 0 (.0%) nonredundant residuals with absolute values > 0.05.

b. Reproduced communalities

**Residuals**

) 0.933

(9-18

-0.018

0.951

14-18

residual

0.05

a



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**Rotated Component Matrix**

<b>Rotated Component Matrix<sup>a</sup></b>		
	Component	
	1	2
English Literature	-.165	.975
French Literature	-.172	.975
German Language	-.349	.914
Fine Arts	.958	-.185
Mathematics	.957	-.174
Applied Sciences	.944	-.304

Extraction Method: Principal Component Analysis.  
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

SPSS

(16-18 )

: 16-18

**Component Transformation Matrix**

<b>Component Transformation Matrix</b>		
Component	1	2
1	-.708	.706
2	.706	.708

Extraction Method: Principal Component Analysis  
Rotation Method: Varimax with Kaiser Normalization

